THE STREET RAILWAY REVIEW

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INDEX TO VOLUME XIV.

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STREET RAILWAY REVIEW

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The Stone & Webster Properties on Puget Sound.

The Seattle Electric Co.—History of the Consolidated Properties—Track and Roadbed—Power Plants—Rolling Stock—Car Service—Apparatus for Sand Drying—Waste Washing—Accounting Department—Coal Mining—Park Systems—Organization—Personnel.

It is beyond dispute that no one living in the East (and in this particular connection the East means east of the Missouri River) and who has never visited the Pacific Northwest, has any adequate appreciation of the resources and possibilities of that region. Twelve or fifteen years ago the state of Washington experienced a "boom", capital was to be had for the asking and the result was an artificial prosperity closely akin to speculative inflation based upon the hope of an indefinite continuation of the favorable commercial conditions. The panic of 1893 found the state of Washington (among others) mortgaged for nearly its full value, and when the boom wave subsided practically all the business interests were owned in the East, after passing through foreclosure or receiverships.

Financial ruin was nearly universal but in most cases was not irretrievable. Washington learned its lesson and within the last decade has more than recovered all the ground lost in the panic—now the commercial enterprises are owned by home interests, and today the banks are loaning money in the East where interest rates are higher. Doubtless the principal factor in the quick recovery of the Pacific Northwest has been the results that followed the Spanish War. The increase of American trade with the Orient has not only fostered shipping interests on Puget Sound but has provided a market for the products of the coast. With a soil suitable for any product of temperate climes, with almost inexhaustible forests, and with coal mines and water-powers at hand the future of the Puget Sound country is assured, and in this future the seaports of the Sound—Seattle, Tacoma, Everett and Bellingham—all have their places.

The electric railways of three of the four Sound cities mentioned are under the direction of Stone & Webster, of Boston, the Western properties of which they are managers being as follows:

1. Seattle Electric Co., which does the electric railway, lighting and power business of Seattle.

2. Puget Sound Electric Railway Co., formerly the Seattle-Tacoma Interurban Ry., which connects Seattle and Tacoma and serving a branch line to Renton.

3. Tacoma Railway & Power Co.

4. Whatcom County Railway & Light Co., which does the electric railway and gas business of Whatcom and Fairhaven (recently consolidated as the city of Bellingham) and the electric lighting business of Fairhaven.

5. Columbia Improvement Co., which is engaged in developing a 40,000-h. p. water power on the Puyallup River.

BIRD'S-EYE VIEW OF SEATTLE.

Seattle lies between Elliott Bay and Lake Washington, and from north to south extend three steep ridges on which the north and south streets form terraces, while the cross streets are a succession of hills many of which are on grades steeper than 20 per cent. From south to north there is also a rise in grade, with steep hills to be overcome. The parallel ridges dividing the city between the bay and Lake Washington are crossed by cable lines and the rough topography makes it extremely probable that these cables will never be superseded by electric traction. In the northern part of the city is a section where the electric lines, the Queen Anne lines, encounter grades in excess of 18 per cent and counterweights are required.

The Seattle Electric Co. which besides including all of the urban electric railway lines of Seattle, has the municipal and commercial lighting of the city, an extensive electric power business, gives steam heating and hydraulic elevator service in the business section, and operates extensive coal mines, is a consolidation of several companies effected Jan. 1, 1900, with which some other properties have been merged since. The Seattle Electric Co. includes:

1. Union Trunk Lire, an electric road of 3 ft. 6 in. gage built in 1891-93. This was 9.88 miles long, with a total of 13.20 miles reckoned as single track. This property was ready for a receivership when acquired in 1900.

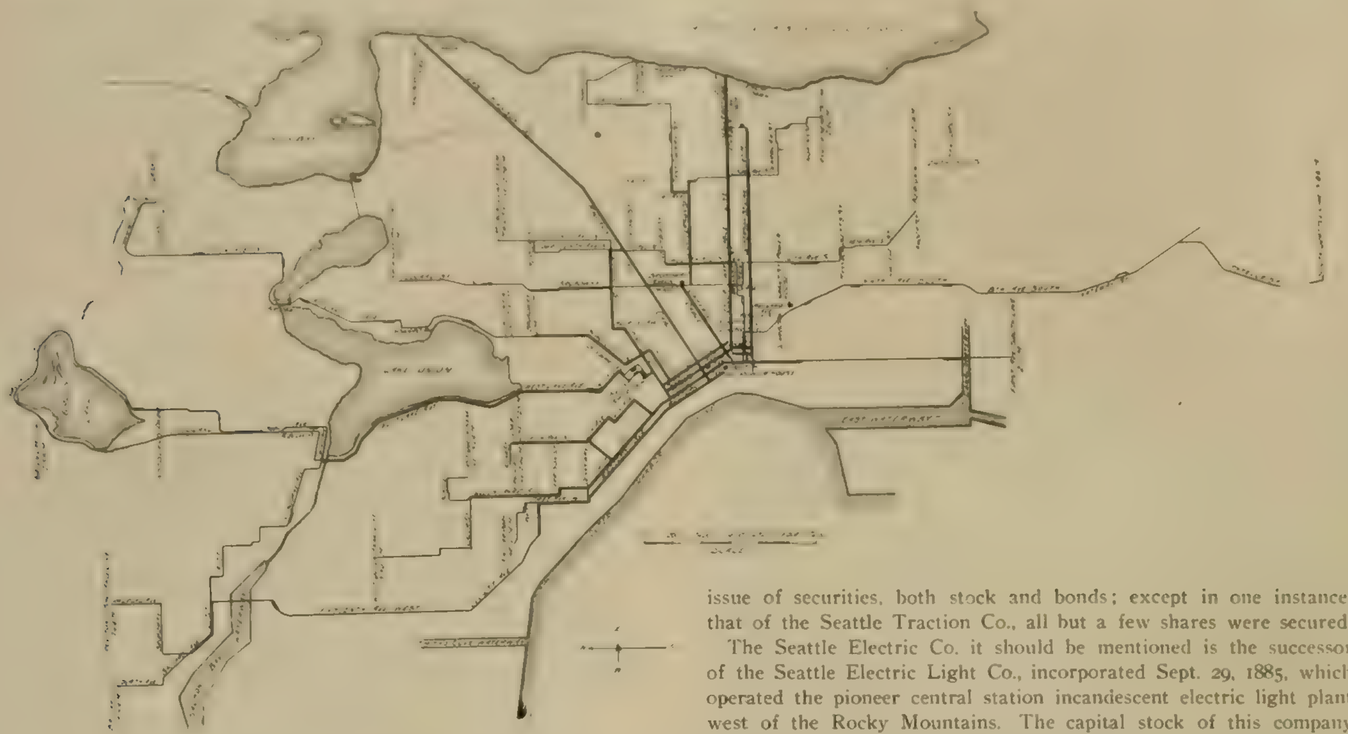
2. Seattle Traction Co., which had 7.77 miles of standard gage including the Green Lake Electric Ry., which had 4.44 miles of standard gage road built in 1889-90. These were acquired Jan. 1, 1900.

3. Third Street & Suburban Electric Ry., which had 6.75 miles of standard gage electric road (8.58 miles single track) built in 1891-2. This company was also ready for a receivership when taken over.

4. West Street & North End Electric Ry., which had 5.85 miles

of standard gage electric road (7.01 miles single track) built in 1890. This property was in the hands of a receiver.

5. Madison Street Cable Railway Co., which had 3.62 miles of double track, 3 ft. 6 in. gage, built in 1889-90.



MAP OF SEATTLE RAILWAY LINES

6. Grant Street Electric Railway Co., which had 5.36 miles of single track, 3 ft. 6 in. gage, built in 1891-2.

7. First Avenue Railway Co., which had 2.05 miles of double track cable road, standard gage, built in 1889. This property was in the hands of a receiver when acquired.

8. Seattle City Railway Co., which had the Yesler Way cable line, 2.22 miles of double track, 3 ft.-gage, built in 1887-8, and the Jackson St. electric line, 2.09 miles (3.51 miles single track) standard gage, built in 1898-99. This property was purchased at receiver's sale Oct. 21, 1901.

9. Seattle Central Ry., which had 3.20 miles (3.80 miles single track) of standard gage electric road built in 1901. This property passed into the hands of the Seattle Electric Co. Oct. 28, 1902. The deed however was not passed until Jan. 13, 1903.

10. Union Electric Co.

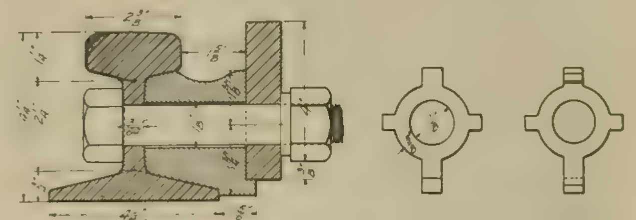
11. Seattle Steam Heat & Power Co.

12. Consumers Electric Co. These three corporations formerly had the lighting, power, heating and elevator business. They were all taken over Jan. 1, 1900.

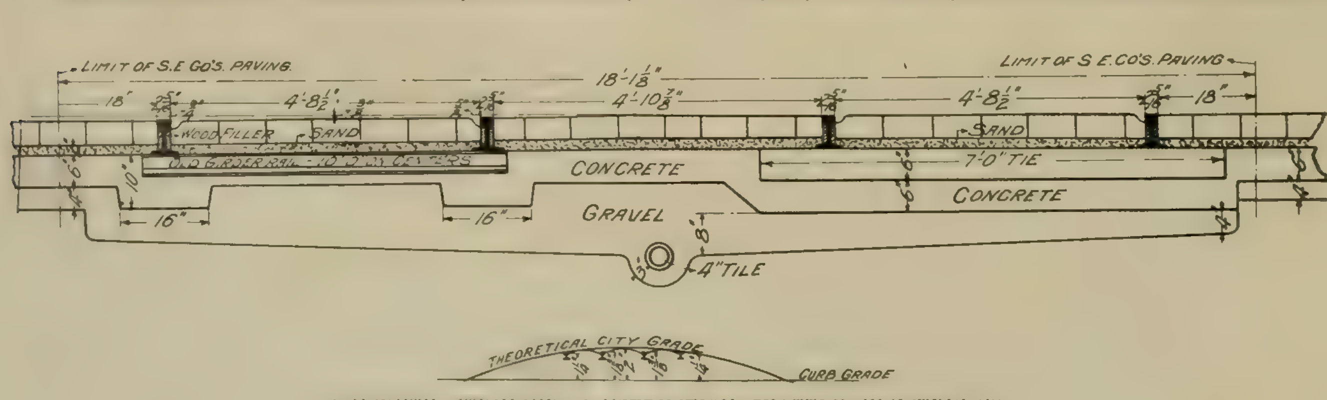
13. Renton Co-operative Coal Co. This concern acquired in June, 1900, was a coal miner's co-operative association owning some 1,000 acres of coal land near Renton which failed because of poor business management consequent upon internal dissension.

All these consolidations were effected by purchase of the entire issue of securities, both stock and bonds; except in one instance, that of the Seattle Traction Co., all but a few shares were secured.

The Seattle Electric Co. it should be mentioned is the successor of the Seattle Electric Light Co., incorporated Sept. 29, 1885, which operated the pioneer central station incandescent electric light plant west of the Rocky Mountains. The capital stock of this company was $50,000 divided into shares of $50 each. The incorporators and first trustees of the company were: J. M. Frink, state senator, president of the Washington Iron Works Co., of Seattle; Capt George D. Hill, U. S. A., retired, then president of the First National Bank; S. Z. Mitchell, then of Seattle, who is now manager of the Columbia Improvement Co., Tacoma, engaged in developing the Puyallup River water power for the Puget Sound Power Co.; T. H. Cann, now municipal judge in Seattle. The original plant comprised one 125-volt No. 10 Edison machine of 25 kw. capacity, one 40-h. p. vertical throttle governing engine, and one 50-h. p.

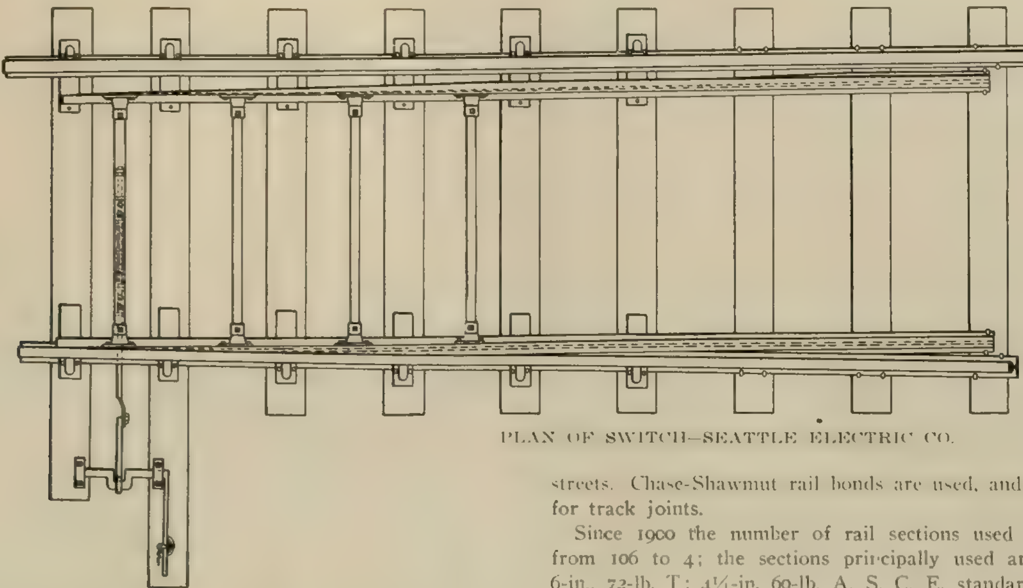


CAST IRON FILLER BLOCK FOR 60-LB. RAIL—SEATTLE ELECTRIC CO.



CONCRETE STRINGER CONSTRUCTION SEATTLE ELECTRIC CO.

horizontal fire tubular boiler. The engine and boiler were both built by the Washington Iron Works. The building which was of rough boards sided up vertically, covered an area about 20 x 30 ft. and was located on the south side of Jackson St. at the corner of the alley between what is now First Ave. South and Occidental Ave. The plant was started in December, 1885, and the entire output was sold at the rate of $3.00 per 16-c. p. light per month, bringing a revenue of $750 per month.



PLAN OF SWITCH—SEATTLE ELECTRIC CO.

TRACKS.

When the railways were taken over there were 53.83 miles of road, 31.87 miles of single track, 21.95 miles of double track, 2.32 miles of turnouts, a total of 78.11 miles measured as single track. Of this total, 20.44 miles were 3 ft. 6 in. gage, 4.44 miles of the 3 ft. gage, and 53.22 miles standard gage. This track was laid with rails of 106 different sections, 1.82 miles 6-in. 72-lb.; .53 mile 6-in. 60-lb.; 6.78 miles 4¼-in. 60-lb.; 10.29 miles 56-lb. T; 4.20 miles 56-lb. girder; 54.49 miles 45-lb. and lighter rails. Of the total track 11.11 miles were in planked streets, 1.69 miles on brick paved streets, 6.37 miles on trestles, and 34.66 miles in unpaved streets.

The foregoing summary of the conditions four years ago gives an excellent idea of the work which the management had before it in the matter of repairing and rebuilding track.

On Sept. 1, 1903, the system comprised 63.51 miles of road, 35.41 miles single track; 28.10 miles double track; 2.49 miles sidings; total 94.10 miles. Rail sections at this date were: 3.27 miles 6-in. 72-lb.; 2.53 miles 6-in. 60-lb.; 33.80 miles 4¼-in. 60-lb.; 14.31 miles 56-lb. T; 40.18 miles 45-lb or lighter. The mileage in planked streets was 14.27, in brick paved streets, 4.29; on trestles, 10.32 miles.

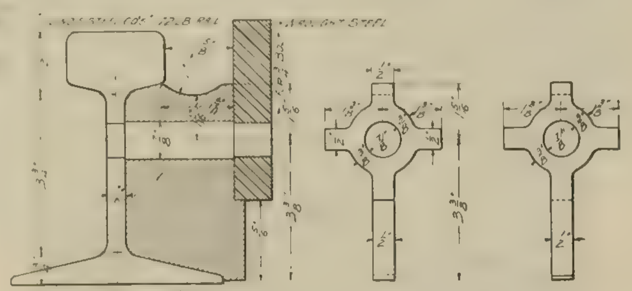
One of the illustrations shows two sections of track as laid in streets paved with brick. One of these is the standard roadbed laid with 7-ft. cedar ties, the other is concrete beam construction with old rails spaced 10 ft. on centers used for tie rods. Wood fillers are used between the rail web and the brick on both sides of the rail. The company paves to a distance 18 in. beyond the outer rails.

The standard concrete for track work is made in the proportion of 1, 4 and 7.

The 72-lb. 60-ft. rails are standard for new work in paved streets. Chase-Shawmut rail bonds are used, and 6-hole angle bars for track joints.

Since 1900 the number of rail sections used has been reduced from 106 to 4; the sections principally used are 6-in., 60-lb. T; 6-in., 72-lb. T; 4¼-in. 60-lb. A. S. C. E. standard T.

Other of the drawings show track details that will be of general interest. The standard point switch is one of these, and the drawings give a plan view of the switch, elevation of the spring bar and details of the fastenings. The bar for throwing the



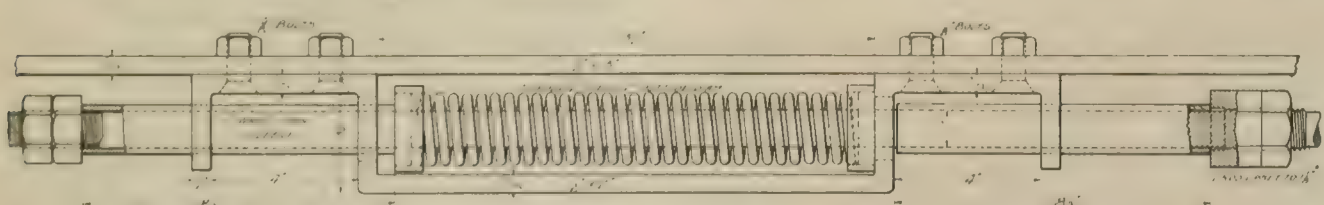
CAST IRON FILLER BLOCK SEATTLE ELECTRIC CO.

switch points is of 1-in. round iron and is connected to the distance bar through a spring which permits the switch point to be thrown over by a passing car without injury to the mechanism. Sections of pipe slipped over the round bar serve for guides and also as distance pieces which permit initial tension to be put upon the spring by means of the nuts on the threaded portions of the bar. The spring seat is made by driving a section of pipe over a washer.

POWER PLANTS.

The Seattle Electric Co. has eight power stations designated respectively, as: New Post St., Old Post St., Pine St., James St., Yesler Way, Madison St., Fremont and Massachusetts St.

The New Post St. station is located in the wholesale district of the city and is adjacent to the Old Post St. plant, both being alongside the Northern Pacific tracks. The new station was designed after Stone & Webster became managers of the property

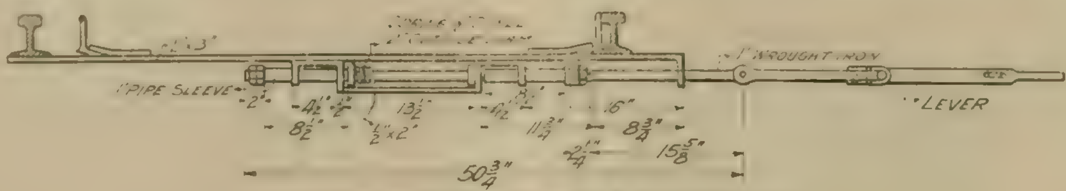


SWITCH DETAILS SEATTLE ELECTRIC CO.

and was first operated in August, 1902, though extensive additions to the converter equipment were made during 1903, when a second storage battery was also installed.

The exciter unit is a 75-kw., 250-volt machine driven by Westinghouse engine.

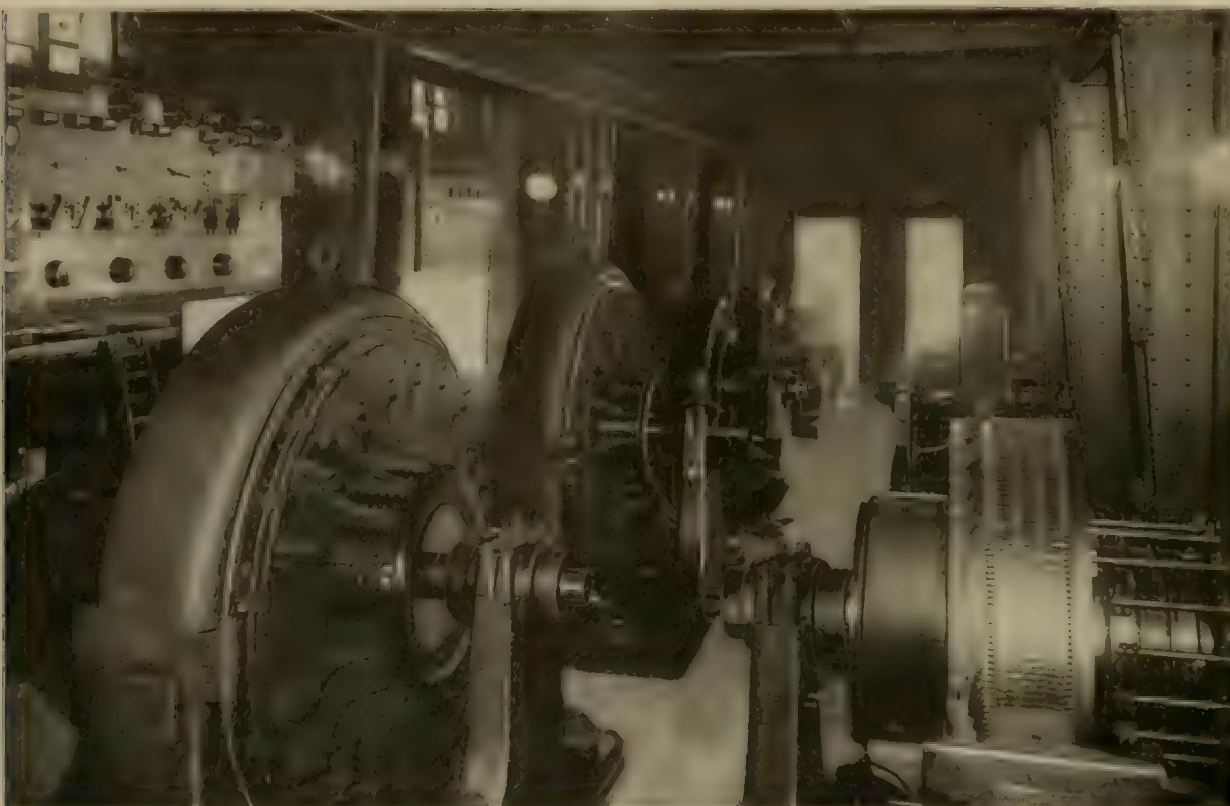
The electrical machinery other than the two units already men-



SWITCH MECHANISM—SEATTLE ELECTRIC CO.

The building is 95 x 108 ft. in ground dimensons and 80 ft. from basement to the coal tracks above the bunkers. The basement is

tioned, at this station comprises four 500-kw., 250-volt, two-phase, three-wire rotaries used for the Edison system, and five 500-kw.,



ROTARY CONVERTER ROOM—SEATTLE ELECTRIC CO.

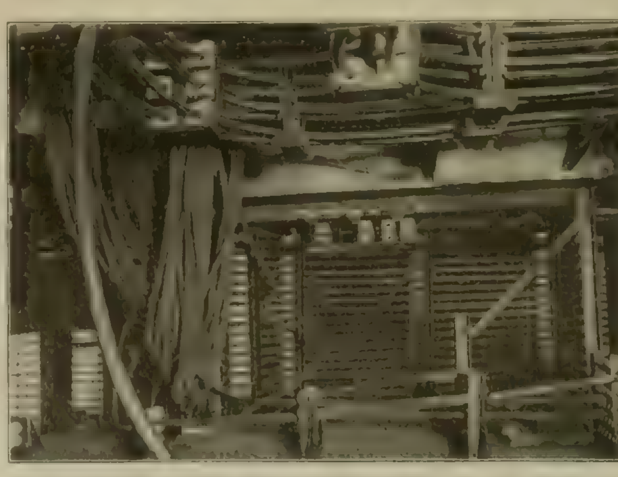
17 ft. high. Above this on the east side are the rotary room, 22 ft. high; the piping and ash conveyor floor, 9 ft. high; the boiler room 32 ft. high, and the coal conveyor. On the west side the engine room occupies space corresponding to the three stories on the east side.

The main units in this station are two double-compound engines with high pressure cylinders 23 x 42 in. and low pressure cylinders 48 x 42 in. Each pair of engines is direct connected to a 1,600-kw. Westinghouse two-phase generator giving 364 amperes per terminal at 2,200 volts, 7,200 alternations per minute.

The generator room occupies one side of the building the corresponding space in the other portion being in three stories, the rotary converters and switchboards being on the lower floor and the boiler room with six 500-h. p. Cahall water-tube boilers above with ash room between. The boilers are equipped with Roney stokers. Above the boilers are coal bunkers of 400 tons capacity, served by a mechanical conveyor; the ashes are also handled by a conveyor. In the up-takes to the stack are two 14-ft. fans as the induced draft equipment.

City water is used in the boilers, and for condensing purposes water is taken from the Sound. Two 24-in. pipe lines 500 ft. long provide for suction and discharge for the condensers which are of the Wheeler admiralty type. The circulation is effected by two No. 12 Wheeler centrifugal pumps.

550-volt three-phase rotaries for the railway road. There is also a differential field booster for regulating the voltage of a 500-kw. h. railway battery installed by the Electric Storage Battery Co.



WIRING IN BASEMENT—SEATTLE ELECTRIC CO.

All the rotary converters are Westinghouse machines and are equipped with Westinghouse Type C starting motors.

The railway battery mentioned is located above the engine room. Besides this there is a 1,000-kw. L. battery with voltage from 230 to 300, located in the basement, which was put in last fall. This is also Electric Storage Battery Co's. installation, and comprises 1,000-kw. plates in 1,500-kw. cells to give opportunity for increased capacity.

There are two switchboards, that for the generators and rotaries being at the floor level, and the feeder board in a gallery. Both boards have glass gangways behind them for the use of attendants.

The station was designed to generate 3,200 kw. and to transform some 2,400 kw. of power (3,250 h. p.) from the Snoqualmie Falls plants, which is transmitted at 30,000 volts three-phase to this sub-station where it is transformed to 2,300 volts two-phase. Normally the older stations of the Seattle Electric Co. are not operated, being called into service only when there is a failure of Snoqualmie power or some unusual demand for current.

The machine switchboard at the station is arranged with three busses so that the converters may be switched into the Snoqualmie current or the station alternators.

The output from the station is approximately as follows:

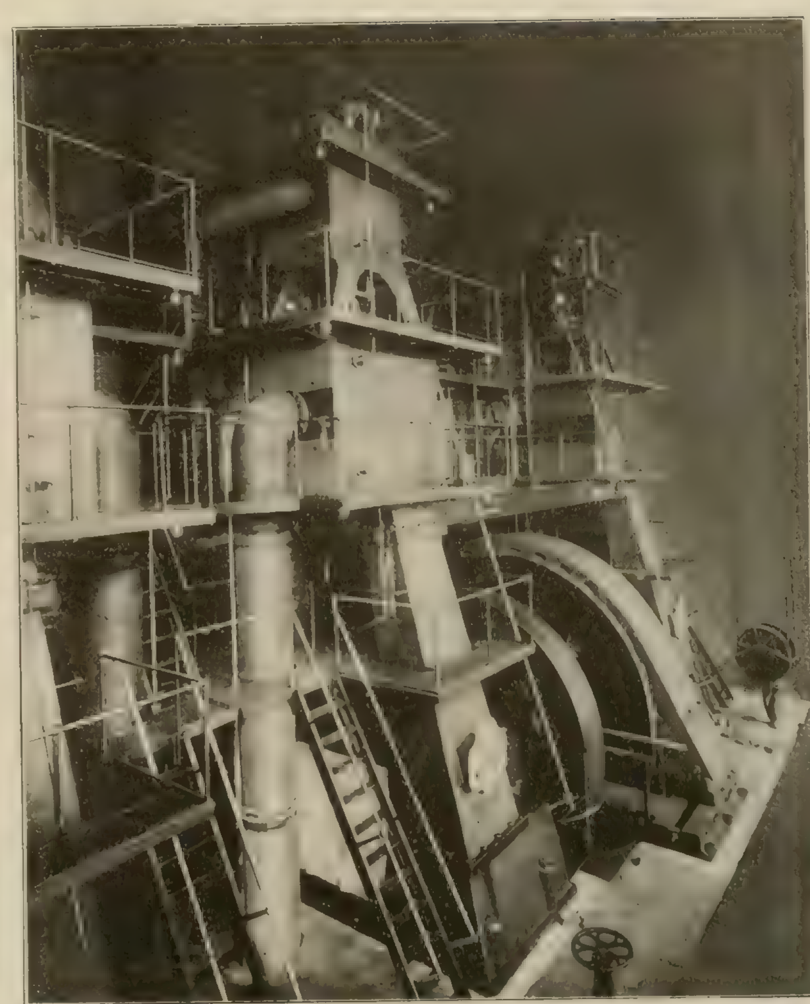
For all of the a. c. incandescent lighting, 1,150 kw. at 2,300 volts two-phase.

For a. c. arc lighting (municipal), 320 kw.

For Edison 250-volt lighting and power current (power being used for the most part during the day when the lighting load is small), 2,000 kw.

For railway feeders, 3,000 kw.

For Fremont sub-station, where there are two 300-kw., 500-volt motor generators, current is transmitted at 2,300 volts.



1,600 KW. WESTINGHOUSE ALTERNATING UNIT

For James St. station current is transmitted at 2,300 volts for operating two 300-kw. 500-volt motor generators which supply current for the street cars on lines nearby and also to three 150-kw. Edison machines that drive the James St. cables, when the engines are not run, which is the normal condition.

There are also connections to the Massachusetts St. sub-station so that the interurban road may be supplied with current from Post St. in event of the Snoqualmie current failing. For this purpose the 2,300 volt two-phase is transformed to 27,000 volt three phase current in two 600-kw. water-cooled transformers.

SECTION OF SWITCHBOARD, SEATTLE ELECTRIC CO.

All of the Edison three wire cables enter the building through ducts.

A portion of the exhaust steam from the New Post St. station is used for heating on the American District system.

The Old Post St. station dates back to 1890, and contains at this time nine return tubular boilers of 100 h. p. each, and two 500 h. p. water tube boilers, which last were installed last fall. The engine and generator equipment includes one 14 and 20 x 14 in. Armington & Sims engine, two 19 x 18 in. Ideal engines, six 60-kw. and one 100-kw. Edison generators, and an exciter unit used in emergency for the large units in the new station.

There are two miles of heating mains supplied from the two Post St. stations.

Water for operating about 30 elevators in the business district is supplied from this station. There are for this purpose one 3,000,000-gallon and two 1,500,000-gallon pumps.

The Pine St. station, which was rebuilt in 1899, has a miscellaneous equipment of small machines aggregating 1,200 kw., and is now used only in case of emergency.

The James St. station is a cable plant built in 1891. The present equipment consists of two 450-h. p. Lane & Bodley engines, three 150-kw. Edison

500-volt machines, and two 300-kw. motor generators. Normally, the motor generators furnish current for the Edison machines which operate as motors to drive the cable machinery, and the engines are not used. In emergencies the engines can be thrown in to drive the cables and the Edison machines used as generators.

The Yesler Way cable station was built in 1889 and remodeled in 1901. It contains one 150-h. p. Allis-Corliss and one 125-h. p. Hamilton-Corliss engines.

COMBINATION ELECTRIC CAR
SUBURBAN CAR.
TOTEM POLE CAR

COMBINATION CABLE CAR
FREIGHT AND EXPRESS MOTOR CAR
CINDER CAR.

The Madison St. cable station was built in 1891. It has two 24 x 48 in. simple Hamilton-Corliss engines, one of which is sufficient to drive the cables.

The Fremont sub-station, built in 1902, has two 300-kw. motor-generators and a battery of 300 kw. capacity for one hour.

The Massachusetts St. sub-station, built in 1902, contains two 600-kw. transformers for changing 27,000 volt three-phase current to 2,300 volt two-phase.

ROLLING STOCK

The rolling stock taken over from the old companies, it is scarcely necessary to say, comprised a miscellaneous lot of cars and trucks of various degrees of usefulness. When the new company took charge the rolling stock was overhauled and classified, records being made on the form illustrated elsewhere, and for the entire equipment, 34 classes were required. The bodies are indicated by a letter and where bodies of the same class have trucks or motors of different make numbers are added. For the 34 classes 14 letters are used, with, in some cases, six numbers to indicate differences in trucks and motors. The number of cars per class varies from 1 to 26; nine classes, from 3 to 16 cars each are for cable rolling stock.

The bodies now in use were made by various builders; Hammond, Brill, Jackson & Sharpe, St. Louis Car Co., Pullman Co., J. M. Jones Sons, Stephenson, Northern Car Co., Stockton Car Co., Rohlf & Schroder and Seattle.

The rolling stock now includes:

Single truck electric cars—closed, 41; combination, 31; convertible, 1; open, 10; total, 83.

Double truck electric cars—closed, 11; chair car, 1; converted, 7;

Brill semi-convertible, 47; open, 5—total, 71. Total electric cars, 154.

Single truck cable cars—combination convertible, 4; open dummy, 7—total, 11.

Double truck cable cars—combination, 31; open, 10—total, 41.

Cable trailers—open single truck, 4.

Total electric cars, 154 (82 closed and 72 open).

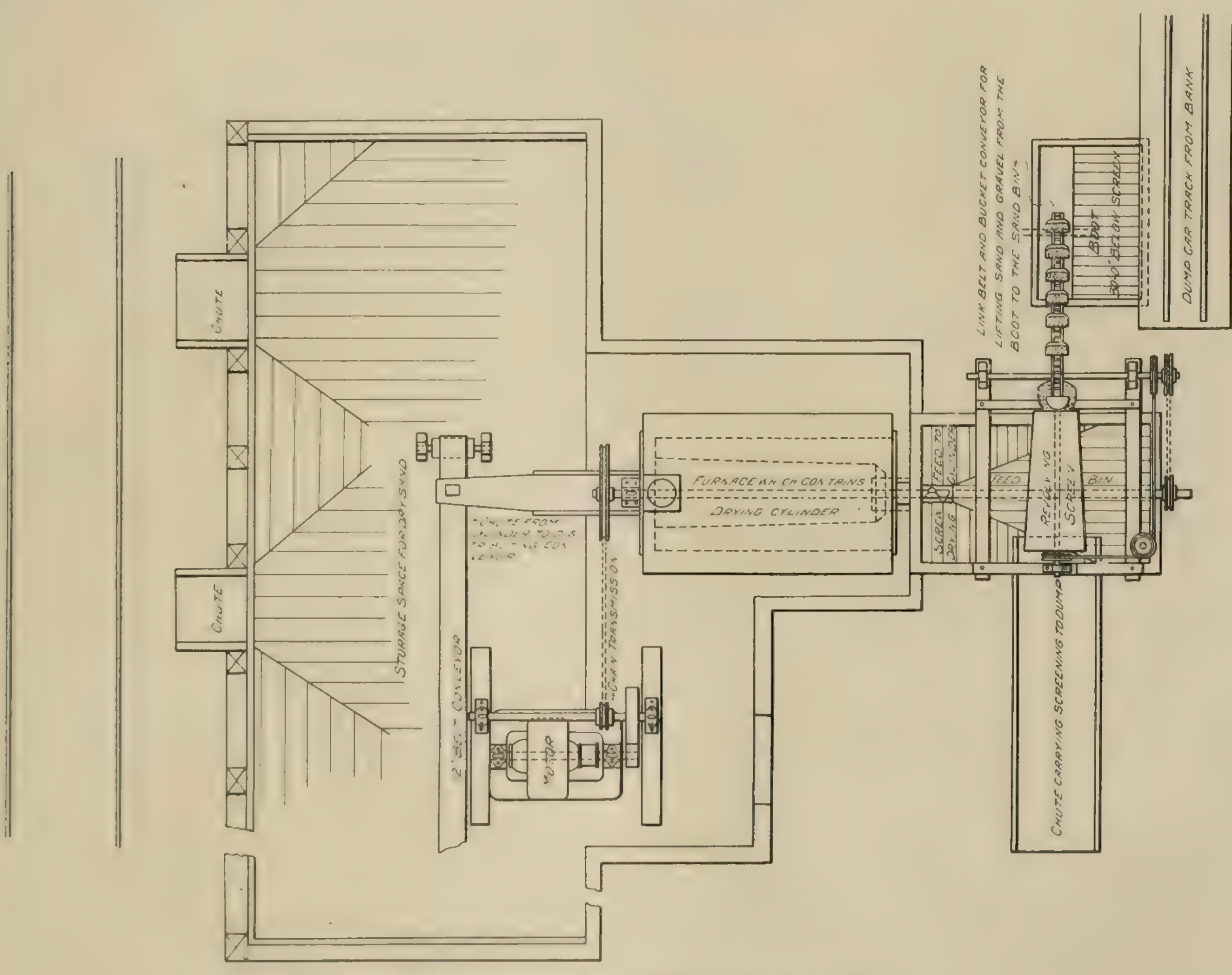
Total cable cars, 56 (35 closed and 21 open).

The miscellaneous equipment includes 2 single truck electric coal cars, 1 double truck cable coal car, 1 cable trailer coal car, 2 tower line repair cars, 2 single truck cable snow plows and salt cars, 2 double truck electric box freight cars, 1 single truck electric box freight car, 1 double truck cable box freight car, 2 single truck and 3 double truck electric construction cars, 1 single truck cable sprinkling car, 1 pile driver, 1 single truck electric mail car, 2 single truck cable box freight trailers, and 21 double truck flat ballast and dump cars.

tree is, and have some idea of its appearance, but as used in connection with the motor car illustrated a word of explanation is necessary. The construction cars as first built were flat cars with a single pole near the center to carry the trolley stand, and were promptly named "totem-poles" by the train men. In the mild but rainy climate of Seattle a very natural development was to add posts at the front and rear ends and place a roof over the car, for the protection of material that rain would injure. In its present form the "totem-pole" is found to be a very useful and convenient car for transporting miscellaneous freight, the open sides greatly facilitating loading and unloading and the roof giving all the protection needed.

CAR SERVICE.

The number of passenger cars ordinarily operated in regular service is 131, of which 39 are on the cable roads. There are five operating car houses, the largest one being at 5th and Pine Sts.,



PLAN OF SAND DRYING PLANT, SEATTLE ELECTRIC CO.

The trucks are principally of Brill and Peckham manufacture, 21 E and 27 G, Brill and 6 E. S. Peckham.

The motor equipment on electric cars is for the most part of Westinghouse 38 B and 69, and G. E. 58, 57, 69 and 67 motors.

For keeping a record of the rolling stock the company uses a special form of Car Data sheet which is known as Stone & Webster Form No. 98. It is 13 x 8 in. and perforated at the top for filing. With each data sheet is filed a photograph of the car described.

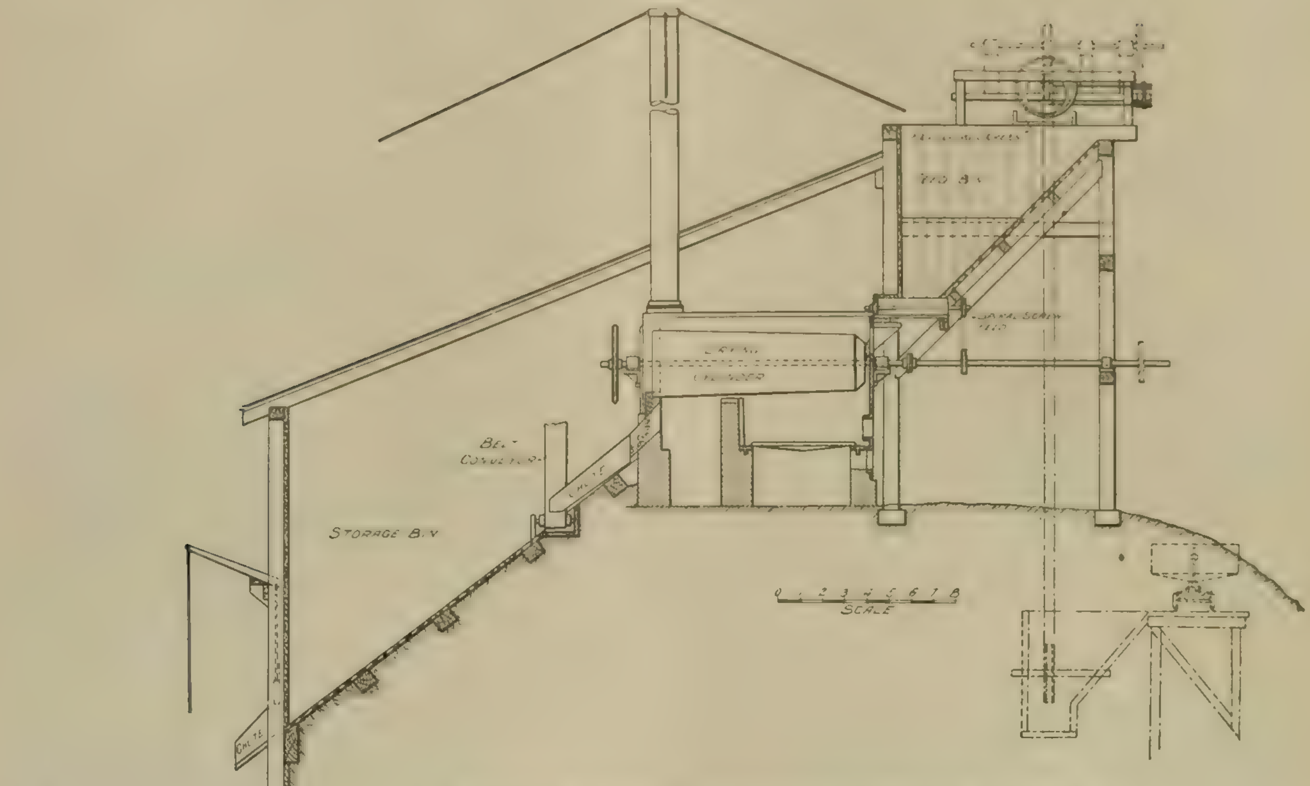
The illustrations show several of the principal types of car now used, including the combination electric car, combination cable car, large closed car for suburban lines, freight and express car, cinder car and a "totem-pole" car. Our readers doubtless all know what a totem-pole is, as used by Alaskan Indians for a genealogical

where the shops and general offices are located. There are 70 electric cars dispatched from here. The other stations are known as Madison St., with 20 cable cars; Broadway, with 7 cable and 15 electric cars; Yesler Way, with 12 cable cars, and Jackson St., with 7 electric cars.

The minimum service is 20 minutes headway, after 8 p. m., on some of the outlying lines. The maximum service is a 2 minute headway on the cable lines during busy portions of the day.

Freight is hauled to all parts of the city, the longest haul being about 6 miles. Fuel, both cordwood and coal, is regularly delivered to five fuel yards into which the company has laid spur tracks. For all sorts of general merchandise and supplies the motor cars, such as illustrated here, are used, two or three coal cars being hauled as trailers. On all electric lines two round trips

with freight trains are made per day; on the cable lines there are three round trips per day.



ELEVATION OF SAND DRYING PLANT SEATTLE ELECTRIC CO

There are now freight stations at 5th and Pine Sts. and at Green Lake, and another is being built at Ballard. At all other points goods are put off at the direction of and at the risk of the consignor.

For handling this business there is used a shipping receipt which we reproduce herewith. This receipt is made out in quadruplicate, carbon sheets being used. In the lower left hand corner will be noted the consignor's instructions as to delivery and the release of liability. The idea is that the consignor has immediately under his eye at the time of signing a brief and plain statement releasing the company, and that it is more effective in the mind of the consignor and in the courts than a release in the usual form, "contained in the fine print on the back hereof."

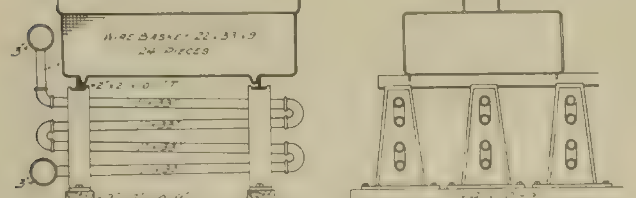


FIG. D. WASTE DRYING MACHINE SEATTLE ELECTRIC CO

The Seattle Electric Co. makes a point of encouraging its employes to reside in suburban districts, where the prices of property will permit them to have homes of their own, and grants various privileges intended to promote the comfort of the men not living near the operating barns. From the barns three cars, known as the employes' cars, are run regularly to University Heights, South Seattle and Green Lake, these cars being taken out by the night men when they quit work, locked and left on the track at the respective termini, and brought back the following morning by the day men.

SAND DRIER.

The large number of long and steep grades on the Seattle system, as also the fact that in the winter and spring there is much rain, makes the provision of dry sand for use on the cars a very important matter. The company owns a pit of good sand and gravel, some 50 acres in extent, and at this pit has erected the sand-drying apparatus shown in two of the line drawings.

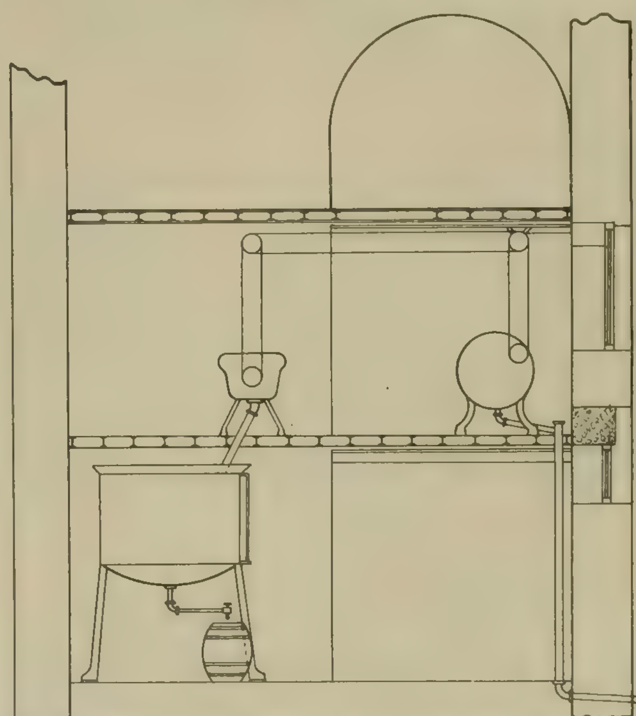


FIG. A. LONGITUDINAL SECTION WASTE WASHING PLANT SEATTLE ELECTRIC CO

In operation, sand is delivered into the boot from dump cars, in which the sand is drawn from the bank. From the boot an elevator takes the sand up and delivers it to a revolving cylindrical screen. The sand passing the screen drops into the feed bin below it and the stones and pebbles pass out the open end to a dump. The gravel is used for ballast and concrete work. From the feed bin the sand is fed into the drying cylinder by a screw.

The drying cylinder is over a furnace, as shown in the sectional view. The rotating chamber has on the interior surface projecting fins to insure the sand being mixed as it dries. From the drying [illegible] belt conveyor, which distributes the dried sand over the storage bin.

[illegible] 15 h. p. [illegible] connections being apparent from the drawings. In operation the [illegible] 70 tons per day.

[illegible] WASHING.

[illegible]

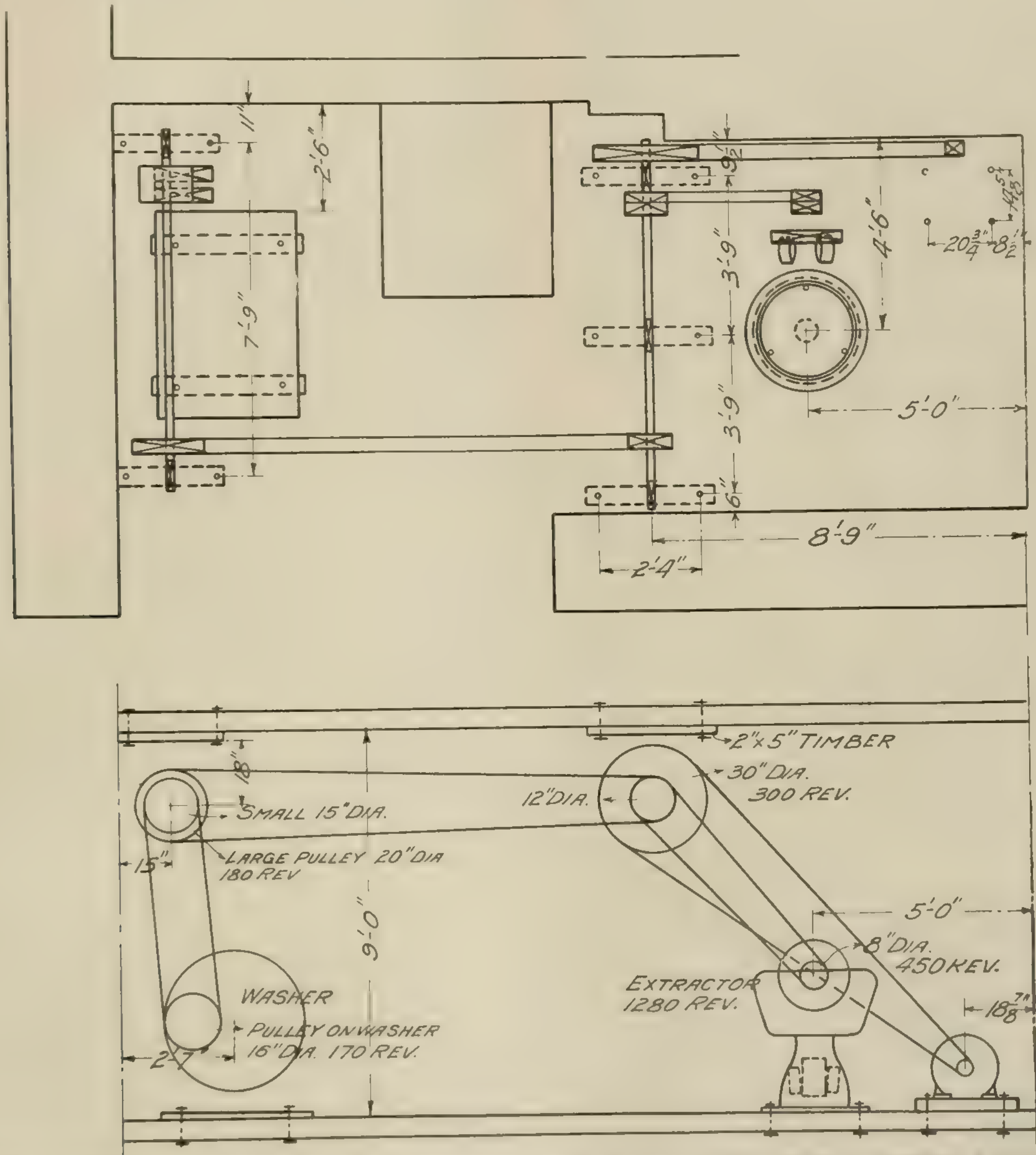
The first story is for the filters and oil storage tanks, the second story for the oil extracting and washing machinery, and the third story for drying the laundered waste. The three stories are separated by fire-proof floors, supported on I-beams. Each of the three rooms is about 21 ft. long by 10 ft. wide inside.

The longitudinal section, Fig. A, shows the general arrangement of the plant; the arched portion at the right indicates the doors (which open on the street), one door on each floor.

Figs. B and C show a plan and a longitudinal elevation of the second story, with full details as to the driving trains. The machinery consists of the driving motor, a Troy grease extractor and a washing machine, also made by the Troy Laundry & Machinery Co., Troy, N. Y.

After passing through the washing machine the clean waste is placed in wire baskets, 22 x 33 x 9 in., and taken to the third story in an elevator.

In the third story are three drying racks, each about 10 ft. long. The baskets set on the two [illegible] that join the [illegible] shown in Fig. D.



FIGS. B AND C. ARRANGEMENT OF WASTE WASHING PLANT EQUIPPED WITH TROY LAUNDRY & MACHINERY CO. WASHER AND GREASE EXTRACTOR—SEATTLE ELECTRIC CO.

ACCOUNTING.

For the guidance of the accounting officers of the different properties, of which Stone & Webster are general managers, the firm has compiled a set of instructions on accounting. This includes the [illegible] Street Railway [illegible] Association

ard by the National Electric Light Association, and also the recommendations of Stone & Webster's accountants in matters that have not been standardized by the associations, and where extensions of the standard systems seem to be desirable.

The monthly report used by the Seattle Electric Co. is a form of eight pages, each 8½ x 14 in.

Page 1. Recapitulation of principal footings for current month and for year to date, with comparisons showing changes from

OVERHEAD CROSSING IN WOODLAND PARK SEATTLE ELECTRIC CO.

previous year. Cash statement. Charges to construction and equipment accounts.

Page 2. Railway department operating expenses, as per standard distribution adopted by Accountants' Association.

Page 3. Statements of earnings of railway department. Recapitulation of earnings and expenses and comparisons with former periods.

Page 4. Light and Power Department operating expenses, as per schedule adopted by National Electric Light Association.

Page 5. Light and Power Department earnings. Recapitulation and comparison.

Page 6. Balance sheet.

Page 7. Monthly statement of operation of coal mining department.

Page 8. Recapitulation and comparison, into which are brought the gross earnings and expenses of the railway and light and power operations and the net earnings of the mining and jobbing business.

By reason of the number of the railway companies merged into the Seattle Electric Co. there is a considerable variety of tickets necessary. These include books of 25 tickets, sold for one dollar; books of tickets for school children, sold at the rate of 2½ cents, upon application signed by parent and teacher, which are good between the hours of 8.00 a. m. and 5:00 p. m. on days when school is in session; tickets sold at the rate of 3 cents, good for passage to the Court House on the James St. cable line; messenger tickets and newsboys' tickets, sold to the A. D. T. Co. and newspapers at the rate of 2½ cents each.

Under an ordinance consolidating the street railway franchises existing in 1900, a grant was received covering all lines, and good

Stone & Webster. Form A281—200 pads—8-12-03. DUPLICATE.

SHIPPING RECEIPT

THE SEATTLE ELECTRIC CO.

NO............ SEATTLE, WASH......................190...

READ THE CONDITIONS OF THIS RECEIPT.

Received of ....

THE FOLLOWING ARTICLES TO BE DELIVERED ALONGSIDE

CAR TRACK AT OR NEAR..

MARK UPON GOODS OR NAME OF CONSIGNEE

....

CONDITIONS

This company undertakes to forward the articles subject to the following conditions, which are agreed to by the shipper or owner in accepting this receipt. This company is not to be held liable for any loss, damage or delay caused by the acts of God, civil or military authority, or by fire, floods, mobs, riots or the enemies of the government. This company is not to be held liable or responsible for any loss or damage to said property or any part thereof from any cause whatever, unless in every case said loss or damage occurs from the fraud or gross negligence of this company or its servants. This company shall not be held liable or responsible in any event, nor shall any demand be made upon it beyond the sum of fifty dollars ($50.00), unless the true and just value of said property is stated herein, nor upon any property or thing unless properly packed for transportation, or upon any articles consisting of glass. This company shall not be liable for any loss, damage or delay to the articles transported unless the claim therefor shall be presented to it in writing, at its office in Seattle, within ten days after the loss, damage or delay becomes known to the claimant, and this receipt shall be annexed to such statement. It is understood and agreed that this company has no stations and no agents other than those on the car, and that the owner assumes all liability of delivery to and from the car, and agrees that if he is not present to receive the goods at the car door at their destination, that the delivery of them alongside the car track shall be a complete delivery to the consignee.

No. of Packages.	ARTICLES.	Weight subject to Correction.
....	....	....
....	....	....
....	....	....
		Advance.

Charges prepaid, amt............ Collect............$............

The Messenger Is Instructed to Unload This Consignment Alongside the Car Track at .... Entirely at My Risk.

For the Company

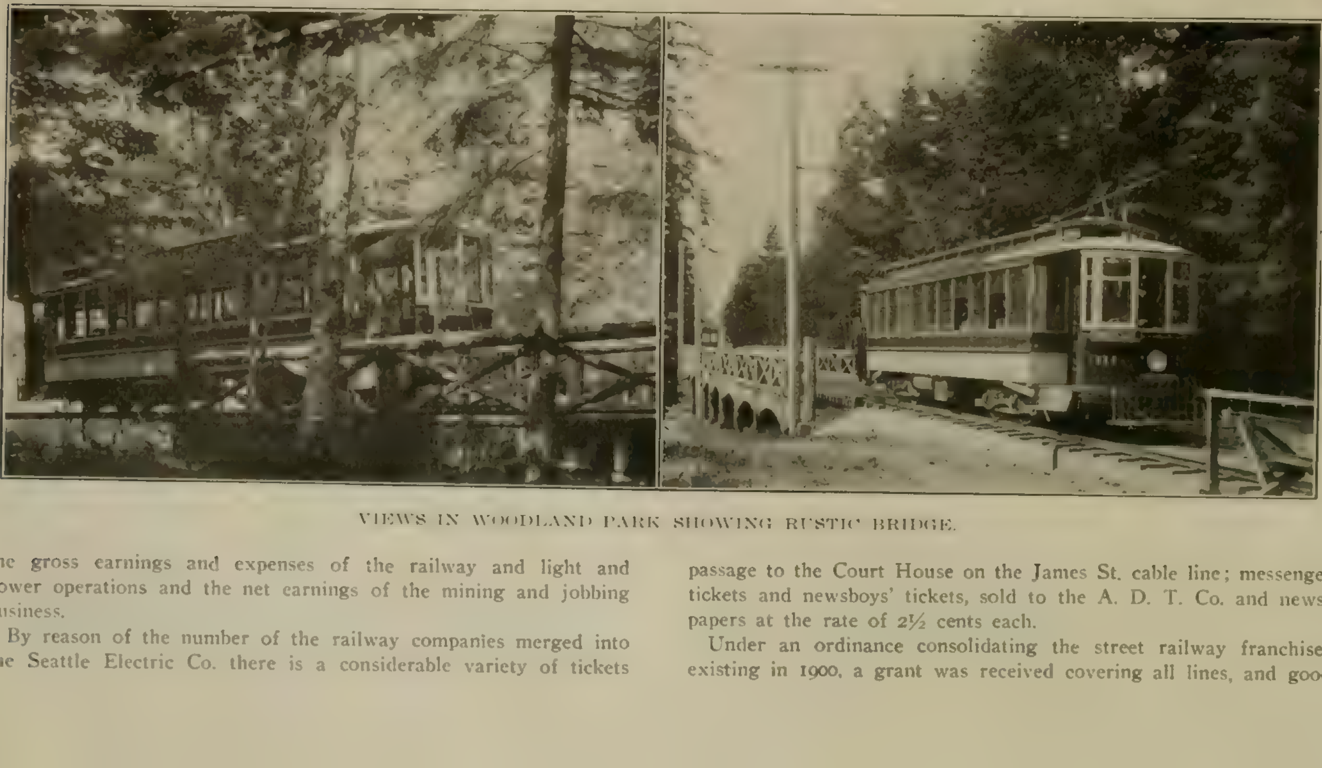
.... Agent.

Received Above Goods in Good Condition

.... Consignor

.... Consignee

SHIPPING RECEIPT (SIZE OF ORIGINAL 9¼ X 9 IN.)



VIEWS IN WOODLAND PARK SHOWING RUSTIC BRIDGE.

for 35 years from 1900. Under this ordinance the company pays the city 2 per cent of its gross receipts from street railway operations and paves between rails and for 18 in. outside, regrading, also, where specified.

While the monthly reports follow the standard system, in distributing the expense accounts on his book the auditor subdivides these to a considerable extent. Thus, instead of "No. 1 Maintenance of Roadway," the auditor on his book substitutes "No. 41 Maintenance of Track and Roadway," which is subdivided into: 1 A Maintenance Track (electric), 1 B Maintenance Track (cable); 1 C Maintenance Trestles and Bridges (electric), 1 D Maintenance Trestles and Bridges (cable); 1 E Maintenance and Renewals of Cable; 1 F Maintenance Road Machinery (cable); 1 G. Maintenance Paving.

Similarly there are "42. Maintenance of Electric Lines," subdivided to show "Overhead Railway Lines," "Telephone Systems," and "Track Bonding"; and "43. Maintenance of Buildings and Fixtures," subdivided into four accounts each covering different groups of buildings. And so on through the list, there being 68 accounts on the books as equivalents or subdivisions of the 39 accounts on the Accountants' distribution.

THEATER AT MADISON PARK
MADRONA PARK
LESCHI PAVILION

MADISON PARK FROM THE WATER
SWINGS IN MADRONA PARK
LESCHI PARK

COAL MINING

The company owns about 1,000 acres of coal land, the opera

tion of the mines being in charge of a superintendent of mines. The mines are at Renton, at the south end of Lake Washington, and at present the output is about 550 tons per day. The coal is in three veins lying on a slope of 12°, and is reached by horizontal tunnels. A washing and screening plant installed by the Jeffrey Manufacturing Co. is operated at the mine, the nut and pea sizes being washed. About 60 per cent of the output is sold; it is hauled from the mines by the Puget Sound Electric Ry., and the Northern Pacific Ry. The distribution of the coal carried to Seattle over the electric interurban constitutes an important part of the freight business of the Seattle Electric Co.

PARKS.

The Seattle Electric Co. owns in Seattle four parks, three of which are on Lake Washington, a large body of water ranging in width from 2½ to 5 miles, and about 20 miles in length. Two of the three are very advantageously situated for beautifying—being naturally very rugged and broken, with heavy growth of fir and madrona trees. About 12 or 14 years ago when the parks were owned by rival corporations, there were large pavilions built, one at each. Since coming into the hands of the Seattle Electric Co. the company has endeavored from time to time to utilize these buildings for attracting patrons to the parks. The buildings, being quite large and open, are not particularly adapted for park purposes, in view of the exceedingly short and cool summer seasons, and the buildings are too cool for pleasure in the evening, with the exception of eight or ten weeks in the months of July, August and September.

The principal attractions tried have been vaudeville shows, dancing, band concerts and beer gardens. Of these attractions the relative drawing power of each was about as follows: Band concerts first, beer gardens second, dancing third; none, however, have been considered altogether satisfactory.

At one of the parks for a number of years there was exhibited a menagerie, but this was not undertaken on a scale large enough to afford attraction to visitors. The company has, however, seals which attract a great many people, particularly at feeding time, when oftentimes anywhere from 100 to 1,000 persons can be seen crowding around the pens to witness this. The expense of maintaining the animals was not justified by the additional fares received; it having been shown that after the animals were removed, there was no falling off in the receipts.

Because of the exceedingly cool evenings the company has decided to eliminate the attractions usually found in eastern sections, where hot nights are the rule, and intends to encourage boating of every description as much as possible. The city has exceptionally good facilities in this line. Lake Washington affords the best canoeing and sailing possible, being a beautiful body of water entirely surrounded by bluffs and primeval forest scenery, with magnificent views of the Olympic and Cascade Mountains. These are covered with snow the year round, making an exceedingly pretty background for the expanse of green intervening.

There have been tried, to a limited extent, various minor attractions such as "A Trip to the Moon," "Haunted Swing," etc., but not on a sufficiently large scale to insure success. It is probable that a company will be organized to take over and operate the parks as a "Coney Island" resort at which can be found attractions of all kinds of sufficiently varied nature to suit all comers.

The fourth park belonging to the company is situated on Green Lake, about five miles from the business center of the city, and is advantageously situated for picnic purposes and children's play grounds and is patronized to a very large extent for these purposes. The principal attractions at this place other than its advantages for a picnic ground are a large boat house and dancing pavilion, which are quite well patronized.

In addition to the company's parks, the city owns and maintains several, many of which afford the most picturesque scenery possible, such as mammoth trees, exceedingly deep gorges and beautiful ferns. Many hundred varieties of the latter are found many times in a very small space.

In order to secure permission to extend its lines through one of the city parks, Woodland Park, the company was required to not only build a long trestle to avoid grade crossings, but also to disguise the structure so that it might be in harmony with its rustic surroundings. However much one may deplore the necessity of railway engineers to become landscape gardeners and conceal behind inappropriate decorations the lines of the structure that should be pleasing to the eye by reason of its strength and fitness it is interesting to see how the requirement was carried out. This is shown in three of the accompanying half tone views.

ORGANIZATION OF SEATTLE ELECTRIC CO.—OPERATING DEPARTMENTS.

- Stone and Webster, General Managers, Boston.
- H. F. Grant, Manager, Seattle.
  - Treasury and Accounting, Frank Dabney, Assistant Treasurer
  - Claims, C. A. Hammond, Claim Agent.
  - Lighting and Power, J. B. Lukes, Superintendent L. and P.
    - Assistant to Superintendent, R. M. Arms
      - Office Force.
      - Meter Department.
      - Arc Lamp Department.
      - Repair Department.
      - Inspectors.
    - Steam Department, W. J. Santmeyer, Ch. Eng. Power Stations.
      - Steam Fitters.
      - Station Men.
    - Electrical Department, S. C. Lindsay, Station Electrician.
      - Station Men.
    - Electrical Engineer, E. G. Allen
      - Staff.
    - Contract Agent, Dr. E. C. Kilbourne
      - Solicitors.
      - Clerks.
    - Superintendent of Wires, L. H. Bean
      - Light and Power, Overhead.
      - Railway, Overhead.
      - Underground.
      - Stables.
      - Telephone Trouble Man
      - Telephone Operators.
    - Jobbing Agent, S. R. Broadbent
      - Fixtures.
      - Inside Wiring.
      - Stock Room.
  - Maintenance of Way, Mark Loud, Superintendent M. of W.
  - Engineering, J. D. Blackwell, Chief Engineer.
  - Purchasing, W. J. Grambs, Purchasing Agent.
  - General Stores, J. R. Stewart, Storekeeper.
  - Mining, F. A. Hill, Superintendent Mines. D. H. Jones, Coal Agent.
  - Transportation, A. L. Kempster, Supt. Transportation.
    - 3 Dispatchers.
    - Timekeeper.
    - Record Clerk.
    - Office Force.
    - 7 Inspectors
      - 260 Motormen.
      - 340 Conductors.
      - 80 Gripmen.
    - Freight Agent, R. G. Crocker.
    - Janitor Force.
  - Mechanical, A. D. Campbell, Master Mechanic
    - Shop Forces.
    - Car House Foremen
      - Equipment Inspectors (In charge of Repairmen, Pitmen and Car Cleaners.)

ORGANIZATION.

The officers of the Seattle Electric Co. are: President, Jacob Furth, Seattle; Secretary, George Donworth, Seattle; Treasurer, A. Stuart Pratt, Boston; General Managers, Stone & Webster.

The local manager in charge of the property for Stone & Webster is H. F. Grant, under whom are the heads of departments as shown by the organization diagram.

A project very dear to the citizens of Seattle is that for a ship canal to connect Salmon Bay on the Sound with Lake Union and Lake Union with Lake Washington, and the Government has dug a canal 20 ft. wide at the bottom and 17 ft. deep between Salmon Bay and Lake Union known as Canal Waterway to determine the material that would have to be removed should the ship canal be decided upon. Gates are provided at the Lake Union end of the canal for controlling the flow. There was a marked rise in the level

WASHOUT ON CANAL WAY SEATTLE.

of Lake Union caused by rains in September and early October, 1903, and these gates being kept closed, the water finally broke through the dam around the gates on October 7th, and carrying everything before it widened the channel from 20 ft. to about 100 ft. One of the accompanying engravings shows a view of the canal at Fremont where the street railway crossed. Traffic across the canal was interrupted for only five hours.

We wish to express our appreciation to Mr. Grant, manager; Mr. Dabney, assistant treasurer and auditor; Mr. Kempster, superintendent of transportation; Mr. Blackwell, chief engineer; and Mr. Lukes, superintendent of lighting and power, for assistance in securing data for this article and other courtesies extended by them.

The Birmingham Railway, Light & Power Co. carried 18,720,689 passengers in 1903, as compared with 15,734,203 the year before.

Employes Rewarded for Carefulness.

January 1st the Boston Elevated Railway Co. distributed among its blue uniformed employes about $60,000 in gold for creditable performance of duty during the past year. Approximately 4,000 men received $15 each. This is in accordance with a section of a general order issued last January, to apply to first year men who have been six months or more in continuous employment in one position. It is intended as a reward for meritorious service only.

St. Louis Transit Co. carmen who did not have an accident in 1903 have been awarded a bonus of 1 cent an hour for the time each worked during the year. Each of 99 conductors and 31 motormen received about $32.

The Rockford & Interurban Railway Co. distributed annual prizes to employes standing highest for general excellence. The prizes ranged from $10 to $25 and were received by motormen and conductors.

Subway to Connect East River Bridges.

The plan and scope committee of the Rapid Transit Commission, New York City, has submitted a plan for the connection of the three Brooklyn bridges in Manhattan by means of a four-track subway to run from Delancey St., to and through Center St., to Elm St. From this point the subway will continue under private property to the Brooklyn Bridge. A spur will be built in Canal St. to connect with the new Manhattan Bridge. It is planned to use two of the tracks for trolley cars and two for elevated lines. Engineers regard this plan the most feasible and inexpensive that has been proposed.

Persons who live in the eastern district of Brooklyn may ride direct to the City Hall, or those who live in the western district may use either the old bridge or the Manhattan Bridge to proceed uptown without change of cars.

Car Tests on the Muncie, Hartford & Ft. Wayne Ry.

As announced in the "Review" for December, in the description of the Muncie, Hartford & Ft. Wayne Electric Ry., a number of interesting car tests were made by Messrs. E. P. Roberts & Co. upon this line. These tests were made with passenger cars under actual operating conditions beside which records were made of a passenger car and also of a work car when hauling gravel ballast. Table No. 1 gives a complete analysis obtained from the results of a single round trip of a passenger car in regular service. The weather was clear and the track in good condition during all tests.

TABLE I

LOCATION	No. of stops.	Distance in miles.	Time in minutes.	Watt hrs. by car watt meter.	Kw. hrs. per car mile.	Average Kw. required.	Elevation of the latter place in feet.	Difference in elevation of the two places.	In city or country.	Watt hours if track were level.	Kw. hrs. per car mile if track were level.	Watt hrs. per ton mile operating conditions.	REMARKS
Office to Harris St., Eaton	1	.61	3	2100	3.44	42.0	155.5	+32.2	C	1240	2.03	132	
Harris St. to So. end Hartford	6	6.84	16	15300	2.24	57.4	121.8	33.7	P	15690	2.30	86	Two curves in town. Two curves in country.
So. end Hartford to Hartford siding	1	1.06	4	2700	2.55	46.5	150.0	+28.2	C	1915	1.90	98	Straight, with 4 and 5% grades.
Hartford siding to No. end Hartford	4	.93	5	1500	1.61	18.0	149.6	.4	C	1310	1.41	62	
No. end of Hartford to sub-station So. of Montpelier	1	7.23	12	11400	1.58	57.0	117.4	—32.2	P	12133	1.68	61	Includes two long, easy curves.
Sub-station to Montpelier Y and turn	6	1.12	8	2400	2.14	18.0	100.0	—17.4	C	2535	2.27	82.5	Includes turning on Y and two curves.
Montpelier Y to sub-station	3	1.12	3	3600	3.22	16.7	117.4	+17.4	C	3015	2.70	124	Includes two curves.
Sub-station to No. end Hartford	[illegible]	7.23	16	16800	2.32	63.0	149.6	+32.2	P	15615	2.16	89	Includes two easy curves.
No. end Hartford to Hartford siding	1	.93	4	1200	1.29	18.0	150.0	+ .4	C	1140	1.23	50	Nearly level and straight.
Hartford siding to So. end Hartford	4	1.06	6	1800	1.70	18.0	121.8	— 28.2	C	2310	2.18	65	Hilly, 4 and 5% grades.
So. end Hartford to overhead crossing at Eaton	1	6.57	16	9600	1.46	36.0	171.7	+49.9	P	8280	1.26	57	Includes two easy curves.
Overhead to L. E. & W. at Granville siding	8	8.68	24	16800	1.94	42.0	174.3	+ 2.6	C P	1-700	1.87	75	
Granville siding to Muncie terminus	[illegible]	2.22	9	3300	1.49	22.0	180.0	+ 5.7	C	3445	1.31	57	
Muncie to L. E. & W. siding in Muncie	3	.35	2	900	2.57	27.0	174.3	— 5.7	C	765	2.55	99	Includes turning on Y.
L. E. & W. siding to Granville siding	4	1.87	7	4200	2.24	36.0	195.8	+21	C P	3460	1.85	86	
Granville siding to office, So. of Eaton	[illegible]	7.80	19	10800	1.39	34.1	123.3	—72.5	P	12235	1.57	53.5	
Totals exclusive of layovers	50	55.62	137	104400	1.88	40.0				100925	1.80	72.3	

Car of 26 tons raised 1 ft. high—approx. 20 watt hours.
If efficiency of 80—25 watt hours input.

C—In city.
P—In country.

Tests on the passenger cars engaged in hauling gravel gave results as shown in table two. The weight of the motor car was 25 tons, weight of gravel car light, 8½ tons, weight of gravel car loaded, (11 yd.) 25 tons. The motor car was equipped with four 50 h. p. G. E.-57 motors. The results were as follows:

TABLE II.

	Miles.	Ton mi.
Total distance hauling 6 loads gravel	93.14	16765.
" " " 6 empties	98.61	7451.
" " work car only	4.89	147.
" ton miles.......	24322.00	......
" kw.	715.80	......
Average watt hrs. per ton mi..	29.40	......

It should be noticed that the runs with six empties do not include all the runs made during the time of hauling the gravel shown by the load column, because some of the runs with empties included hauling other material and changing about which was not a part of the regular routine.

The results obtained from the work car were as follows

TABLE III.

	Light.	With 6 empties.	With 3 loads.
Total run, miles.....................	157.60	25.85	109.02
" average load, tons.......	25.00	77.00	100.00
" ton miles	1868.50	2067.45	10902.00
" kw. at car	74.88	96.60	396.30
Watt hrs. per ton mile......... ...	40.00	46.70	37.80

The above amounts are only those for which wattmeter readings were taken for each individual part of the trip.

The total for two days' complete work gave results as follows:

TABLE IV.

	With empties.		With loads.
Total run, miles..............	10.16	6.32	8.67
" average load, tons	100.00	96.00	180.00
" ton miles.........	1622.00		1562.00
" kw. at car............... .	67.20		43.80
Watts per ton mile......	41.40		28.00
Average watt hrs. per ton nearly 35			

This total result is considerably smaller than those obtained from the individual trips given in the previous table. Using assumed values of 26 watts per ton mile for loads, 38 watts per ton mile for empties and 40 watts per ton mile for running light gives the following:

Hauling loads	16,765 ton miles at 26 watts per ton mile =	435.9 kw.
Hauling empties	7,451 ton miles at 35 watts per ton mile =	275.7 kw.
Running light	147 ton miles at 40 watts per ton mile =	5.9 kw.
Total	....	717.5 kw.

which checks very closely with the actual results.

Assuming 11 yd. of gravel per car the results per yard of gravel for the work cars are as follows:

TABLE V.

Train miles..........	93.14
Cubic yards per train................................	66.
Equivalent to one yard hauled........................	6,147.24 mi.
Total kilowatts expended.	715.8
Total watt hours required to haul one yard one mile including the necessary switching, unloading with plow and the hauling back of the empties.................	116.

For the passenger car hauling gravel on another part of the road on two other days the record is as follows:

TABLE VI.

Train miles of three loads..............................	109.
Yards per train load . . .	33
Equivalent to one yard hauled . .	3,597 mi.
Total watt hours required to haul one yard one mile including the necessary switching and hauling back of empties	195.

It should be noticed that in both cases the grade conditions are not favorable to the highest economy. On the section where the passenger car was working are several grades and curves including a reverse curve and a 3 per cent grade on a 23° curve. On the section where the regular work car was hauling the curves are all easy but the grades through Hartford City reach a maximum of about 5 per cent. For the same reasons the work of the cars cannot be compared with each other, but both tables give data obtained from actual working conditions and are therefore valuable.

Canadian Notes.

At the coming session of the Ontario legislature bills will be introduced in behalf of the following: Toronto & Suburban Ry., to extend through Hamilton; Ontario Traction Co., charter to build between London, Stratford, Seaforth and Wingham; Brantford & Erie Railway Co., charter to build between Brantford, Simcoe and Port Dover, with a loop from Waterford to Simcoe; Hamilton, Grimsby & Beamsville Ry., to build branch railways and acquire land for parks; London, Aylmer & North Shore Electric Co., to reduce its capital stock to $400,000 and to issue bonds to the extent of $25,000 per mile.

Mr. A. C. Douglass has started under the center of the Horseshoe Falls at Niagara to drive a power tunnel for the Electric Development Co., of Ontario. The tunnel will be 2,200 ft. long, 23 ft. 6 in. wide and 28 ft. high, and will extend from the power house at Dufferin Islands to the foot of the falls.

The Electric Development Co. will erect a granite power house at Niagara Falls, Ont., 425 x 200 ft., to cost $400,000. E. J. Lennox, Toronto, is preparing plans and specifications. A visitors' gallery at the top of the building will afford a good view of the falls, as well as of the immense machinery plant.

Mr. N. M. Coutin, of St. Joseph's, Ont., has applied for a franchise for a city electric line, and a radial line from Stratford to St. Joseph's.

The Stratford city council has granted the Stratford Radial Co. a 50-year franchise, with the option of purchasing the property after 25 years, the railway company to be exempt from taxes for 20 years and to be given the right to supply light and power.

Plans have been completed for an electric line from Montreal to Ottawa. The directors of the company are Messrs. F. D. Monk, J. A. Ethier, J. E. Leonard and Thomas Gauthier, all Members of Parliament, and Mr. Wells, of New York. Colonel McMullen, also of New York, is president.

The newly formed Montreal Street Railway Benefit Association has over a thousand members. Mr. W. L. Wanklyn is president and the directors are Messrs. Duncan McDonald, W. C. Ross, L. Robinson, Patrick Dubee, L. Charland and John Donald. Mr. Dubee is secretary.

A commission has been appointed to report on whether it will pay the municipalities within a radius of 120 miles of Niagara Falls to develop their own power from the falls to generate electricity or to purchase power from existing companies.

The South Western Traction Co., of London, Ont., has been financed by an English syndicate to build from Hamilton to Paris, London, St. Thomas, Aylmer and Glencoe, with two spur lines. Mr. A. E. Welch is managing director.

Mr. G. H. Gray, of Victoria, B. C., is surveying for a monorail railway which a Minneapolis syndicate proposes to build in the Lardeau-Duncan district.

The Toronto Street Railway Co. has 34 cars under construction.

The Scranton (Pa.) Railway Co. contemplates the expenditure of about $500,000 on improvements this season. Several lines will be double tracked and a number of new cars purchased.

Hudson River Tunnel Plans.

The plans of the Hudson & Manhattan Railroad Co., which proposes to connect Jersey City and Manhattan by tunnels under the North River, have been accepted by the Rapid Transit Commissioners and the resolutions granting the franchise have been adopted by the New York board of aldermen. The plan provides for two tunnels from some point near the Pennsylvania R. R. station in Jersey City to the corners of Church and Fulton and Church and Cortlandt Sts., New York City, these termini to be connected by a tunnel under the property on the west side of Church St., between Fulton and Cortlandt Sts. Practically all this property from Fulton to Dey Sts., and from Dey to Cortlandt Sts., has been acquired. On these two Church St. blocks two 16-story office buildings will replace the present buildings, and the new buildings will, if permission can be obtained, be connected by an ornate arched passageway over Dey St.

Passengers from the Pennsylvania R. R. trains at Jersey City will enter the cars at an underground station and be carried through the tunnel across Cortlandt St. and around the corner to Church St., where the tunnel will continue under the basement of the first big building. From there, according to the plans, passengers may take elevators to the station of the Sixth Ave. elevated road at that point, or they may continue to Dey St., where a walk of one block through a tunnel will take them to the big station of the subway in Broadway.

If they do not wish to take advantage of either of these points of exit they may continue under the second big building at the corner of Fulton St., and thence to the street. Passengers going from New York to Jersey City will board the cars at the Fulton St. station. The tunnel trains will thus practically make a continuous swing from Jersey City to New York and back.

The tunnels will be 16 ft. in diameter and contain but one track each. Trains will be run by electricity. The course of the tunnels has been laid out by the engineers, and borings indicate that the river bed will present comparatively few difficulties in the construction.

The Hudson & Manhattan Railroad Co. is controlled by practically the same interests that constitute the New York & New Jersey Railroad Co., which is constructing the tunnels begun years ago to connect the Erie and Lackawanna railroads on the New Jersey side with New York at Christopher St.

The president of the newer corporation is William G. McAdoo, and among the directors are John S. Williams, of the Seaboard Air line; Walter G. Oakman, president of the Guarantee Trust Co.; Judge E. H. Gary, H. B. Hollins, Frederick B. Jennings, A. M. Brady and John G. McCullough, governor of Vermont.

International Electrical Congress of St. Louis.

We are informed that the State Department at Washington, in response to solicitation from the Director of Congresses at St. Louis, and the president of the American Institute of Electrical Engineers, as well as the committee of organization of the congress, issued instructions, on December 17th, to the American diplomatic officers abroad that they shall invite the various foreign governments to appoint official delegates to the International Electrical Congress at St. Louis in September, 1904. The number of delegates requested to be appointed by each country is in conformity with the precedents established at the Chicago Congress of 1893, and at the Paris Congress of 1900.

Removing Refuse in Brooklyn.

The Brooklyn Rapid Transit Co. has entered into a contract with the American Railway Traffic Co. for the removal of ashes and street sweepings throughout Brooklyn by means of a new system which contemplates the establishment of 13 receiving stations, centrally located, at which the ashes and refuse will be left by wagon to be taken during the dull hours of the day over the trolley lines, in flat cars, to Coney Island and Jamaica, L. I., to be dumped. The refuse may be carried in bags which will be transported from the stations to the cars [illegible] by means of [illegible] tramway.

Under a new rule of the Interurban Street Railway Co. cars stop at the near side of cross streets.

International Railway Employes' Association.

We have received from Hon. W. Caryl Ely, chairman of the board of trustees of the International Railway Employes' Association, Buffalo, the third annual report of the association, covering a period of 13 months, the beginning of the fiscal year having been changed from October 1st to November 1st. The report is prefaced with the statement that for death claims and sick benefits the past year has been a record breaker. Within seven months Class R paid nine death claims, while during the preceding 28 months there were but two, and during the past year Class R paid $6,388 for sick benefits, against $4,104.50 for the preceding year. In other words the death claims increased 800 per cent, sick benefits 65 per cent, and medical attendance 27 per cent over the preceding year. During the past year the members paid in initiations and dues $9,154.92 and received in benefits $10,058.57, or $913.65 more than they paid in, and the trustees urge other employes who are eligible to join the association as a purely business proposition. There was a deficit in Class H, which was paid by the railway company, of $198.50. There was a total membership Oct. 31, 1903, of 1,320, a net increase of nearly 200, and it was stated that in November 175 new members would be enrolled.

During the past three years the railway company has expended about $14,000 in building and equipping the rooms, over $10,000 in salaries and other expenses of the association, donated nearly $1,000 to Class R, met deficits amounting to $678 in Class H, and started the reserve fund with a $500 bond. During the same period the members have paid $20,356 in initiation fees and dues, and drew in sick benefits $15,056, death claims $2,103, and medical attendance $4,664, a total of $21,823, or $1,467 more than they paid in.

The treasurer's report for the 13 months shows receipts amounting to $9,873.03; disbursements, $9,990.97; net deficit, $57.94. The net surplus Oct. 31, 1903, was $1,664.09.

Rochester Street Railway Y. M. C. A.

The first annual report of the Rochester (N. Y.) Street Railway Y. M. C. A. has been published. It shows that Y. M. C. A. work among the street car men during the past year has met with even much greater success than was anticipated, and employe and employer have been benefited by it amazingly. This was the first street railway Y. M. C. A. to be inaugurated in the world, dating its inception Aug. 4, 1902.

During the year there has been an average attendance at the rooms of over 200 daily; six concerts were given with an attendance of over 500 in each instance; several prize bowling matches were played; the billiard tables earned $600.38 at 1½ cents a cue; receipts from bowling were $473.68 at 2½ cents per man per game; the company appropriated $500 towards maintaining the rooms, besides heating, lighting and cleaning them.

A significant and pleasing incident of the year was the closing of a pool and billiard saloon directly opposite the rooms.

The report is typographically attractive and combines 32 pages of text and illustrations.

Steam Roads Cut Rates.

The Delaware & Hudson Railroad Co. announced that beginning December 19th its rates between Scranton and Wilkesbarre, Pa., would be cut in half, this step being taken, it is stated, in order to compete with the recently opened Lackawanna & Wyoming Valley third-rail system.

The Lake Erie & Western Railroad Co., to meet competition by the Indianapolis & Northwestern Traction Co. between La Fayette, Franklin, Indianapolis, Mulberry and Dayton, has reduced its fares between those points. The reduction is considerable, but the fare is still higher than that charged by the traction company.

The Cincinnati, Hamilton & Dayton Ry. issued a circular letter to its agents offering half rates for the holidays between all points south from Lima to Cincinnati, and it is understood that the steam road will this season charge the same rates as the Western Ohio Traction Co. south from Lima as far as Piqua.

The disputed franchise of the Mill Creek Valley Street Ry., of Cincinnati, has been declared valid.

Consolidation at Salt Lake City.

The consolidation of the Utah Light & Power Co. and the Consolidated Railway & Power Co., of Salt Lake City, which was announced as pending in the "Review" for September, has been consummated by the incorporation of the Utah Light & Railway Co. The consolidation went into effect January 1st. The capitalization of the new company is $10,000,000, of which $6,000,000 will be issued at once, to be taken up by the stockholders in return for their old stock. The other $4,000,000 will be held to be sold for improvements and repairs. Three shares of the old companies' stock will be exchanged for two preferred and one share of common stock in the new company. The par value of the shares is $25. Dividends will not accrue on the common stock until after the preferred has earned 8 per cent per annum. The majority of the preferred stock is held by Joseph F. Smith, A. W. McCune and W. S. McCormick, trustee, and these gentlemen control about 70,000 shares of the common stock. The stock is divided into 240,000 shares of common and 160,000 shares of preferred. The plans for improvement have not been outlined, but better light and better car service are promised.

The officers and directors of the new company are as follows: President, Joseph F. Smith; first vice-president, John R. Winder; second vice-president, Joseph S. Wells; treasurer, L. S. Hills; secretary and general manager, R. C. Campbell; general counsel, LeGrand Young; superintendent street railway, W. P. Read; auditor, G. S. Gannett; assistant secretary, John M. Whittaker. Directors: W. S. McCormick, L. S. Hills, Joseph F. Smith, J. R. Winder, Anthon H. Lund, A. W. McCune, Joseph S. Wells, W. P Read, Thomas G. Webber, Charles S. Rood.

Cross Roads Shelter Houses.

The Joliet, Plainfield & Aurora R. R. has erected natty frame waiting rooms, or shelter houses, at all cross roads along its line between Joliet and Plainfield. These shelter houses are exceedingly attractive and cosy, and are lighted and heated by electricity.

In front of each shelter house and between it and the track is a platform, 24 ft. long and 4 ft. wide, and connecting the platform and the station is a passageway, 8 x 4 ft. The platform floor is 15 in. above the top of the track rail, and the platform sets back 32 in. from the outside rail. A two-rail wooden fence has been erected at the rear of the platform and the sides of the passageway. The platform is of 2-in. hemlock or oak, and rests on 6 x 8-in. joists.

The building is 8 ft. wide, 6 ft. deep and 8 ft. to the roof plate. The roof, which is shingled, is peaked, the peak being 3 ft. above the roof plate. The roof overhangs 2 ft. 6 in. on all sides of the building. The floor is of white pine, tongue and groove style. A board seat, 10 in. wide, extends around three sides of the interior of the shelter house, and on two sides and in the door sliding windows have been placed. The exterior of the station is painted a lemon yellow, with white trimmings.

Each shelter house is lighted by one series of five lights receiving current from the trolley wire, two lights being placed inside of the building, and three lights on the eaves. These lights are controlled by a small switch inside of the building, enclosed in a locked box. Trainmen light the lamps in the evening, it being the duty of the crew on the last car to turn out the lights.

The buildings are heated by means of Consolidated electric heaters, connected in series of three, the current to be turned on by the first morning crew and turned off by the last crew at night.

Creditors Attached the Cars.

A dispatch from Sault Ste. Marie, Mich., stated that on December 18th as fast as the cars of the Trans-St. Mary's Traction Co. arrived at the barns late in the afternoon they were attached at the instance of two judgment creditors. The road's attorneys unsuccessfully applied for an injunction, and it was finally agreed to allow the creditors to retain possession until the claims are satisfied, or the road sold, the cars to continue running. The road was not covered by the mortgage held by Messrs. Speyer & Co., who recently purchased the assets of the Consolidated Lake Superior Co.

Trolley on Mt. Vesuvius.

The old wire rope railway which has transported tourists up Mount Vesuvius, as far as the crater, for the last 25 years has been supplanted by a modern railway system which is a combination of electric adhesion, cog-wheel traction and overhead trolley. In the construction of the new system, which was begun in the fall of 1902, many engineering difficulties were overcome, especially on the rack, or cog-wheel section, on which over 1,500,000 cu. ft. of earth, rock and lava were removed. The new Vesuvius Ry. is 4.8 miles long. It starts at the little village of Pugliano and traverses first a fertile tract, following the old streams of lava which flowed during the several eruptions of the volcano since 1737. The rack wheel section begins about 150 ft. from the great laval deposit formed in 1872, and reaches to the station of Eremo-Osservatorio, where stands the famous observatory built by King Ferdinand II. From the observatory grounds the road runs nearly 1,300 ft. over the ridge of the Puzzolan Hill, formed by masses of lava. This part of the line uses the overhead trolley.

Powerful locomotives of special design are used on the cog-wheel section. The passenger cars are divided into three compartments and accommodate eight passengers. Each car weighs a little over eight tons, while the locomotives weigh 10½ tons each. The locomotives are equipped with electric brakes. The cars are lighted by electricity. All of the power plant machinery and rolling stock are of Swiss make. The road cost about 1,500,000 francs. It was successfully opened for traffic last September.

Nonunion Carmen Attacked.

A mob of union sympathizers attacked the nonunion crew of a Chicago City Railway Co. at 22d St. and Archer Ave., Chicago, December 27th, and in the riot that followed two policemen, who were riding on the car to protect the carmen, were severely injured. One officer was knocked insensible. Reinforcements dispersed the mob. Several times since the recent strike nonunion men have been attacked while on duty, the absence of the union buttons on their coats making them easily distinguishable from other employes.

During the past month the grand jury at Chicago has voted 14 indictments against union members and business agents for alleged violence during the street railway and Kellogg Switchboard Co. strikes.

Record Run from Norwalk to Cleveland.

Car No. 103 of the Cleveland & Southwestern Traction Co. made a record-breaking run from Norwalk, O., to Public Square, Cleveland, Sunday, December 6th, covering the 57.6 miles in 1 h. 29 m. 50 s., or four minutes faster than the Twentieth Century Limited time between those points. The feat was considered a remarkable one in view of the fact that there was no especial preparation beyond seeing that the road was clear, and also because the car was loaded with passengers, who were delighted with the speed and the comfort and ease with which it was accomplished. The car had been chartered to convey a party of Elks and ladies to the Elks memorial celebration, and it was in charge of Motorman W. F. Kearins and Conductors Lysle Chevalier and Ed Wilcox, to whom the company officials give due credit.

The attempt to make a record at this time was really the outgrowth of a rivalry between the Cleveland & Southwestern and the Lake Shore Electric Railway Co., and it had been arranged that both should race cars on the occasion in question. The Lake Shore car made a good start, but was unfortunately delayed by the breaking of a trolley wire, so the race was not finished.

Speaking of the fast trip of No. 103, F. T. Pomeroy, president of the Cleveland & Southwestern Traction Co., said: "We made a nice trip then, but I feel that with a little better road and power we can cut that time down nicely. Without a doubt we have one of the fastest roads in this section, and are proud of it." The best previous time made between Norwalk and Cleveland by a Cleveland & Southwestern car was at the beginning of the base ball season, when Motorman Kearins took a special through in 1 h. 57 m.

The Northern Ohio Traction & Light Co. has sold Randolph Park at Chagrin Falls, O., and the new owners have dismantled it.

New Lines and Extensions Opened.

The new belt line of the Pittsburg Railways Co., which covers all the principal towns of the Monongahela and Turtle Creek valleys, has been opened to traffic. The cars start from Pittsburg over the United Traction line to Glenwood, to Six Mile Ferry, via Calhoun Park to McKeesport, then to East McKeesport over the line of the old Wilmerding & McKeesport branch, to Wilmerding over the new $300,000 steel viaduct across the Pennsylvania R. R. tracks and the Westinghouse Air Brake Co. yards at Wilmerding, along Grant St. to Turtle Creek, thence along the old route of the United Traction Co. to East Pittsburg, Braddock, Rankin and into Glenwood and Pittsburg.

The Philadelphia & Eastern Street Railway Co. has completed its line between Easton and Riegelsville, after three years' work. This affords the most direct route between Philadelphia and Easton, and the new branch also links Trenton with the Lehigh Valley trolley system.

The Indian Territory Traction Co. has establishd a 40-minute schedule between 6 a. m. and 11 p. m. on its recently opened system which connects South McAlester, Alderson, Krebs, McAlester, Busby and a number of other mining towns and mines.

The last gap in the line of the Chambersburg, Greencastle & Waynesboro Street Railway Co., from Pen Mar to Waynesboro, Pa., has been completed and the company operates over the entire 15 miles of the system.

The formal opening of the Pittsburg Railways Co's. Oakmont, Edgewater and Hulton branch, which is a continuation of the Verona branch, occurred December 19th.

Through service was inaugurated December 18th on the Urbana, Bellefontaine & Northern Ry., and the event was celebrated at both Bellefontaine and Springfield, O.

Christmas day the first electric passenger car was run between Coeur d'Alene, Idaho, and Spokane, Wash., over the recently completed system of the Coeur d'Alene & Spokane Railway Co. At present the company will use steam to transport freight and electricity for passenger service, but intends to use electricity for both passengers and freight later.

The Toledo & Western Railway Co. has opened its extension to Pioneer, which gives the company 80 miles of road. With the exception of 10 miles between Pioneer and the Indiana state line there is an unbroken chain of electric railways across northern Ohio, paralleling the Lake Shore & Michigan Southern Ry.

Regular service between Rockwood, Mich., and Toledo was instituted by the Detroit, Monroe & Toledo Short Line Co. December 25th. With the line completed to Sibley's transfer can be made to the Wyandotte & Detroit River line, thus giving electrical connection between Detroit and Toledo. It was expected that this would be done this month.

The Illinois & Iowa Electric Railway Co. has opened its interurban line between Davenport and Clinton, Ia., as far as Bettendorf, and it is expected that the whole line will be completed by next summer. The line is the first of consequence in eastern Iowa. Mr. T. J. Wilcox, of Des Moines, is general manager.

The connecting of the tracks of the Pittsburg, McKeesport & Greensburg Railway Co. and the Pittsburg, McKeesport & Connellsville Railway Co. systems at Hunter, Pa., has been completed and arrangements made for through express train service between Greensburg and Uniontown.

The first cars were run on the Center & Clearfield Street Railway Co's. system Christmas day. The road runs from Philipsburg to Winburne, Pa., 12 miles, winding through a populous mining country, touching Decatur, Morrisdale, Munson and other towns. Mr. J. C. Platt, of Philadelphia, is president of the company.

The East St. Louis, O'Fallon & Lebanon Electric Railway Co's. line connecting East St. Louis and Lebanon, Ill., is completed and regular service was inaugurated December 20th.

The Macomb & Western Illinois Railway Co., which is building a line from Macomb to Littleton by way of Industry, Ill., has opened the line to traffic as far as Industry, the first passenger trip being made January 1st.

Limited traction service between Indianapolis and Richmond, Ind., was inaugurated January 4th by the cars of the Indianapolis & Eastern Railway Co., which run over the tracks of that company to Dublin, and from Dublin to Richmond over the Richmond Street & Interurban Railway Co's. tracks. The running time for the 72 miles is 2½ hours. The cars cannot enter the city of Richmond on account of the Chicago, Cincinnati & Louisville R. R. bridge, and passengers are transferred to city cars at West Richmond.

January 1st the Central Pennsylvania Traction Co. began to run cars on the Linglestown extension as far as Paxtonia, Pa.

New Year's day was celebrated at the Oklahoma Military Institute, Oklahoma City, by a reception in honor of the arrival of the first car of the Metropolitan Railway Co. at the Institute grounds. All the prominent citizens of Oklahoma were present and the advent of the car was greeted by a salute of 12 guns.

F. C. Randall.

Mr. F. C. Randall has been elected vice-president and general manager of the National Electric Co., successor to the Christensen Engineering Co., of Milwaukee, to succeed Mr. R. P. Tell, resigned. Mr. Randall graduated from the English High School, of Boston, in 1875 and entered the office of his father, who was an importer of special grades of English iron and steel, in Boston. After two years he entered the employ of the New York & New England Railroad Co., as "performance of engine" clerk in the Norwood Central, Mass., shops, and later was appointed chief clerk of the motive department of the same road at Hartford, for all divisions west of Willimantic, Conn. He resigned to become chief clerk of the motive power department of the Boston & Lowell R. R. and its leased lines. Upon the consolidation of the latter road with the Boston & Maine Railroad Co., he severed his connection with the steam railroad business to embark in the manufacturing field. He first entered the shops of the Tripp Manufacturing Co., and after several years, during which he obtained a practical knowledge of the manufacture of electric railway trucks, he was made foreman and later superintendent of the shops. He resigned this position to accept a position as eastern sales agent of the J. G. Brill Co., and was later made western sales agent for the company, with headquarters at Chicago. He was employed by the Brill Co. about six years and then became eastern sales agent of the Christensen Engineering Co., and was later appointed general sales agent of this company, and its successor. During Mr. Randall's connection with the sales department of the company the sales of the Christensen air brakes increased from less than 200 equipments to a total of over 11,000, which are in use at present. In his steam road experience he gained a valuable knowledge of organization, which added to his insight of electric railway affairs gained by personal contact with the leading electric railway operating men, enabled him to form a corps of salesmen and engineers, covering the railway field of the entire country, and in the success of which organization he takes great pride. In addition to his duties as vice-president and general manager, Mr. Randall will continue to attend to the duties of general sales agent not only of the air brake department, but also of the electrical machinery department of the company.

F. C. RANDALL.

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SUMMARY OF CONTENTS.

THE ARNOLD ELECTRO-PNEUMATIC RAILWAY SYSTEM.

Since the announcement, made at the Great Barrington meeting of the American Institute of Electrical Engineers in June, 1902, by Mr. B. J. Arnold of the principles of his system for utilizing single phase alternating current for railway operation, the publication of the results obtained on the Lansing, St. Johns & St. Louis Railway, which was to use the Arnold electro-pneumatic system, has been awaited with keen interest. It was therefore a keen disappointment to learn of the fire which on Dec. 18, 1903, destroyed the car house and shops of the company, and two new cars equipped for regular operation as well the experimental locomotive built by Mr. Arnold. Mr. Arnold in June last made two trips of about three miles each with the experimental machine, and it is only the complete and unexpected destruction of his equipment that prevented him from being the pioneer in single-phase railway operation on a commercial basis.

RAILWAY AND LIGHTING ACCOUNTS.

The number of corporations which operate electric railways and also conduct a light and power business, electric or gas, and perhaps both, is large at the present time, having increased rapidly because of the consolidations of public service companies effected in recent years. In keeping the accounts of these companies there is a wish to follow standard systems in order to facilitate comparisons with others in the same line of business, and consequently for the railway department they follow the classification of the Street Railway Accountants' Association, and for the lighting and power department follow that of the National Electric Light Association.

The classification of operating expenses for electric railways was devised with three grand subdivisions—Maintenance, Transportation, General. This arrangement is upon the theory that in order to operate properly the plant must be maintained at a certain standard and therefore "maintenance" should be the first division.

The classification for the operation of electric lighting properties has three grand divisions also—Manufacture, Distribution, General.

Analysis of the two classifications shows that the difference other than variations in the names of accounts by reason of the differences in the nature of the two departments lies in treatment of maintenance charges. These differences are shown in the two tables.

A. ELECTRIC RAILWAY
- I. Maintenance
  - 1. Way and Structures.
  - 2. Equipment.
- II. Transportation—
  - 1. Operation of Power Plant.
  - 2. Operation of Cars.
- III. General.

B. LIGHT AND POWER—
- I. Manufacture-
  - 1. Operating.
  - 2. Maintenance.
- II. Distribution
  - 1. Operating.
  - 2. Maintenance.
- III. General.

Classification B could be made to conform to A by bringing I-2 and II-2 together as "Maintenance" divided into, 1. "Power House" and 2. "Lines" (or 1. "Manufacture" and 2. "Distribution") and bringing I-1 and II-1 together as "Operation," divided into, 1. "Manufacture" and 2. "Distribution."

Classification A could be made to conform to B by an analogous rearrangement, for instance, making the first two grand divisions I. "Fixed Equipment" to include power plants, shops, other buildings and lines, and II. "Rolling Stock," each being subdivided into 1. "Operation" and 2. "Maintenance."

Both of the schemes of subdivision in the existing standards are logical and both are perhaps equally convenient when used separately, but when both are found in the accounts of one company the variation in principle is striking, and the suggestion is made that the associations that have adopted these standards could with advantage take action with a view to adopting a single classification that could be used in both branches of the business. The fact that a division exactly corresponding to "Cost of Manufacture" as used in the Light and Power accounts cannot be made in Railway accounts, while on the other hand "Manufacture" and "Distribution" are equally satisfactory for grand divisions or subdivisions in the

Light and Power accounts, is a reason why the latter instead of the Railway classification should be changed in an attempt to secure uniformity.

AN EXPERIMENT WITH LOW FARES.

An interesting experiment is now in progress in Cleveland, Ohio, where the Cleveland Electric Railway Co. has agreed to conform, for the period of 90 days, to the provisions of an ordinance by which the city council undertakes to reduce fares on the railway system. This is the first attempt made in America to apply the zone system of street railway fares on city lines, although there have been several notable attempts made to establish in American cities a rate of fare on street railways less than 5 cents. At Detroit franchises were granted to a rival company with the expectation that it would operate successfully, selling tickets at the rate of eight for 25 cents; after a year or so of bitter competition, which brought both the old and the new companies to the verge of bankruptcy, an arrangement was effected whereby the older company leased the new lines, and since 1896 the low-rate tickets have had but limited use, and on these no transfer is granted. The attempt to provide adequate service for the entire city at the 3-cent rate was a failure. The city of Indianapolis also attempted to establish 3-cent fares, by municipal and state legislation, but the railway company contested the legality of the city's action and after years of litigation a compromise was effected, and after reorganization in 1899 the company was given a new franchise with provisions for a 5-cent fare and the sale of 25 tickets for one dollar. A third celebrated case was the attempt of Milwaukee to establish a 4-cent fare in that city, which also failed, because the company proved the proposed rate to be unreasonably low.

Heretofore the disadvantages of the zone system in limiting the territorial growth of cities, and promoting overcrowding in tenement and factory districts, have had sufficient weight to prevent a trial of such a street railway tariff by any American city or company.

For the Cleveland experiment the rates are to be: Within a certain district, 3 cents without transfers, or 5 cents with transfers; to and from the city limits and suburbs 5 cents without transfers, or 7 cents with transfers. The city limits of Cleveland embrace an area of about 28 square miles, and the 3-cent zone comprises about three-fourths of this; the estimate of Mayor Johnson is that 85 per cent of the passengers on the Cleveland Electric Railway will ride for 3 cents, and that not above 3 per cent will be required to pay 7 cents. This would result in a decrease of receipts of about one-third, if the volume of traffic were to remain the same.

Inasmuch as the bare operating expenses of the Cleveland road are about 56 per cent of the gross receipts, and the interest charges are about 10 per cent more, leaving the net income less than 34 per cent of the gross receipts, it would appear to be impossible to suffer a reduction of one-third in receipts and maintain the service at the present standard.

The outcome of the 90 days' trial, beginning January 21st, will demonstrate whether these rates are practicable, and if not a revision of the low fare ordinance must follow, as has been the outcome in the other cities mentioned.

RESULTS OF THE BERLIN-ZOSSEN EXPERIMENTS.

The high speed experiments which were carried out on the Military railroad between Berlin and Zossen with electric cars and which were completed November 21st have contributed some important experimental data in connection with high speed electric railway work. Consul General Guenther reports that both electric cars which were equipped with apparatus for measuring the resistance of the pressure of the wind repeatedly made the trip of [illegible] at speeds from 118.75 to 126.25 miles an hour. It was evident that the roadbed with its rails of only 90.2 lb. per yard [illegible] strong enough [illegible] for the highest speed attained and was found to be in perfect condition, although it must be borne in mind [illegible] Dr. Zimmermann pro[illegible] that it would not be [illegible] rails of much greater weight for high speed pur[illegible]. The results achieved [illegible] to abstain from a greater speed than [illegible] of the experimental cars, however, each and corresponding roadbed, although it is obvious that the cost of maintenance of the roadbed would be increased. The apprehension also, that the gage of the track would have to be increased considerably on account of the wind pressure has not been realized. The highest speed attained in the electric car experiments was 130.5 miles. A new series of experiments is shortly to be inaugurated in order to accomplish greater speed by means of steam locomotives, and the construction of the required apparatus for measuring speed is about completed.

LIMITATIONS ON SPEED.

Some years ago the "Review" made a compilation of the municipal regulations affecting speed and headway of electric cars in the principal cities of North America. This was published in our issue for September, 1897, page 567, and showed that a maximum speed was specified in three-fourths of the cities from which reports were received. At that time the most common limit set upon the speed of electric cars operating in the business district was 8 miles per hour; in a few cities the limit prescribed was as low as 6 miles, and in a few others as high as 10 miles per hour. In residence and outlying districts the maximum speed permitted was generally fixed at from 12 to 15 miles per hour.

Recently the Massachusetts Railroad Commissioners promulgated a rule limiting the maximum speeds of electric cars to 10 miles per hour in thickly settled parts of cities and towns, to 15 miles per hour outside of business districts, and to 20 miles per hour where the railway is at one side of a traveled road. This pronouncement, which may be taken as reflecting public opinion in New England at the present time, fixes the maximum limits at points about one-fourth higher than was considered safe seven years ago. Abroad, the British Board of Trade has ordered recently that tram cars in London shall not exceed a speed of 10 miles per hour, with limitation to 6 miles and 8 miles at certain congested points.

There may be some doubt as to whether uniform interpretations have been placed upon the speed ordinances referred to in the first paragraph—that is, whether maximum speed or schedule speed is meant, and doubtless in some cases when the former was intended the latter has come to be accepted in practice. In the Massachusetts and British regulations cited in the second paragraph, however, there is no doubt that the maximum speed is meant, the Board of Trade rule also specifying that cars shall carry speed indicators.

The regulation of speed of vehicles is a proper subject for the exercise of the police power of a municipality, in the sense of being within the legal right of the city, but the specification of a hard and fast limit, as 10 miles per hour, is of doubtful wisdom. The municipality is right in attempting to prevent vehicles being driven at reckless speeds that endanger other users of the streets, but the speeds that conform to the requirement "safe" are a matter of experiment and cannot be decided a priori by even a city council.

The most common accidents in which street cars are concerned are due to carelessness of the men in charge of the car or to carelessness on the part of the public using the streets, and a slow speed for the cars encourages rather than prevents carelessness in employes, passengers and others. Six years ago the Market Street Railway Co., of San Francisco, stated positively that a number of the most serious accidents had been occasioned by children and others running suddenly in front of a car that was moving at a speed of not more than three or four miles per hour. This is a negative argument to the effect that low speeds do not necessarily prevent accidents.

By courtesy of Mr. John A. Beeler, vice-president and general manager of the Denver City Tramway Co., we are enabled to present some results of the experience of that company which constitute a positive argument that increase of speed within reason will decrease instead of increase the danger of accidents. The management of the Denver company desired to improve the service by increasing the speed of its cars, and the change was made with the expectation that while there might be temporarily an increase in the number of accidents, the higher speed would cause all persons on or near the cars to exercise a higher degree of care that would in a short time reduce the number and cost of accidents to the normal. The results were surprising in that from the first there was a decrease in the accident account. The higher schedule was put in effect last year, and the following table shows nine months of

1903 compared with four preceding years, the basis adopted, percentage of receipts expended on account of accidents being one that takes account of increased traffic and normal increased number of accidents.

Year	Per Cent Damages	Per Cent Damages, and Legal Expenses	Schedule Speed, Miles per Hour
1899	1.98	2.42	8.3
1900	1.78	2.18	8.4
1901	1.70	2.21	8.3
1902	1.38	2.07	8.3
1903 (9 mos.)	1.00	1.74	8.9

In November, 1903, the schedule speed was 9.5 miles and in December, 1903, it was 9.6 miles per hour. This speed is determined by dividing the total number of car hours by the total mileage, thus all time lost in making stops and because of delays being included, and the highest speed recorded 9.6 miles per hour corresponds to a maximum speed considerably in excess of that figure. The damages and legal expenses in connection therewith for the month of November last amounted to but 1.40 per cent of the gross receipts.

The accidents on the Denver system during the five years mentioned in the table increased in number, being as follows: 1,033 in 1899; 1,016 in 1900; 1,097 in 1901; 1,354 in 1902; 1,085 in 9 months of 1903. Of these so-called accidents, however, which are reported by employes, over 85 per cent are never heard from again. While the number of reported "accidents" is larger in 1903 than in the preceding years when the speed of cars was slower, we do not consider the conclusion as to the higher speed being safer is vitiated, because the cost of accidents is a better measure than the mere number. The fact that in 1902 there were on this road nearly 25 per cent more accidents reported than in 1901, and at the same time the cost for accidents and legal expenses in connection therewith was reduced 2.21 per cent of the gross receipts in 1901 to 2.07 per cent in 1902, shows a most efficient administration of the claim and legal departments. Also it justifies the inference that the reported "accidents" in 1902 and 1903 include larger percentages of incidents that are not accidents, but are reported only for the purpose of preparing the company to better contest fictitious and fraudulent claims for damages.

Observation in Denver shows that since the cars have been run at increased speed, all persons affected show a greater degree of care—motormen keep a better lookout and do not permit their attention to be easily distracted, because they appreciated the greater damage that would naturally follow a collision at the higher speed; passengers do not so often as formerly attempt to enter or leave the cars while they are moving, and others on the street use more care in keeping out of the way. The conclusion is that what constitutes a safe speed is a matter of experiment, and that legislation which fixes an arbitrary limit is misdirected. The limit fixed does not necessarily insure greater safety and if placed too low does prevent improvement in the service.

Boiler Explosion at St. Louis.

About 5 p. m., Dec. 21, 1903, six boilers exploded at the Geyer St. power plant of the St. Louis Transit Co. (the old Union Depot road plant), killing seven persons and destroying property to the value of $50,000. This plant contained 17 Heine water-tube boilers and 6 of two other makes, all connected to a single header, which was something over 200 ft. in length and without expansion joints.

Six of the seven Heine boilers that constituted that part of the plant east of the large brick chimney exploded, the seventh boiler being thrown out bodily into the street uninjured, except that a few tubes were torn out by the same force that displaced the boiler. The rear waterlegs were torn from the six boilers that were ruptured. In the case of only one boiler were the shells parted from the front waterleg. The tubes were practically all torn out of the waterlegs, and with only one or two exceptions were not burst. The severed portions of the ruptured boilers were thrown to distances of 100 ft.

The boilers that failed were installed in 1891 and were rated at 250 h. p. each.

The evidence presented at the coroner's inquest and before the St. Louis Board of Engineers shows that the accident was not due to any defect in the construction of the boilers, but to negligent inspection and operation of the plant. Examination of the two feed pipe nipples of one of the exploded boilers showed one to be completely filled with scale and the other to be so nearly filled that a passage ½-in. in diameter only was open, and the Board of Engineers found that while the prescribed limit of pressure was 125 lbs. the safety valves when tested required from 142 to 170 lbs. per sq. in. to open.

It is believed that a single boiler exploded first, and that following this the five other boilers failed simultaneously or in rapid succession.

It is considered probable that the primary cause of the explosion was the failure of some portion of the steam header near these oldest boilers.

Annual Meeting of Boston Elevated Ry.

At the anual meeting of the Boston Elevated Railway Co., January 4th, the president, Gen. William A. Bancroft, presided. The old directors and officers were re-elected. The reports showed: That more than 80 per cent of the 133,000 shares of stock is held in Massachusetts; the total mileage of the road is 437.499 miles; the total number of subway passengers for the year ending Sept. 30, 1903, was 2,018,986, an average per day of 87,723, as against 79,923 last year; as against a 5 per cent increase in total revenue passengers, the receipts at main line elevated stations, exclusive of subway, increased 15.9 per cent, and at Atlantic avenue elevated stations 59.3 per cent; the receipts at subway stations for elevated service alone increased 8.3 per cent; the surface car mileage increased 0.8 per cent, while the elevated mileage increased 23.8 per cent; the extension of surface tracks amounted to 5.16 miles during the year.

President Bancroft brought out the fact that coal and the handling of the same cost the company $409,017 for the year, an increase of about 71 per cent over the previous year.

The earnings from operation were $11,959,515; net earnings, $3,759,511, an increase of $301,053; balance for dividends, $826,955, as compared with $621,898 the year before; surplus, $28,955, against $21,889 the previous year. The road carried 233,563,578 passengers during the year, an increase of 11,078,767 over the previous year.

Three-Cent Fare in Cleveland.

The Cleveland city council, January 11th, passed an ordinance making the fare within certain limits on all street railway lines three cents, without transfers, or five cents with transfers, while the fare to and from the extremities of the city and the suburbs is to be five cents without, and seven cents with transfers. At first the directors of the Cleveland Electric Railway Co. voted not to conform to the measure, believing that the three-cent zone is too large. Later an understanding was entered into between the mayor and the railway officials whereby the company agrees to a 90 days' test of the new plan, which becomes effective January 21st. If not satisfactory, legal steps may then be taken to enjoin its enforcement.

Chicago Union Traction Co.

The hearing of the validity of the 99-year act, which was set for January 16th, was postponed until the last of February, or later. The case will be heard at Chicago. Mr. Henry G. Foreman has resigned as a director of the company, stating that as president of the Cook County board of commissioners he is required to take a position in opposition to the company.

Chicago City Railway Franchise.

The principal development in the Chicago City Railway Co.'s application for renewal of franchise is the proposition submitted by the company to pay the city 5 per cent on $197,000,000, which the company estimates will be the approximate amount of its earnings in the next 20 years, the capital stock tax to be deducted. If the earnings exceed that amount the company is willing to pay 20 per cent on the excess.

The Tramway System of Sheffield, Eng.

BY W. C. SAMPLE.

Under the provisions of the Sheffield Tramways Act of 1872 powers were granted to the corporation to build tramway lines and lease them to the Sheffield Tramways Co. for a period of 21 years. Nine miles of double track were laid and the company operated its cars upon these lines, the terms of payment being an annual rental of £100 per mile of route and the maintenance and repair of the paving between and 18 in. outside of the outer rails. The rails laid weighed 49 lb. per yard and were supported on Kincaid patent chairs which were imbedded in concrete. The corporation, however, was not entirely satisfied with the manner in which the company carried out its part of the contract, and being desirous of streets. Of this distance 29 miles is of double track and about 7 miles is single track. The latter is to be changed to double track in the near future.

The total cost of the work carried out to date including paving, power stations, cars and other equipment is about £850,000, and by the time the total work is completed over £1,000,000 will have been expended. The street improvements along the lines of the tramways when completed will have entailed a cost of over £500,000. The engineering difficulties of laying out the tramway routes were numerous owing to the very steep grades (the steepest is 1 in 9.5), the heavy sidefalls in some of the streets along the lines and the

CAR REPAIR SHOP SHEFFIELD TRAMWAY SYSTEM.

meeting the requirements of a rapidly increasing population obtained Parliamentary powers on the termination of the lease to operate the tramways itself.

The overhead trolley system was decided upon and a bill was passed by Parliament authorizing the corporation to operate the system by electrical or other mechanical power and granting an extension of 36 miles, thus making a total length of 45 miles, three-fourths of which is double track. It was estimated the total cost of the work authorized would be £[illegible]. Sept. 5, 1899, the first length of 1½ miles was opened and other routes followed in quick succession, but it speedily became evident that to meet the requirements of the city further extensions would be necessary. Other [illegible] promoted granting the corporation power to [illegible] tramways and [illegible] considerable sum upon street widening and improvements, most of which were required for the improvement of streets on which the tramways were to be built. The total length of route authorized [illegible] aggregated [illegible] and up to the present time [illegible] has been [illegible]

steep grades of the side streets crossing the lines. These difficulties were successfully overcome by Mr. Wike, city surveyor.

Paving.

Owing to the steep grades already mentioned and the heavy nature of the traffic in the city a number of different kinds of pavements have been used for the tracks. Granite, wood, gritstone, whinstone and tar macadam have all been tried and in the streets where the traffic is heaviest granite has given the best results. It is the most durable, but as it is slippery and noisy it has not been laid in Sheffield on grades steeper than 1 in 25. Wood has been extensively used in Sheffield for the past few years, £23,000 having been expended on this paving material on one tramway route. Gritstone has been used on many of the steepest grades, but it wears away much more rapidly than granite. It is customary in Sheffield to groove the gritstone sets to provide a foothold for horses, but the constant traffic gradually wears the grooves away and the sets become rounded and slippery. On some of the routes the tracks have been paved with granite and the sides of the

street with macadam. This system of paving cannot be pronounced a success. A patented system of paving has been laid on trial and is being watched with great interest. This paving consists of alternate courses of granite and wood, the wood courses being about half the width of the granite. It is claimed that this paving will not become slippery and that it can be used on grades too steep for an all granite pavement. After noticing its effect upon vehicular traffic for some months past the writer has come to the conclusion that it will not become slippery and that it affords a splendid foothold for horses. Also, that for the length of time it has been down it has worn fairly well.

The following table shows the kind and approximate lengths of the paving on the various tram routes:

Pavement.	Miles of Route.
Granite	17
Wood	8
Gritstone	1½
Tar Macadam	2½
Paved Tracks, Macadam Sides	6¼
Experimental Paving	1
Total	36

Track.

The rails used in Sheffield are of the girder type 7 in. deep, 7 in. wide on the flange, weighing 108 lb. per yard. They are laid

BRACKET CONSTRUCTION, SHEFFIELD TRAMWAY SYSTEM

to standard gage, 4 ft. 8½ in., and the width of the tread is 1 11-16 in. and the depth of the groove 15-16 in., leaving a clearance of 7-16 in. between the wheel flange and the bottom of the groove. In a paper read by Mr. Wike before the Association of Municipal and County Engineers he stated that "when the rails have worn sufficiently to enable the wheel flange to touch the bottom of the groove the life of the rail is to be considered at an end. Before this can happen a sectional area of .706 in. of steel must be worn away." The Sheffield specification for rails is a stringent one and provides for both chemical analysis and mechanical test. A large proportion of the Sheffield Tramway system was laid with 30-ft. rails, although 60-ft. rails have also been used; recently rails 45 ft. in length have been put down. The 30-ft. rails are expensive on account of the large number of joints required while the 60-ft. rails are unwieldy, although for laying track over the brow of a hill there is no doubt that they are extremely useful. The 45-ft. rails are, however, the most convenient length and their adoption in Sheffield is now general. The greater part of the rails were supplied by the Barrow Hematite Steel Co., Ltd., the Leeds Steel Co. (Walter Scott, Ltd.) having supplied the remaining portions. These two concerns have supplied upwards of 11,000 tons of rails. The method of joining the rails in Sheffield is by fish plates. These are 36 in. long, half of them having eight holes 1⅛ in. square and the other half eight circular holes 1⅛ in. in diameter. The fish plates for crossings, etc., are 27 in. long, one-half of the quantity having six holes 1⅛ in. square and the other half six circular holes 1⅛ in. in diameter. The weight of the eight-hole fish plates is 80 lb. per pair and that of the six-hole fish plates 60 lb. Each bolt and nut weighs 2¼ lb., each being of the self-locking type, supplied by Ibbotson Bros. & Co. A space of 1-16 in. is left between the ends of the rails to allow for expansion and tie bars are placed between the rails at intervals of 10 ft. to keep them to gage. Two bonds are provided at each joint and the tracks are cross bonded every 40 yards. The bonds used are the "Chicago" type.

The points, crossings, etc., were supplied by Hadfield's Steel Foundry Co. and Edgar Allan & Co., Ltd., both of Sheffield. Some American special work supplied by the Lorain Steel Co. has been installed experimentally in which a special metal having great resistance to wear was introduced. The results, although never made public, were, I believe, eminently satisfactory. Great care is taken in Sheffield in the design and laying out of double junctions. The design is considered both from a theoretical and practical standpoint and the curves when put in place are theoretically exact and are not laid out as I have often seen them, merely by the eye. In Sheffield double truck cars are unknown and the laying out of the curves is of great importance, as the four-wheeled cars, like bogie trucks, are not adapted for conveniently rounding curves of a radius shorter than 40 ft. It is frequently customary in double junctions to splay one rail to the other at the point of intersection, but in Sheffield crossing blocks have always been used for connecting intersection rails. These blocks were formerly made from cast steel but more recently of manganese steel. The satisfactory and effective jointing of rails is a question which tramway engineers are anxious above all others to solve, and Mr. Wike, city surveyor, has experimented with one or two different patented methods of jointing. He has reported, however, that the royalties on most of the patents in the market render their economical working impossible. In laying rails in Sheffield they are fixed at the necessary levels by means of rubble foundations on which they rest, the rubble consisting of three or four built-up courses placed at the ends and center of the rail. The concrete foundation is then laid for the permanent way and is well packed in and around the rails and is filled in to within 5½ or 6 in. of the finished level of the road. In streets provided with a concrete foundation the latter, if in good condition, is cut out under the rail and for a short distance either side of it for a depth of about 2 in., the rails are brought to a level and the concrete is then built up around them. It is thus seen that the rails are held down, first, by their own weight, second, by the depth of concrete above the bottom flange of the rail and, third, by the paving abutting against it. The following table gives the cost per yard of single track laid in Sheffield:

Rails	£8-15-0 per ton	= £0-16-10.5 per yard
Fishplates	8-15- 0 per ton	= 0- 1- 3 per yard
Bolts	16- 0-0 per ton	= 0- 0- 5.8 per yard
Tie bars	10-10-0 per ton	= 0- 0- 4.7 per yard
Copper bonds		= 0- 1- 0.3 per yard
Plastering and packing rails		= 0- 1- 6 per yard
Labor		= 0- 2- 6 per yard
		£1- 4- 9.3

or say £1-4-10 per yard of single track.

Overhead Equipment.

The greater part of the overhead work is supported by poles carrying single brackets varying in length between 12 and 22 ft. In the center of the city and on one of the first routes opened center poles were used, but this method of supporting the overhead work has not been a success and will not be extended further. Both the side and center poles are spaced 120 ft. apart on tangents and at varying distances on curves. Span wire construction has been used in many of the wider thoroughfares, and there is no doubt that this construction gives the most satisfactory results. The greatest length of span between poles used in Sheffield measures 65 ft., but a length of about 110 ft. will be required on one division in the course of construction. It has been found by experiment that on a span of this length a sag of 3 ft. 6 in. will occur, and to neutralize

thus the poles are made 34 ft. 6 in. long instead of the usual 31 ft., so that the trolley wire will come to the same height as that part which is carried on bracket arms which are used on the greater part of the line under consideration. Rosettes have been used to support the span wire on a number of buildings, but this method is considered somewhat dangerous and property owners in many cases

DOUBLE DECK CAR, SHEFFIELD TRAMWAY SYSTEM

are much opposed to placing rosettes on their premises. The trolley wires are No. 0 B. W. G. and are in all cases supported by flexible suspension. The poles and brackets already in place were supplied by John Spencer, Ltd., of Wednesbury, and the remainder by Walter Macfarlane & Co., Glasgow. The phono-electric trolley wire erected on curves and places where the wear and tear is greatest was supplied by Maguire & Baucus, while the copper wire has been furnished by the British Thomson-Houston Co., Frederick Smith & Co., Salford, and Thomas Bolton & Sons, Oakamoor. Guard wires in accordance with the Board of Trade regulations have been erected wherever necessary, but their value as a protection against accidents is, in the opinion of the manager of the tramway, extremely doubtful.

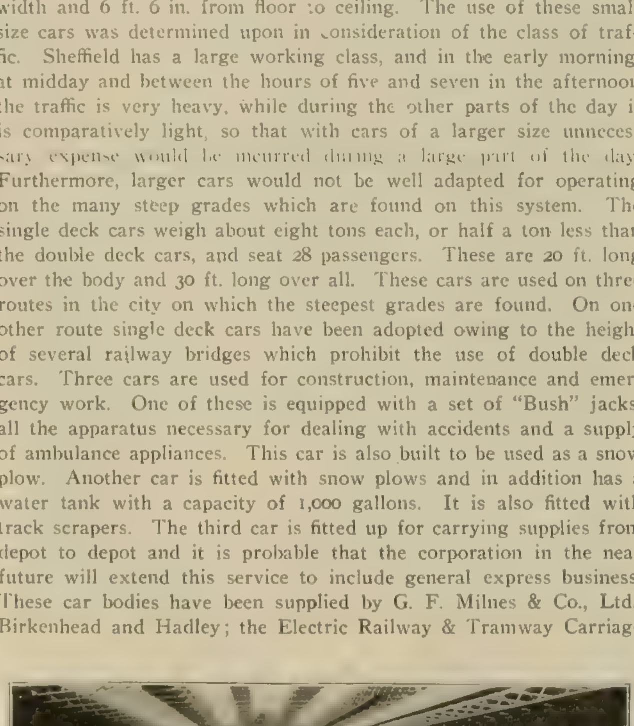
Cables.

The cables are in all cases drawn into ducts, most of which are of the earthenware type which have proved highly satisfactory. Cement concrete ducts have also been experimented with and cast iron ducts have been used on sections where the traffic is heaviest. To carry the constantly increasing number of cables to the power station a tunnel has been built under the goit adjoining this building and a section through this tunnel shows 72 cables in place. Cable boxes are located 280 ft. apart, being built of common red brick lined with Staffordshire blue brick. The bottom of the boxes have a cement floor, which slopes to a point where a short length of 6 in. pipe is inserted to collect the water draining from the sub-soil and the ducts. From this point the water is pumped out whenever necessary. Feeder pillars fitted with two main cable switches and four side lead switches, lightning arresters on the front of the panel and choke coils on the back of the panel, are placed at distances apart of ¼ mile in the city and ½ mile in the suburbs. The cables were furnished by the Callender's Cable & Construction Co., Ltd., London, the British Insulated & Helsby Cables Co., Ltd., Prescott, Lancashire, and the St. Helens Cable Co., Ltd., Warrington, Lancashire. The [illegible] ducts were supplied by the Albion Clay Co., Ltd., Leicester.

Cars

The cars used by the Sheffield Corporation are of both the single and double deck types. Several of the double deck cars have been fitted with canopy top covers made by G. C. Milnes, Voss & Co., from whom 32 of these equipments have been ordered. These top covers extend the full length and width of the car, the sides being of the Magrini collapsible type. A continuous spindle running the full length of the car and operated by means of a ratchet handle enables the sides to be raised or lowered by means of a tooth rack and gear wheel fitted to the continuous spindle. The ends and the roof are both fixed, the former containing windows and a door and the latter being made of tongued and grooved boards supported by angle irons. Where these covers are adopted the trolley stands are removed from the top of the car and fitted to the top of the roof cover. Torpedo ventilators of the Laycock type and bulkhead electric light fittings are fixed in the roof.

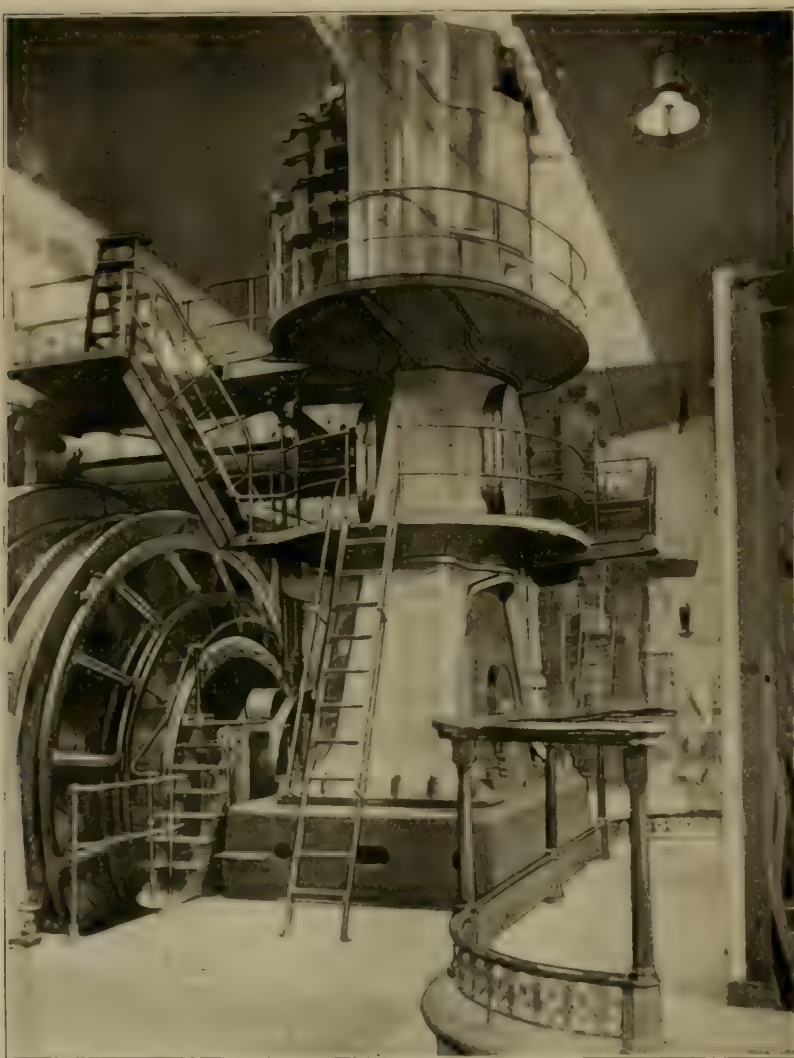
At the present time the Sheffield Corporation owns 208 cars, of which 139 are of the double deck type and 69 of the single deck type, and six more are now in course of construction at the car building sheds of the corporation. There are also 25 double deck cars on order, which will be received within a few months, which will bring the total number of cars up to 239. The double deck cars accommodate 51 passengers, 21 outside and 22 inside, and measure 16 ft. over the body and 27 ft. 6 in. over all. They are 7 ft. in width and 6 ft. 6 in. from floor to ceiling. The use of these small size cars was determined upon in consideration of the class of traffic. Sheffield has a large working class, and in the early morning, at midday and between the hours of five and seven in the afternoon the traffic is very heavy, while during the other parts of the day it is comparatively light, so that with cars of a larger size unnecessary expense would be incurred during a large part of the day. Furthermore, larger cars would not be well adapted for operating on the many steep grades which are found on this system. The single deck cars weigh about eight tons each, or half a ton less than the double deck cars, and seat 28 passengers. These are 20 ft. long over the body and 30 ft. long over all. These cars are used on three routes in the city on which the steepest grades are found. On one other route single deck cars have been adopted owing to the height of several railway bridges which prohibit the use of double deck cars. Three cars are used for construction, maintenance and emergency work. One of these is equipped with a set of "Bush" jacks, all the apparatus necessary for dealing with accidents and a supply of ambulance appliances. This car is also built to be used as a snow plow. Another car is fitted with snow plows and in addition has a water tank with a capacity of 1,000 gallons. It is also fitted with track scrapers. The third car is fitted up for carrying supplies from depot to depot and it is probable that the corporation in the near future will extend this service to include general express business. These car bodies have been supplied by G. F. Milnes & Co., Ltd., Birkenhead and Hadley; the Electric Railway & Tramway Carriage



CAR SHED, SHEFFIELD TRAMWAY SYSTEM

Works, Ltd., Preston; the Brush Electrical Engineering Co., Loughborough; Messrs. Cravens, Ltd., Sheffield, and the Sheffield Corporation. The trucks were furnished by the Peckham Manufacturing Co., the J. G. Brill Co. and the G. F. Milnes Co., Ltd. The entire electrical equipments for the cars were made by the British Thomson-Houston Co. The motors used are of two types, G. E.-52 and G. E.-58. The controllers are of the B 13 type. The cars have fixed wheel base and in order to safely operate on the steep grades

and sharp curves the wheel base has been shortened as much as possible, the length being 5 ft. 6 in. This type of truck is better adapted to the use of slipper brakes than bogie trucks. These slipper brakes with which the cars are equipped are often called into play owing to the steep grades in Sheffield and by means of these brakes the weight of the car is taken almost entirely off the wheels and is supported by wooden brake blocks which slide upon the rails. The electric brakes with which the cars are equipped are extremely powerful. Internal spring trolleys are now adopted for all double deck cars, having taken the place of the external spring trolleys which were formerly used. The trolleys have to run at heights varying from 11 ft. 6 in. to 21 ft. 6 in. and no trouble has occurred to mar their successful operation. Most of the trolley heads were made



ENGINE ROOM, SHEFFIELD TRAMWAY SYSTEM.

by R. W. Blackwell & Co., Ltd., London, and are of the spherical type with graphite bushed V-grooved wheels. The question of dry seats for the top of double deck cars has been solved by the adoption of canopy tops, but in cases where canopy tops are not used the question has not been satisfactoriiy answered.

Car Sheds.

The car sheds at present erected are two in number. One of these, known as the Tinsley car shed, accommodates 95 cars and contains in addition repair shops, paint shed and brass foundry. The other car shed is situated at Queen's Road and has a capacity for 84 cars, but extensive additions will soon be completed which will increase its capacity to 120 cars. At the Queen's Road shed all of the tracks are laid on supporting cast iron columns, making it possible to overhaul every car stored here in a thorough manner. At the Tinsley shed this method of construction has only been partially adopted and several of the tracks have been paved in, making the work of overhauling the cars on these tracks a difficult and trying one. Large repair shops form part of the extensive additions now in the course of construction and these will soon be in full working order. The cost of the two car sheds, including additions, will amount to about £60,000. The establishment of a car building plant is one of the latest examples of the enterprise of the Sheffield Corporation. The idea originated with Mr. Fell, the tramways manager, and little time was lost in putting it into execution. The result was the establishment of a highly creditable car building plant and already several cars have been turned out, while a number of others are in course of construction. The machine shop contains the latest and most efficient labor saving machinery and is operated by a 25-h. p. electric motor. A number of improvements in the general design of the cars have been introduced in these shops. The building is located at Nether Edge and was erected on the site of the old horse car sheds.

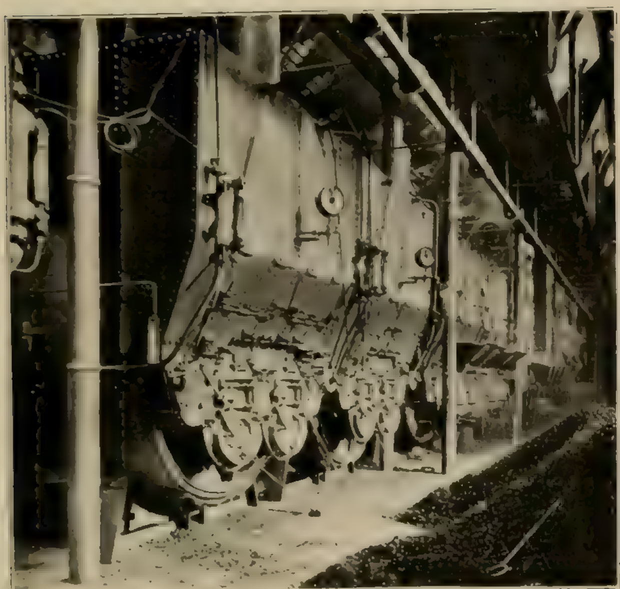
Kelham Island Power Station.

The power station of the Sheffield Tramways is situated on an island bounded by the River Don and a goit fed from the river. The city water supply is drawn for the boiler feed, while the goit supplies the circulating water for the surface condensers. The boiler house is 182 ft. long, 40 ft. 6 in. wide and contains 12 boilers capable of evaporating 120,000 lb. of water per hour and operating under a pressure of 160 lb. Four of these boilers were made by John Brown & Co., Ltd., Sheffield, and three by the British Thomson-Houston Co. They are of the wet back marine type, each boiler being capable of evaporating about 8,000 lb. of water per hour. One of these boilers is fitted with a Bemis stoker and the remaining six with automatic stokers. There are two dry back marine boilers capable of evaporating 18,000 lb. of water per hour, made by Davy Bros., Ltd., Sheffield. Both of these are fitted with Bemis stokers and superheaters and an induced draft system and air heating apparatus made by Ellis & Eaves; the latter is also supplied to the seven wet back marine boilers previously mentioned. There are also two Stirling boilers made by the Stirling Boiler Co., Ltd., each capable of evaporating 18,000 lb. of water per hour, fitted with superheaters. Bemis stokers and Howden's system of induced draft and air heating apparatus. The automatic stokers are all driven by motors, the shafting being supplied with coil clutches made by the Consolidated Engineering Co. and arranged so that it can be divided into sections in case of accident or repairs. The motors, two in number, were supplied by the Westinghouse Electric & Manufacturing Co., Ltd., and are each capable of taking the whole load. The coal and ash conveying plant supplied by the New Conveyor Co., of Smethwick, and fitted above the front of the boilers, forms an interesting feature of the boiler house. The coal is first dumped into a hopper, then carried by a bucket elevator into the conveyor, and can be tipped either at the rear of the boilers where the coal storage is situated or into bunkers placed in front of the boilers. An ingenious arrangement of traveling automatic weighing machines above the bunkers enables the coal passing from the bunkers to be automatically weighed, and coal can be taken from any bunker to any boiler. A tray ash conveyor is fixed under the floor plates in front of the boilers and receiving hoppers under grids, the ash being conveyed to the ends of the building and taken up by a bucket elevator into a tank fixed on iron columns outside the building. From this tank it is discharged into wagons underneath

The pipe work in connection with nine of the boilers was erected by Corporation employes, while that of the remaining boilers was installed by the British Thomson-Houston Co., Sempler & Ranol and Messrs. Crane. The steam and other pipes were installed by Messrs. John Spencer, Ltd., and the boiler fittings by J. Hopkinson & Co., Ltd.

The engine room contains the most up-to-date machinery obtain-

able. The first engines installed were the Allis-Chalmers horizontal type, three in number. Each of these drives a 225-kw. multipolar generator, direct coupled, running at a speed of 136 r. p. m. To meet the growing demands of a system four vertical cross compound condensing engines were afterwards bought from Cole, Marchent & Morley, Ltd. Two of these engines of 1,450 h. p. each have 1,000 kw. British Thomson-Houston generators mounted on the shafts between bearings, and run at a speed of 90 r. p. m. The fly wheels are 20 ft. in diameter and weigh 50 tons each. The remaining two engines of 800 i. h. p. each are direct connected to British Thomson-Houston generators mounted on the shaft and have fly wheels 18 ft. in diameter and weigh 23 tons each. These also run at a speed of 90 r. p. m. The engines and generators are built to run at 25 per cent overload for half an hour and 50 per cent overload for a very short time. The total nominal capacity of the plant is 3,675 kw.



BOILER ROOM, SHEFFIELD TRAMWAY SYSTEM

The condensers are five in number, four being of the Wheeler Admiralty type made by the Wheeler Condenser & Engineering Co. Four boiler feed pumps with a total capacity of 14,800 gallons of water per hour are installed in the basement of the engine room, two being made by G. & J. Weir, Ltd., and two by F. Pearn & Co. The British Thomson-Houston Co. supplied the whole of the switchboard, which consists of seven generator panels, feeder panels, a return feeder panel and two Board of Trade panels, the whole being built of marble. The instruments are of the Weston type, except the Board of Trade instruments, which were supplied by Elliott Bros. The engine room contains an overhead traveling crane built by Booth Bros. and capable of lifting 20 tons.

The cost of supplying current in Sheffield amounts to .67d. per kw. hour and comparison with many other leading cities in the Kingdom shows this to be a very economical figure. Herewith is a list of a few of the principal tramway systems municipally owned, giving the cost of current per unit in pence:

Aberdeen	1.81	Leeds	0.30
Blackburn	1.50	Liverpool	1.20
Bolton	1.25	London County Council	1.40
Bradford	1.00	Manchester	1.50
Cardiff	0.50	Newcastle	0.35
Dundee	1.50	Nottingham	1.25
Glasgow	0.46	Oldham	1.50
Halifax	1.60	Salford	2.00
Huddersfield	0.38	Sheffield	0.67
Hull	0.60	Sunderland	2.00

Financial.

The following table gives the financial statistics of the Sheffield Tramway system from the time of its inauguration:

	No. of Passengers.	Earnings
Sept. 5, 1899, to Mar. 25, 1900	13,722,380	£54,936- 2-6
Mar. 25, 1900, to Mar. 25, 1901	34,239,810	132,980-12-8
Mar, 25, 1901, to Mar. 25, 1902	48,773,942	189,225-19-2
Mar. 25, 1902, to Mar. 25, 1903	54,946,915	206,729-10-1

During a portion of last year horses were used on one route only and were taken off on Nov. 11, 1902. The figures for the route operated by horses are not given in the above table and are as follows:

Income, £7,345-16-6; operating expenses, £10,143-9-0; deficit, £2,797-12-6.

The above table shows that the revenue of the corporation from the tramways is constantly on the increase and it has not yet, by any means, reached its maximum. The present average weekly income amounts to £4,400.

A. L. C. FELL.

From the time of the inauguration of the system until Oct. 28, 1902, the maximum fare on any of the routes was 2d., but on the latter date the city council reduced the fares on all routes to 1d., at which figure they have since remained. It is possible to travel a distance of about 3¼ miles for 1d. Halfpenny fares for average distances of half a mile are in vogue throughout the system and the returns show that about one-seventh of the passengers carried pay the halfpenny fare. The tramways committee, owing to the financial success of this undertaking, has voted large sums of money for the relief of the rates, the sum thus voted for the year ending Mar. 25, 1903, being £13,979-19-7, bringing the total amount voted for this object since the inauguration of the system to £40,979-19-7.

The tramways committee has also agreed to contribute towards the capital expenditure on street widening and work necessitated by reason of the tramway construction, an estimated sum of £155,204-1-0. The estimated contribution payable on this sum, including interest and sinking fund, is £6,895-7-5 per annum. Mr. W. Fisher Tarker, F. C. A., the city treasurer, has prepared a complete report upon the tramway finances for the year ending Mar. 25, 1903, and the writer is indebted to him for many of the figures given.

SWITCHBOARD, SHEFFIELD TRAMWAY SYSTEM

Personnel.

Alderman W. E. Clegg from the inception of the tramway scheme has been chairman of the tramways committee. Mr. C. F. Wike,

M[illegible], city surveyor, has prepared the various Parliamentary [illegible] had charge of the design, construction and maintenance of the permanent way, as well as the power stations and one of the car sheds. Mr. A. L. C. Fell, M. I. E. E., is general manager of the tramways and was in charge of the installation of the power station equipment, electrical equipment, the design and building of cars and the laying of cables. Mr. Fell, [illegible] considered a leading authority on electric traction in England and his recent election to the post of tramways manager to the London County Council is a well merited acknowledgment of his ability. He takes with him to London the best wishes for his future success of all who have been brought into contact with him. For much of the information relating to the power station, cars and electrical equipment the writer is indebted to Mr. Fell.

Operating Criticisms on a Country Road.

In traveling about the country by trolley the electric railway man cannot but notice a remarkable diversity in the standards of service adopted by the different systems upon which he rides. City lines, interurban railways and country roads all have their own peculiar problems to solve and difficulties to face, and it is not surprising that the character of equipment, types of track construction, and operating methods vary widely when we realize how much more local conditions influence electric than they do steam roads. When one considers defects in operation, however, it almost always works out that all the different systems ought to avoid every specific fault that may occur on any one. A wide latitude in the character of service may be permitted, but it is difficult to condone a defec. in operation for the benefit of any particular road, if one is strictly just

The writer chanced to spend two months last summer in a small New England village traversed by a through trolley line, connect ing a seacoast resort with a manufacturing city some fourteen miles away. In a spirit of friendly criticism this article has been written to emphasize some of the flaws in operation which from time to time manifested themselves to the writer when he was a passenger upon the road in question.

Perhaps the most noticeable fault in the service was the reckless running of the cars on curves and grades. Many of the motormen handled the controller as though resistance notches and the series running point were figments of the imagination, and the way power was kept on when going down hill was enough to put the coal dealers on "Easy Street" for the entire season. Reduction in speed on curves was an afterthought—generally after the car had lurched madly at the change in alignment with sufficient violence to make the passengers hold fast to each other or the nearest post. The rocking of the equipment which is produced by careless handling cannot be readily expressed in dollars at the end of an operating year, but that the maintenance bill is considerably larger no one can doubt if he keeps an eye on the hospital end of the car house when reckless running holds sway outside. The danger of severe injury to passengers and even loss of life is far greater on a road where the cars at times run down grades of six or eight per cent at full multiple on the controller for half the length of the hill than on a line where the cars invariably coast down such grades well under control. The former road may make a faster schedule, but some day, when its precipitate speed lands a car in the ditch, the resulting injuries and damage suits make the fast schedule shrink decidedly in importance. The strain on car equipment which is reversed at high speed in attempting to stop on a stiff down grade is terribly severe, and every stop of this nature adds money to the repair and renewal accounts. On the road which the writer has in mind cars were nearly always run too rapidly down a five per cent grade, with a sharp curve and bridge at the bottom, spanning a wide tidal inlet.

Carelessness in starting the car when passengers alighted was one of the sins of commission common with the conductors. This is, of course, an old offense, and no particular road can claim to be always free from it. The cars of our country road were equipped, in open types, with double running boards on each side, the steps being rather too high for the comfort of ladies. Dismounting from the car was, for women, a hazardous process at best, and the careless giving of the two bells for starting resulted more than once in the unfortunate passenger being thrown down. On a city system such heedless operation would not be tolerated by the public, and the only explanation of its continuance on the country line under the fire of the writer's criticism was the ignorance of the bulk of the passengers as to what actually constitutes good service. One of the writer's family was severely injured in the hip by reckless running around a sharp curve, and forced to lie in pain for weeks on account of a careless motorman's maltreatment of the car and its passengers. In justice to the road, it is but fair to say that the exceptional motormen were skillful operators of their cars, and used discrimination in coasting, braking and power application, but the general run of the men handled their cars in a distinctly inferior manner.

One of the most serious defects in the road's layout was the extremely narrow clearance between feeder posts, trees and fences and the car running boards met with at many points on the line. The route traversed is one noted for its scenic beauty, and with the large summer traffic handled this year it passes comprehension how serious accidents to standing passengers were escaped. Certainly no road is safely located which requires the conductor to warn passengers of the danger from adjacent posts and trees. On a steam road with closed cars one does not expect to put head or arm out of the window with safety, but the case is very different on an open trolley car. Sharp projecting ledges and rocks ought not to be allowed to exist within six inches of the running board, to put the case mildly.

When slight accidents to the car equipment occurred it was frequently the custom of the employes on the car to treat the occurrence as a high-class joke. Now there is no doubt that a cheerful temper in the face of difficulties goes a long way toward getting those who are unfortunate out of the scrape in which they find themselves, but it is difficult to see the use of coarse horse play and buffoonery in cutting out a damaged motor, or the assistance that three or four husky employes riding free on the front seat can give to the afflicted motorman whose controller is short circuited, if all that they do is to loll about and make witless jokes at his expense. It is no small offense against the company's welfare to destroy public confidence in the abilities of the car crew to go about their business in times of trouble as though they were equal to the emergency. Few things hurt a road more than to have the idea spread abroad and at home that experiments are being tried on the public, and that the cars are sometimes dangerously operated. Women are especially timid when anything goes wrong on a car, as a general rule, and ill-timed levity sits poorly upon any employe who is brought into close relations with the travelling public at times of mishap. It is said of General Grant that he could be silent in twenty languages, an accomplishment that every discreet motorman and conductor may well strive to perfect in his own make-up. On the other hand, there is no advantage in acting as though a burned out rheostat or motor was a case for the coroner. What is needed most of all at times of breakdown is common sense and strictest attention to the business of getting traffic under way.

The writer seldom rode upon a car that did not lose its trolley every three or four miles. When this trouble occurs at the same places on the line day after day it is its own criticism of slipshod inspection, reports, construction and management.

Continued conversation of motormen with "lady friends" on the front seat is another one of the little things which, on a single track road, end in forgotten orders and bring cars together in head on collision half way between turnouts. In the old horse car days the motive power was sufficiently under control to enable many a social chat to be exchanged with the driver as the day wore on and the vehicle majestically rolled its weary way toward the haven where it would be. Now all this is changed, and the driver of a modern high speed electric car equipped with a hundred or more horse power in motors needs every faculty alert to control its movement in safety. How long would a locomotive engineer retain his seat in the cab of an express flyer if he attempted social felicities with his fair friends at fifty miles per hour?

Conductors ought to know the name and location of every im-

portant settlement, resort and place of interest along the route which they traverse day after day. Allowances must of course be made, especially in the case of new men, but if a man cannot remember the important points after a little trial, he had better be in some other business than street railroading. Stupidity in this direction is something that the public finds hard to forgive. It is not necessary that the conductor know all the steam railroad schedules of half the continent, but it is vital to the welfare of the road that prominent points be at his tongue's end.

In case of accident, however slight, the conductor should never fail to obtain the names and addresses of the injured parties and witnesses at once, and at the earliest opportunity make a report in person and also in writing to his next in command. Probably nothing causes a street railway company as much vexation as insignificant accidents which form the basis of claims by the unscrupulous passenger and ambulance-chasing lawyer. The extent to which such grievances will be carried is beyond belief. The importance of correct, prompt, detailed information for the company's files is literally tremendous. However simple a fall may sometimes appear, it frequently hides an internal injury of a serious nature, and the company's protection against unfair suits and its knowledge for the settlement of just dues demands the most faithful record on the part of the conductor of every unusual occurrence with which he comes in contact while performing his duties.

It is difficult to realize the demoralization which the careless acceptance of miscellaneous tickets from undesignated classes of passengers induces. If a book of tickets is sold at 25 rides per dollar for workingmen's use and so marked it is very unbusinesslike for the transportation department to accept them from persons who cannot by any stretch of imagination be called workingmen. It is morally as bad for a conductor to accept such tickets in the daily trips of his car from persons for whom they were not designed as it is for him to slur over certain rules in the "Instruction Book" because he knows they will probably not be enforced. The name of such tickets should be changed to "Twenty-five Ride Tickets," or some such class before all types of men and women, children, relatives, friends, and acquaintances are allowed to ride upon their presentation. Each fare or group of five or six should be rung in on the register as soon as taken, and not in the continuous fusillade of shots on the register bell which run up to an ear-harrowing eighty, which the writer once counted on a cross-country trip.

All the coal for the road which the writer has been picking flaws in is hauled some two miles to the power station by teams. The power station is located on a tidal inlet, and a moderate amount of dredging would render it accessible to a large variety of water craft. There are one or two shovellings in addition to the present haulage from tide water to tide water again. The coal teams follow the car track the entire distance. Why an old coal car isn't rigged up and run by electric power from the wharf over the company's lines to the power house, instead of employing asthmatic horses, is another unsolved mystery to believers in modern methods of operation. The cost of haulage amounts to something like $1,500 per year with the present facilities for handling, a sum which would pay interest on a considerable outlay in dredging.

One of the best features of the road is found in the numerous little covered and platformed waiting stations sprinkled along its lines. These are of neat design, built of wood with pitched roof, and liberal seating facilities, and need but two things to make [illegible], and water. The condition of [illegible] these is so dirty that at times neighboring residents take a hand in cleaning them up, and it is no exaggeration to say that they are [illegible]. At no time during the summer did the writer see any employe of the road in one of these stations.

Perhaps the criticisms included in this article seem unduly harsh, but they at least have the merit of being truthful. Nothing is further from their object than peevish and pessimistic fault-finding. Many admirable features in operation could be set forth if space permitted, especially the maintenance of a reliable schedule and freedom from annoying delays. If the writer's comments are [illegible] upon those features of practical operation which he would first strive to improve were he superintendent of the road and [illegible] written for the cause of good service which is the goal of every progressive employe in the field of transportation.

OBSERVER.

Graphical Mathematics.—I.

Fundamental Principles of Notation. Addition and Subtraction.

BY A. G. HOLMAN, M. E.

The graphic method of solving mathematical problems is a process of arriving at results by means of the relations of lines and points, as distinguished from methods making use of numerals and other characters.

It is quite common to think of "figuring" as the simple and easy method, and to consider charts and diagrams within the realm of mystery and higher mathematics. On the contrary, graphic methods are at the foundation of the science of quantity, and a proper understanding of the principles involved will often furnish short cuts that are valuable in this strenuous age and open up paths which

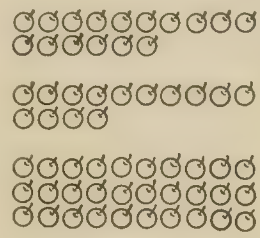


FIG. 1

FIG. 2

should be free to all. It is the purpose of this series of articles to follow out some of the first steps in graphics, assuming no mathematical knowledge by the reader beyond the ability to read figures and to make use of the most simple rules of arithmetic. It is proper to begin upon this elementary basis, even at the risk of making it a review exercise to many readers, because it is the clearest way of presenting the logic of the method.

When addition or subtraction is spoken of, it is quite natural to think only of some arrangement of figures such as

16		17
14	or	13
—		—
30		4

These operations, however, are not really the addition and subtraction of quantities, unless possibly the addition of a small quantity of ink to the paper and its subtraction from the pen; they are

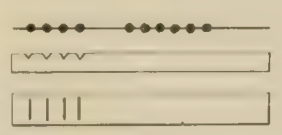


FIG. 3

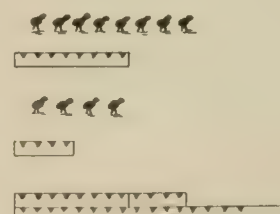


FIG. 4

only the stories or descriptions of certain changes in quantities and not the processes themselves.

A South Sea Islander, without knowing the meaning of figures or the names indicating quantity, could arrive by a simple method at the same results as a mathematician.

If one man had 16 apples and another 14, Fig. 1, and they decided to put them together, this union of the lots would certainly be addition, and the result would as certainly be 30 as if the operation were performed by veritable scientists. It is evident that actual subtraction could be performed in the same manner.

It is only a step from the transfer of a certain class of articles to the corresponding manipulation of a collection of more convenient objects representing them. For instance, instead of going into the field and driving a number of animals around to ascertain the result of a certain transfer, it would soon dawn upon the savage intellect that a number of pebbles arranged in groups would more

conveniently tell the same story, Fig. 2, and thus, probably, were performed some of the first calculations. The very word calculate, meaning a mathematical operation, is derived from a word signifying a stone, and originally referred to the use of pebbles in reckoning. Instead of pebbles, a string of beads could be used, or notches on a stick, or tally marks, Fig. 3.

The first definite idea of a number is that it is made up of single, separate objects. We usually call such a single object, in its relation to number, a unit (derived from *unus*, the Latin name for one), but it is obvious that this separate object is the foundation of the science of numbers whether we call it one or unity or "barn door." It will also be readily seen that names could be devised by the savage which would mean any particular number of pebbles or notches.

Please mark the steps. If a man had 8 chickens he could cut 8 notches on a stick to indicate them, Fig. 4. The notches would not be chickens, but they would numerically represent them. If his neighbor had 4 chickens and represented them in the same manner, the joining of the two sticks would be addition. Suppose that the notches were cut at regular intervals and that a long stick used for reference had a number of similar notches with a name for each notch. This would constitute a regular adding machine, for the two men, or several men, could place their tally sticks end to end on the reference stick and read off the sum.

It should be observed that the name against the sum of 8 and 4 might not bear any resemblance either to our "twelve" or 12 but it would indicate the same definite number of objects. For example, the quantity that we know as ten is represented in Arabic numerals by two characters, as 10, and in Roman notation by one symbol, as X, but these or a hundred other characters or names would not change the fact that a certain combination of notches or units always brings the same numerical result. The name or character is only a sort of shorthand way of representing a place on the tally stick.

Let us now imagine our early mathematicians to be Egyptians or some other race having bricks at their disposal. Bricks are chosen because a familiar object of regular shape. Suppose that a frame is arranged, Fig. 5, for the reception of bricks, and with graduations along the edge to measure the number of bricks received. A hod carrier bringing 12 bricks at a trip would add 12 to 12 at the second trip, 12 more at the next, and so on. If he conceived the wish to have the carrier contain the same number of bricks that he had fingers and thumbs he could cut off the end of the carrier to a capacity of 10 and he would then have a regular decimal system; that is, a scheme of numbers advancing by measurements of 10. The word decimal is from the Latin *decem*, meaning ten.

At this point we may present in perhaps a different way from the usual school method the philosophy of our system of Arabic numerals. The space for each brick in the carrier, Fig. 6, is marked with a single character, 1, 2, 3, etc., up to 9. The last space is marked 10; that is, one times ten plus nothing, so the figure at the right may tell the number of bricks in the partly filled holder, while the next figure gives the number of full holders. For instance, when the holder is full there are 10 bricks, otherwise read as one hod full and nothing over; 15 would be one hod and 5 bricks; 30 would be 3 hods and none over. Now we can perform certain calculations within the range of the frame with considerable speed and undoubted accuracy.

Taking, for illustration, the simple problem of adding 16 to 14, Fig. 7, the two numbers can be measured in the hod and piled in the frame and the result read from the top, or by putting 14 bricks in the frame and shoving the pile up until the bottom is at the 16 mark we have added 14 to 16, and may note the result at the top without the actual transfer of more bricks. In a similar manner subtraction may be performed, for if the frame is filled to 30 and a section at the bottom up to the number to be subtracted is pulled out, the remaining column will drop down so that its top will stand at the difference.

It will be noted that all the operations described are graphic in their character. The facts stated may seem self-evident, but they are sufficiently out of the ordinary, so that several adding machines based on the principles here explained did not appear until a comparatively recent date.

The next article will present a glance at the origin of characters to represent numbers, a study of the principles of multiplication and division, and illustrations of simple applications of such principles.

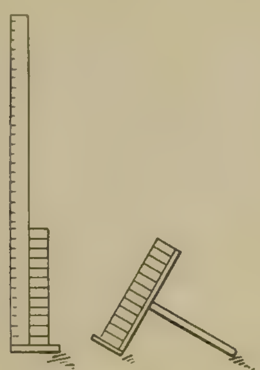


FIG. 5.

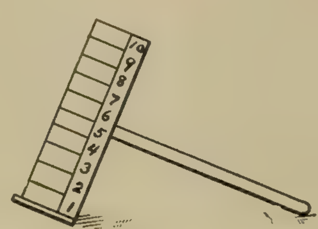


FIG. 6.

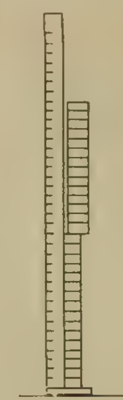


FIG. 7.

New Transfer System at Pittsburg.

Beginning with December 15th a change was made in the street car system of Pittsburg, and instead of the destination points being North, East, South and West, as on the old transfers, the tickets bear the names of the different transfer points or lines. To prevent mistakes each division has two different colors, one for morning and one for afternoon and evening. In addition to the day of the week, the hours and tens of minutes, the new transfers show the points of line of issue as well as the destination points. No transfers are issued after 11:30 p. m.

Twin City Rapid Transit Co's. Plans.

A mortgage for $10,000,000 given by the Twin City Rapid Transit Co. to the Central Trust Co., of New York City, was recorded in the register of deeds' office at St. Paul December 14th. The mortgage covers all the city railway property in St. Paul and Minneapolis. The improvements contemplated by the company are a new power house at Minneapolis, sub-stations at St. Paul and Minneapolis, the Hamline line on Blair St., a cross-town line on Snelling Ave., or some other street, Lafayette line extended to Phalen Park, Stillwater line extended to South Stillwater, Wildwood line extended to White Bear village, Minnehaha line extended to Fort Snelling and across the river, and new plants, shops and rolling stock.

The La Fayette (Ind.) Street Railway Co. has completed its tracks in the public square, which were begun some time ago, and the Indianapolis & Northwestern Traction Co. interurban cars use the new loop formed thereby.

The chief of the detective department of the Philadelphia Rapid Transit Co. has announced that the company has been robbed by certain employes of $100,000 worth of copper during the past year. Two employes, one a foreman and the other a laborer, have been arrested.

Electric Cars in Manila, P. I.

It is announced that within a year Manila will have a complete modern electric street car system with 40 miles of track extending throughout the business section and through the suburbs. The system will cost $3,000,000, it is stated, and the new company will absorb the old horse car line, which will be abandoned. Track construction on the new line was begun last September, the work proceeding at the rate of a mile a week. The line will run from a point one-half mile beyond Malate on the south to Caloocan on the north.

A correspondent of the "Review" has forwarded interesting data anent the change, together with views of the old horse cars, which we reproduce herewith. He states that the present system is of little

DELAY TO REPAIR BROKEN HARNESS.

convenience to the traveling public, as may be gathered from the views which show the limited size of the cars and the diminutive horses, whose speed is necessarily slow. The cars are sadly in need of repair; much time is lost in transit by the breaking of some part of the equipment; the car axles squeak, the bearings being worn to such an extent; the footboards are dangerous to step or stand upon, being narrow and in some places bent or warped out of shape; there are no grip handles at the ends of the seats, and the harnesses

ALONG THE ESCOLTA.

are rotted so that delays are frequent while the drivers mend the breaks with wire and cord.

Not only are the cars hauled slowly, but they are run on such long headway that the traveling public prefers when it can to ride in native vehicles, the cheapest charge for which is 10 cents in United States money for a ride of two miles in what are called "chicken coops"—small vehicles which are utilized exclusively by natives and Chinese. The next best type of vehicle is the quilez, for which the charge is 20 cents per hour. Then there are carametta and two-horse vehicles which may be hired for from 50 cents to $1.00 per hour. It is always difficult to obtain a vehicle, the demand is so great. In fact, there is so much traffic in the principal streets that one has to be wary to avoid being run over.

The new street railway, which will be the first electric road in the Philippine Islands, will be a boon to all classes of citizens,

STREET CAR ADVERTISING IN MANILA.

whereas the present road is patronized chiefly by Filipinos. It is proposed to not only carry passengers, but also light freight, a plan that will appeal to the natives especially, it being their custom to carry large bundles on the cars. Compartment cars will be provided for the purpose.

In building the roadbed and tracks Chinese labor is used extensively, under American and Spanish foremen, and native labor is plentiful and cheap. The streets of Manila are for the most part suitable for an electric line and the bridges are substantial and

FERRY ACROSS CANAL.

sufficiently wide for the new tracks. Generally the suburbs are reached by bridges, although there are a few points at which small raft-like ferries are used. The present line runs through the Escolta and out into the suburbs; it is expected that the new road will run over the Luneta, which is a wide thoroughfare.

The present company does a profitable business in advertising, carrying signs on the tops of the cars as well as inside, and already the new company has been approached by advertising agents who wish to control the privilege in the new cars. The old company is owned principally by Filipinos, while New York capital is largely interested in the new company.

The new line of the Georgia Railway & Electric Co., between Atlanta and Marietta, will be built entirely on private right of way and will be fenced in, to permit speed.

Motormen, conductors and inspectors who have been in the employ of the Louisville Railway Co. three or more years will hereafter wear star or bars on their coat lapels to denote their term of service.

45-Ft. Car for Twin City Rapid Transit Co.

The car shops of the Twin City Rapid Transit Co., which are now under the direction of Mr. W. H. Evans, master mechanic, and the standards then used in car construction, were illustrated and

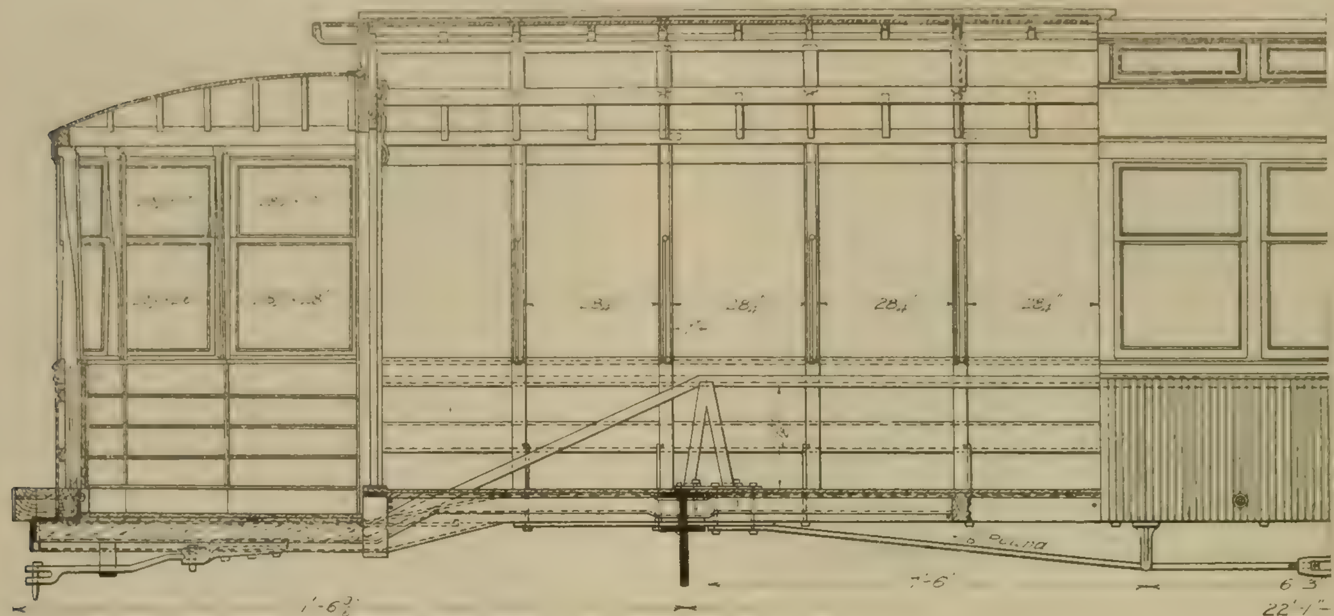


FIG. 1—HALF SIDE ELEVATION OF CAR

described in the "Review" for February, 1899. Since 1898 all the company's new rolling stock has been built there, and orders have been filled for the other roads controlled by the same interests.

The company is convinced that double truck cars are more desirable for urban as well as interurban service and accordingly, as fast as practicable, large cars are being substituted for the older single truck equipment.

The present equipment includes 279 double truck closed cars, 42 of which were built this year, 35 double truck open cars, 365 single truck motor cars, and 50 closed trailers. The present requirements are for about 250 double truck and 250 single truck cars during

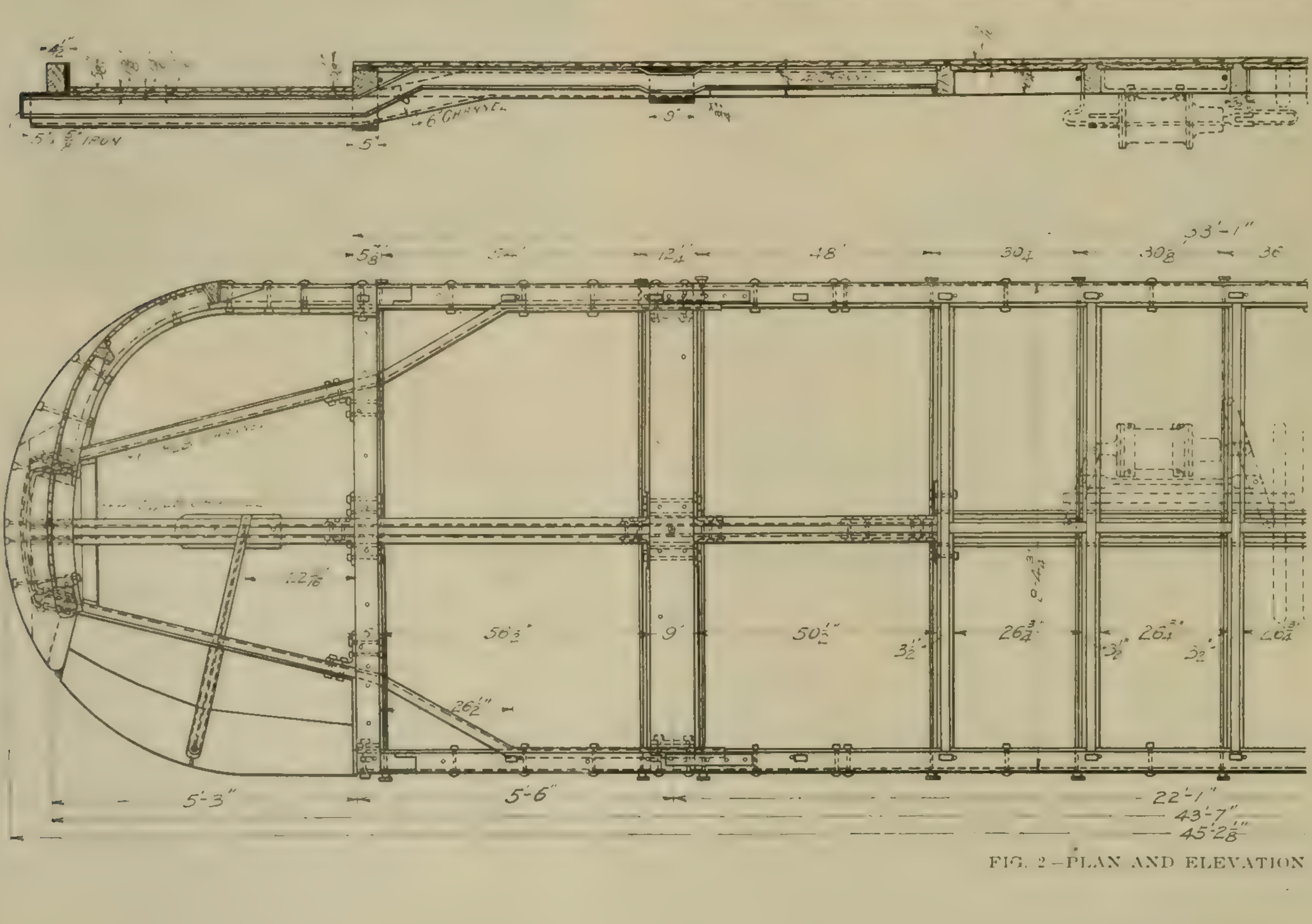


FIG. 2—PLAN AND ELEVATION

the busy hours of the day. Some trail cars are operated during rush hours, but they are being discontinued as fast as possible.

The cars now being built, which are the standard for new work,

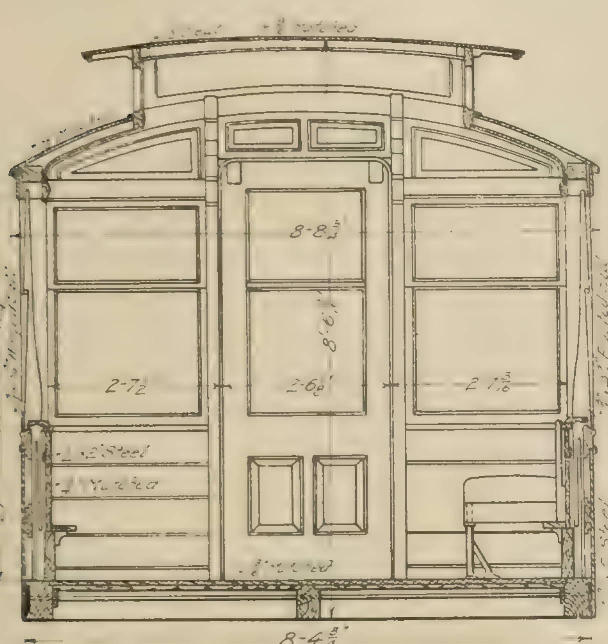


FIG. [illegible]—END ELEVATION OF CAR BODY

are of the same general type as those illustrated in the "Review" in 1899, but are larger, being 45 ft. 2¼ in. over the bumpers. Other changes are that the rear platform has been dropped 5⅛ in. below the car floor to reduce the height of the steps, the steps are wider, with double gates (four gates), and the rear half of the body is fitted with longitudinal seats.

The four gates are designed to provide two passages so that the entrance and exit of passengers may be simultaneous. The experience of the Twin City company in equipping its cars with gates operated under control of the motorman—who does not open them till the car has stopped, and who does not start the car till the gates have closed—has continued to be most satisfactory.

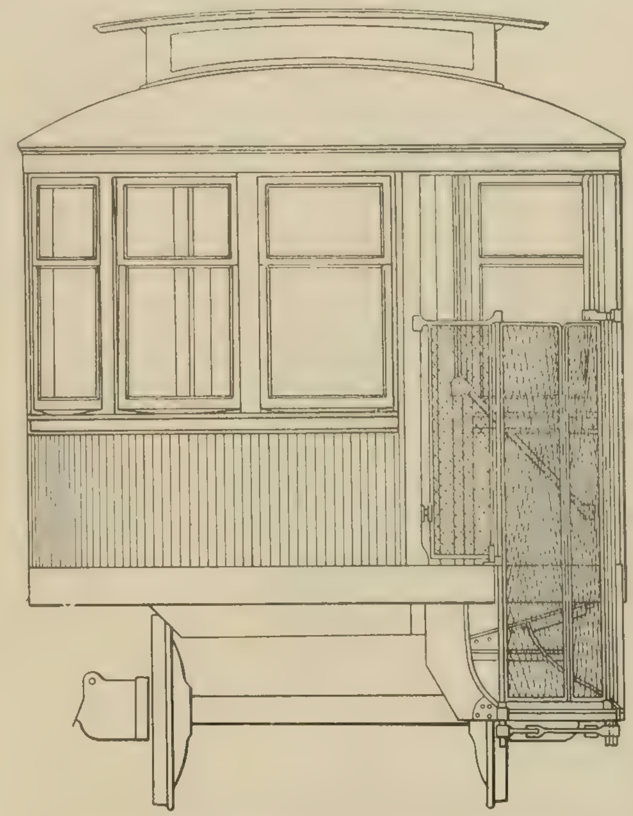
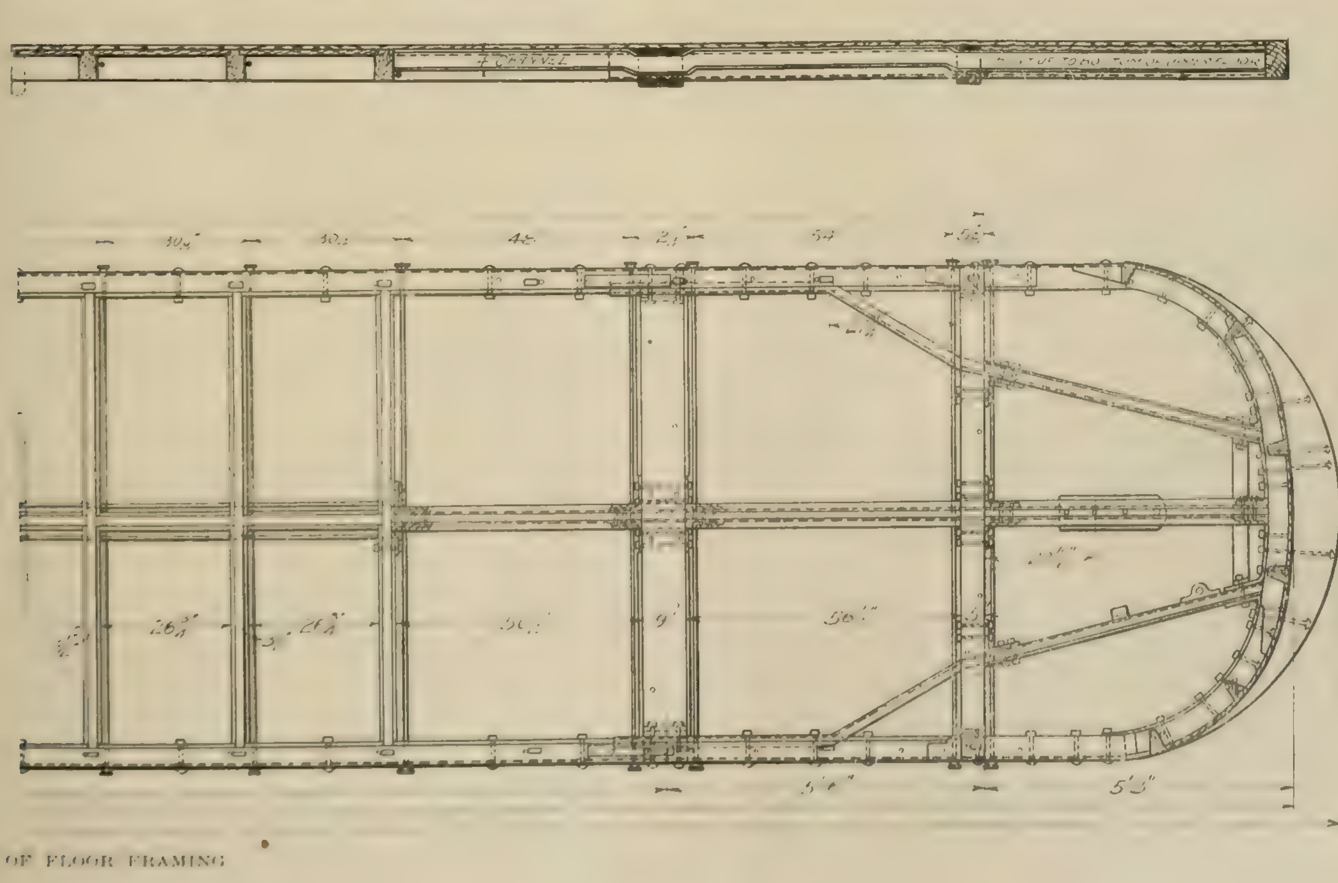


FIG. [illegible]—END ELEVATION OF CAR WITH GATE

The double gates and the diagram of levers for operating them are shown in connection with drawings of the car.



[illegible] OF FLOOR FRAMING

The main transoms are placed symmetrically with respect to the extreme dimensions of the car and are 22 ft. 1 in. between centers. Between these are cross sills 3½ x 6 in. The side sills are carried

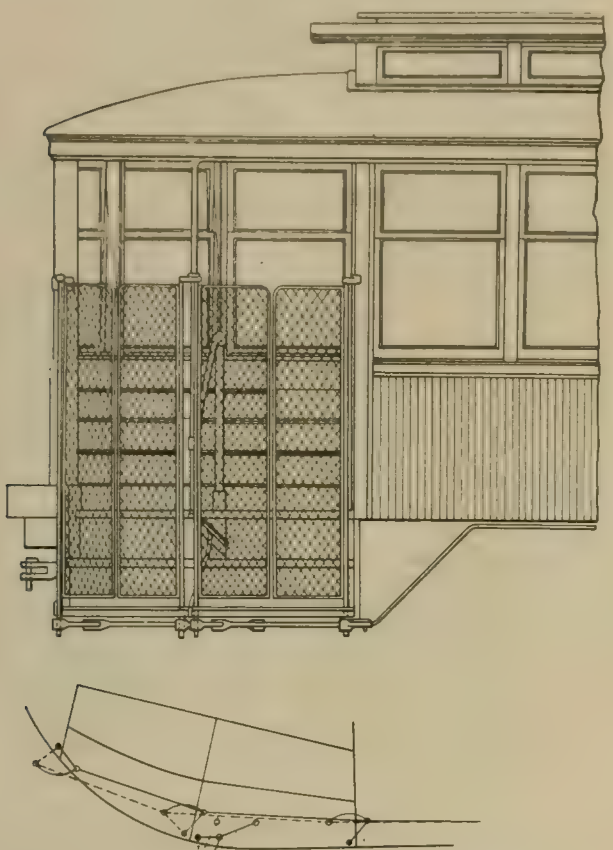


FIG. 5.—ELEVATION OF GATE AND DIAGRAM OF GATE LEVERS.

on the main transoms, and at the ends of the body are transoms similar in general design to the main transoms, but inverted and hung from the sills. The three types of transoms are shown in elevation.

The platform sills are four in number, two 4-in. channels about 17

FIG. 6. REAR END TRANSOM.

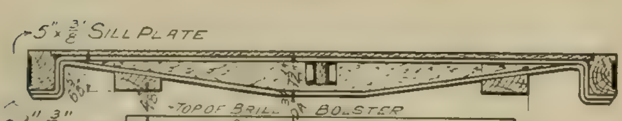


FIG. 7. TRUCK TRANSOM.

FIG. 8. FRONT END TRANSOM.

ft. long extending from the first cross sills through the main and end bolsters and bent up to bring the tops to the elevation of the floor, and two 6-in. channels about 11 ft. long, extending through the two transoms. The 6-in. channels are bent in two planes as indicated in the drawings of the car.

In connection with a description of this car, something concerning the methods used in the forge shop to shape the bolster members and platform sills will be of interest.

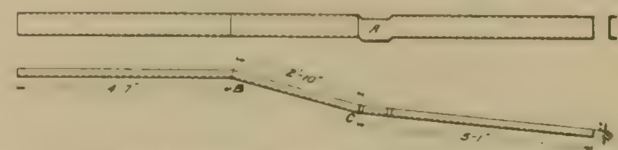


FIG. 9.—OUTER FRONT PLATFORM SILL.

The bolster members, of ¾ x 9-in. and ⅝ x 5-in. iron, are forged by hand, the bends being made over suitable forms. The bends in the platform sills are of three kinds, a double offset as at A in Fig. 9, bends in a horizontal plane as at B, C, F and G, and bends in a vertical plane as at D and E, Fig. 10.

These bends are made with a rail bender, suitable dies being

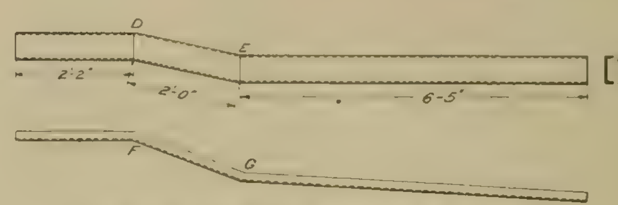


FIG. 10.—OUTER REAR PLATFORM SILL.

provided and forms to fit into the channels. For offsetting, the forms and dies are placed as shown in the sketch, Fig. 11, the blocks c and b being about 10 in. long and the blocks a and d of dimensions corresponding to the width of the transom member to be cleared.

For bends like B and C only the filling pieces for the channel are

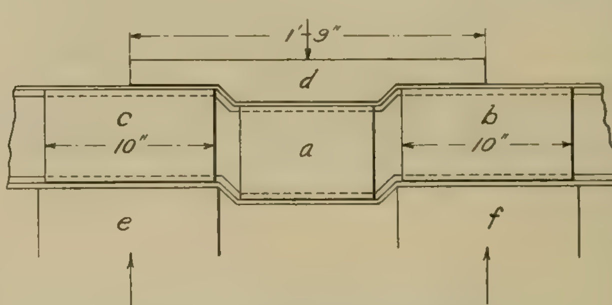


FIG. 11.—FORMS FOR OFFSETTING.

needed, but for bends like D and E there is required a third narrow piece, beveled at top and bottom to match the channel when bent, which is placed between the filling pieces and serves to preserve the sharp corners in the outer flange. The most difficult of these bends are made with only two heats.

Another interesting device is a roll for bending cold 1¾ x 1¾ x 5-16 in. angles used for cable racks in tunnels which the company is

FIG. 12.—FORMS FOR VERTICAL BENDS.

building to connect the new power house with the sub-stations in Minneapolis. The angles are bent into U shape, the radius of the curve being about 18 in. The form is a 1½-in. bar bent to the proper shape and bolted to a plate trimmed to a concentric curve of 1¾-in. greater diameter. At the center of the plate is pivoted a

lever 7 ft. long, and this carries a pin 2 ft. from the fulcrum with two rollers mounted on it. One roller has a face of 1¾ in. to engage the vertical flange of the angle to be bent, and the other is of smaller diameter to correspond with the outwardly projecting horizontal flange of the angle, the roller having a projecting lip which extends under the form plate and serves as a guide for the roller. Following the bending lever at an angle of about 30 degrees and connected to it is a second lever carrying a single roller shaped so as to engage both the flanges to the angle, which serves to prevent the angle from bulging during the bending process. Four men operate the bender, this number being required because of the small ratio between the power and resistance arms of the lever.

Heating and Ventilating Car and Locomotive Paint Shops.*

BY W. H. DUTTON, LEHIGH VALLEY RAILROAD.

No doubt by far the larger number of railroad paint shops recently erected are equipped with the hot air fan blast system of heating, and to this system attention is particularly invited. In providing for the installation of a heating plant for the car and locomotive paint shop at least three important considerations are involved.

First—Capacity for heating the shop at the floor line to any desired temperature consistent with requirements.

Second—Uniform distribution of heat, maintained at a low air velocity.

Third—A recirculating system which works without sufficient draft to stir up dust or inconvenience the workmen, and which furnishes a means of ventilation and the expulsion of bad air as well as giving an ample supply of fresh air.

Under properly adjusted conditions the heat furnished by the so-called hot air blast system is more reliable and generally better adapted to paint shop uses than steam or hot water heat. It affords convenience in handling, the heating system for a building being controlled at one point, and there is less danger from fire, as the heating apparatus is confined in a steel housing with no wood partitions to be looked after. Moreover, by the hot air blast system it is possible to obtain better ventilation during the cold months when windows and doors are tightly closed than by direct steam or direct hot water, and in the summer ventilation is provided by forcing outside or cool basement air through the shop.

This ventilation, if rightly utilized, becomes immediately effective in promoting the drying of paint and varnish, and contributing to the comfort of the workmen.

Naturally, opinions differ concerning the hot air blast system of heating best adapted to the paint shop, but all will agree upon the necessity of a system that will furnish adequate heat with a low air velocity. The modern paint shop requires a greater quantity of heat to fit it for the purpose intended than its predecessor, because, as a rule, it is better lighted, and, with more artificial light, more heat is needed by reason of the greater radiation from glass surfaces.

The hot air blast system, to best serve in its heating capacity the needs of the paint shop, should be furnished with an air circulating system that insures a return of at least a part of the air to the blast apparatus. There are three ways of establishing this return of air, namely, by an underground duct system, by an overhead galvanized iron pipe system, and by an overhead pipe system which delivers the hot air in a way to drive the cold air to the floor of the shop, and thence to the fans by means of a suction connecting directly with the steel air chamber of the blast machine.

In reference to the distribution of the air it is manifest that to get the most benefit from hot air it should be furnished where it is most needed. This leads to the suggestion that the greatest quantity of available heat is to be had from installing the heating apparatus around the walls of the shop, and for the paint shop it is an open question if the most satisfactory results are not obtained by forcing the air through an underground pipe or duct, using heat outlet pipes for the discharge of the air along the walls at the floor line. By this method the air is furnished directly at a point where it will do the most good, and the full strength of its heating power secured at a low air velocity.

By the overhead pipe system of delivering hot air it becomes necessary, in order to get the heat well down to the floor, where it is needed, to employ a higher air velocity than is usually safe to have in the paint shop.

The recirculating system for paint shops, in connection with the hot air fan blast system of heating, may easily be made to retard the drying of paint and varnish, and delay all processes of work. The constant recirculating of air without taking at least 50 per cent or more fresh air from the outside, except in extremely cold weather, is productive of both moisture and a poisonous air, which are alike detrimental to freshly painted or varnished surfaces and to the health of the workmen.

This danger from moisture and foul air may, of course, be considered greater in a low shop, or in a shop with a low ceiling, than in a shop with a comparatively high ceiling, the principle being based upon the fact that, proportioned to the size of the heating system, the greater the volume of air that can be safely taken from the shops for heating purposes.

While the paint shop should be provided with a series of ventilators which open from the highest point in the roof or ceiling of the shop, and operate effectively in removing the foul air naturally accumulating at that point, it is nevertheless true that a thorough circulating system entirely effective in furnishing fresh air and from the outside, furnishes in itself a valuable method of ventilation, and brings it at once and continuously where both the work and the workmen most need it.

To summarize, in brief compass, what the foreman painter has a right to expect in the matter of shop heating and ventilation is to urge the importance of furnishing ample heat to the shop at a location along the wall, and sufficiently close to the floor to give thorough and uniform distribution of dry heat throughout the entire shop from floor to ceiling at a very low air velocity and with a recirculating system entirely effective in furnishing fresh air and plenty of ventilation.

The installation of such a system will mark the disappearance of many difficulties confronting not a few painters at the present time.

*A paper read before the thirty-fourth annual convention of Master Car and Locomotive Painters' Association, Chicago, Sept. [illegible]

Investigate Your Transfers.

"Considerate people upon the busy lines of traffic will appreciate how much a conductor has to do in the taking of fares, making of change, answering questions and seeing that the car is not in motion when passengers are getting on or off. Rapid work is called for and the receiving conductor has too much to do to explain and convince a skeptical passenger. A person when getting a transfer should examine it to see that it is right, just as he does his change on the car or wherever else he may be dealing. It is plain why incorrect transfers cannot be accepted, and it is a simple matter to see that no mistake has been made so far as you are concerned. It is to your own interest and a great accommodation to the company."
—Extract from Detroit United Weekly, Issued by Detroit United Ry

The Brooklyn Rapid Transit Co. has installed a new dynamo and engine, with a capacity of 4,500 amperes, in its Third Ave. power house.

The Westinghouse Electric & Manufacturing Co. has purchased a controlling interest in the Lackawanna & Wyoming Valley Rapid Tranist Co., paying therefor about $6,000,000. Of this amount $4,000,000 was taken from the company's treasury and the rest was borrowed at 6 per cent on notes purchased by Kuhn, Loeb & Co.

Simple Oiling System.

Mr. William L. Knowlton, chief engineer of the Portland (Me.) Railroad Co., has devised and has been using for over four years a very simple yet effective system for carrying oil to the engine bearings at the central power house of the company. The system was devised with the end in view of avoiding the use of auxiliary pumps for lifting the oil, such as are required with any gravity or compressed air automatic lubricating apparatus.

The salient feature of the method is thus tersely stated by Mr. Knowlton: "We took a piece of heavy iron pipe about 1½ ft. in diameter and about 7 ft. long. We capped it at both ends and stood it on end for our oil pressure tank. Then to get the pressure, we merely connected the bottom of this oil pressure tank to the city water main."

The general layout of the system is indicated in the diagram. The oil in the pressure tank floats on a stratum of water, the water coming from the main at about 70 lb. pressure. The water forces the oil up through the feed pipe leading from the top of the tank to the engine room above and to the bearings of the several engine units. The oil drips from the engines are collected in drip pans and flow by gravity to the oil filter, from which the filtered oil flows by gravity into the open tank for storing the filtered oil. From the bottom of this filtered oil tank, a connection leads to the top of the pressure tank previously mentioned. When the water in

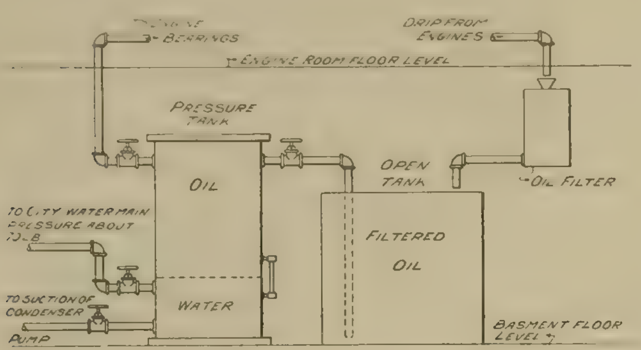


DIAGRAM OF OILING SYSTEM.

the pressure tank has risen sufficiently to force nearly all the oil therefrom, the connection to the water main is closed, and a valve is opened giving connection to the suction of one of the condenser pumps, that pump being used which happens to be working at the time. This action draws the water from the bottom of the pressure tank and at the same time draws filtered oil into the top of the pressure tank from the filtered oil storage tank.

The only attention required by the apparatus is that the level of the water in the pressure tank be watched to prevent the supply of oil from becoming exhausted and the water from rising into the oil piping system. This is not a serious task. A glass gage shows the level of water at all times, but in daily operation it is the custom to replenish the supply at regular stated intervals. With the apparatus in use it becomes necessary to do this about every two hours. Knowing the supply of oil required, it would be an easy matter to so proportion the size of the tanks as to make this interval any length of time desired. If the tanks are made large enough, replenishing would not be necessary more often than once a day. The time required to draw the water from the bottom of the tank is not over two or three minutes. Losses of oil by evaporation and waste are replenished by pouring new oil into the filtered oil tank. The company is now installing a set of tanks of sufficient capacity to run all day without refilling.

The entire apparatus complete did not cost over $20, and for four years has successfully performed the work of an automatic gravity or compressed air system that would have cost from $1,500 to $2,000 to install. Moreover, there are no pumps of any kind required other than the condenser pump, which, of course, is a necessary part of the station equipment, and is not an extra charge against the oiling system. Mr. Knowlton states that if the city water main fails for any reason, the bottom of the pressure tank can be connected direct to the boiler feed supply with equally as good results.

The Economical Use of Coal.*

When we consider the actual use of coal in a power station we are faced by two propositions; first, how to use coal economically, and, second, how to use the power obtained from that coal so that less coal may be needed in the furnaces. There are thus really two problems connected with the modern power stations. The first is the economical consumption of coal and relates almost entirely to the furnaces of the boiler plant. The second, which deals with the economical development and use of power, relates entirely to the feed water supply and to the mechanism for generating and distributing power.

In order to burn coal completely it is necessary that it should have an adequate supply of oxygen—that is, of air. The air must be brought into contact with every atom of the combustible; otherwise there will be a waste. Energy must therefore be expended in bringing the air to the coal. This energy will be a natural expenditure in case the air is brought through the grate bars and the furnace by means of a chimney. A certain amount of the heat of the coal will be expended in maintaining a hot column of gases in the chimney and thus in producing an inverted siphon effect. The hotter air rushes in to fill what would otherwise be a partial vacuum in the chimney.

Another method of producing a draft is by means of a blower, which may be called the forced method. In this case steam is taken from the boiler to drive an engine connected with the blower. It will readily be seen that both cases demand an expenditure of heat, and it is often a serious question to decide between them. I have seen conditions where a low chimney and a good blower were vastly superior to a high chimney, but I have seen the reverse, and I am sure it must be difficult in some cases for an engineer to decide without a full knowledge of the conditions, just which method to use. With very volatile coal, demanding at times a rapid supply of air, a blower is probably the better. To give an idea of the waste involved in volatile coal without a blower, a practical example may be cited. Some years ago the government instructed one of our ships to take 600 tons of black diamond coal at Seattle in order to test it for steaming purposes. It was carried to sea, but found very inefficient. There was a beautiful torchlight from the top of the smoke pipe, where the volatile gases had taken fire, and the ship was actually making seven knots upon a consumption of coal which ought to have given her ten. The blowers were started, with the idea of increasing the supply of air in the furnaces. Immediately the flame disappeared from the top of the chimney and the ship increased her speed by two knots upon a lower consumption of coal. This demonstrated at once the need of a larger supply of air to consume the gaseous materials, and the consequent increased efficiency.

The amount of air needed for the complete combustion of one pound of carbon is a little short of twelve pounds, and at 60° this occupies a space of about 150 cu. ft.; that is, for every pound of carbon consumed we must furnish to the furnace 150 cu. ft. of cold air. Now it is almost impossible to burn a pound of coal with anything like the theoretical volume required by it. If we measure the amount of air delivered into furnaces, we find it varies from 200 to 300 cu. ft. per pound of coal. This is probably due to the fact that a certain amount of air of dilution must be driven in with that which actually consumes the coal. The additional air thus passed through the grate is a very large loss, as it is heated up to the same temperature as the products of combustion and it usually passes out of the boiler at a temperature of about 600°. Various inventions have been devised to regain some of this lost heat, but they involve either the sacrifice of the draft or else the addition of a blower to the plant. The method of introducing warm air, for instance, is interesting and sometimes effective. We find it in use for marine purposes. But there is one aspect of the introduction of warm air which is sometimes lost sight of. The hotter the air the greater volume occupied by one pound, and therefore the less actual air in each cubic foot. Consequently, if 200 cu. ft. of cold air is necessary for the complete combustion of one pound of coal, an increase of temperature to, say, 600° F., would make this volume 400 cu. ft. more. Thus, a much larger expenditure of energy is

*Abstract of a talk by Professor Ira N. Hollis, of Harvard College, before the New England Street Railway Club, September 24th, 1903.

required to drive it through the furnaces. This has been the cause of the failure of many hot air systems for boilers.

In designing boilers engineers have to remember that one of the chief causes of expense is the lack of a proper supply of air at the right instant. If bituminous coal is used and there is a large amount of volatile gases which burn suddenly or escape up the chimney, we must have some automatic device for increasing instantly the supply of air. If the normal rate of air supply goes on, then the gases are lost. On the other hand, after the volatile gases have been consumed, and there is nothing but pure carbon left, the rate at which the air enters the furnace should be decreased below normal. Otherwise we have too much air instead of too little. What this comes to is that it is difficult to adjust the supply of air to the supply of coal with the ordinary types of furnaces. This has led to a number of inventions for handling the coal. The most successful of these are based simply upon a regular supply of coal and air. They are the ordinary types of underfed stokers, traveling grates and moving grates, by which the coal is supposed to be fed in at just the same rate as the supply of air can be given to it. Often these devices are more expensive to maintain than the additional cost lost by the average fireman who has only the plain grate. As a station has to be run upon a money basis, the money expended in the course of the year is the measure of success, and consequently the repair bill as well as the coal bill must be kept down. Where there are a large number of boilers and it pays to keep a skilled man busy repairing, there is no doubt of the advantages possessed by some of the patent grates. In my own belief much would be gained by the better training of firemen and a stricter license law. Of course a better trained man would demand more pay, and I think he ought to have it.

In case coal is burned with the highest economy there is still great room for improvement in a power station. One pound of ordinary coal is capable of giving out between 14,000 and 15,000 heat units, and of this less than one-tenth is realized in the power given out. The rest is waste; so that, as a matter of fact, when a ton of coal is burned, less than the heat of 200 pounds is actually utilized. It has already been explained that part of the waste heat is necessarily employed in producing a draft. Another part of it is radiated off to the atmosphere before steam is generated. Still another part goes into the ashpan with the ashes and clinker. The steam generated in the boiler represents from six to seven-tenths of the heat of the coal and an enormous amount of it is lost in the engine. In practice we have not even begun to obtain economy in the expenditure of the heat derived from coal. The engine wastes vastly more than it utilizes, and here great improvements may be effected.

Exhaust steam carries away the bulk of the loss, some of which can be recaptured by what is now known as an exhaust heater, placed in the path of the steam on its way from the cylinder to the condenser. A well-appointed power station will always have this form of heater and also another heater in series with it. The second utilizes the exhaust steam from the auxiliary engines, such as the feed pump and the air pump. A third heater is sometimes placed in the base of the smoke pipe to lift the feed water to a still higher temperature. This is known as the economizer, and is of great use in many power stations. It seems to me that an economizer is of questionable benefit where it is designed for a high power but used normally for low power, as is the case with many lighting stations. One example that I have in mind is a station with 4,000 h. p. and an economizer designed for the full capacity of the boilers. As the engines are ordinarily run at only 600 or 700 h. p., the gain is not sufficient to warrant the first cost and care required. Where, however, a station is run at something near its normal capacity, the case is different, as stated above.

One of the most important considerations is to get the steam from the boiler into the cylinder with a minimum of condensation. [illegible] of a pound of steam [illegible] the boiler and one-fourth of it is condensed before it gets to work, we have a serious loss. The steam jacket is intended to prevent part of this condensation, but there are conditions under which a steam jacket is not of great advantage. It seems just better to superheat the steam before it leaves the boiler at least 100°, so that it may enter the cylinder without initial condensation and exhaust without moisture. [illegible] superheating the steam than we, as we have only recently undertaken to superheat to any extent. The improved oils have made it possible to carry steam at from 75° to 150° above the temperature of saturation, although I am persuaded that 100° is perhaps the limit under ordinary circumstances. As stated above, there are conditions under which the steam jacket is of no use whatever, particularly if it supplies too much heat to the steam during its passage through the cylinders. The ideal condition would seem to me to be superheated steam for the high-pressure cylinder, with a reheater between the various cylinders into which the steam flows in doing its work. With a compound engine that would be one reheater. With a triple expansion engine it would mean two reheaters. The object of the reheater should be to superheat the steam before its entrance into the succeeding cylinder, and the practicable maximum economy would be obtained by having the steam leaving the last cylinder just saturated. If it is superheated, too much heat is carried into the condenser; if damp, too much heat is lost in the cylinder.

It does not seem to me that enough attention is paid in the ordinary power station to the study of the conditions under which coal is burned. In case of a large station or number of stations, it would pay to have a careful daily examination of the products of combustion, as a check upon the firemen. A chemical analysis would show the amount of carbonic gas and air of dilution discharged into the chimney, and a careful study of these could not fail to inform the engineer in charge of a station. The amount of moisture in the steam should also be examined daily. If the steam is superheated, a thermometer is sufficient to disclose just what is happening. It would also be of advantage to have a regular examination of the kind of coal used as a means of discovering that which is best adapted to the furnaces and boilers in use. Some varieties are very hard to burn at all, especially if they have weathered a long time. With anthracite coal which has been exposed to the atmosphere, a large amount of moisture is usually absorbed, and the external surface is so acted upon that it is likely to require a very high temperature for complete combustion. The bituminous coals undoubtedly suffer by the escape of volatile gases. No doubt it is difficult for power stations to obtain the same quality of coal throughout the year, and we have seen during the past winter what a coal strike means to all of our large cities.

Although we have what seems to be an almost limitless supply in our enormous superficial area of coal deposits, yet corporations should if possible find the most economical means of burning fuel. It is not only to the interest of the country, but it is to their interest as a means of paying larger dividends.

Discussion.

Mr. Baker, of the Boston Elevated Railway: I am much pleased with the remarks made by Professor Hollis. Some of his statements were interesting to me from the fact that our purchasing agent is here tonight. The professor stated that it would take him two weeks to find out how to burn a certain kind of coal. I take it he has reference to such coal as our people purchased last winter, or what is known as Admiralty small coal. Of course, there are times when the purchasing agent cannot have any choice in the matter, but those having to do with the purchasing of coal should stop and consider that an engineer or an expert fireman cannot get the best results out of his fuel where the same is frequently being changed, or if it is mixed in all kinds of proportions; consequently the result is poor efficiency and possibly at times low steam.

In regard to burning coal, the professor states, as I remember, that theoretically 150 cu. ft. of air per pound of coal is required, while in actual practice double that amount is sometimes used. In burning the coal the amount seems to be governed by the demand for steam, and to regulate the amount burned as per the demand for steam it seems to me that the air admitted, either by force or natural draft, should be a governing factor, although it is true that if the air supply is shut off and fresh coal is on the fire we are liable to lose a part of the combustible matter, depending more or less on the volatile matter contained in the coal. So I believe the proper method of burning coal in railroad practice, or where the load is fluctuating, is to keep the fire at a nearly even thickness, then depend

ing somewhat on the kind of coal and air pressure, regulating the fire by the amount of air admitted. This may be done by automatic dampers controlled by the steam pressure. In railway and electric light power stations the load is more or less fluctuating, especially so in small plants. In large plants or systems the load factor in the engine is fairly steady, for the reason that one or more engines can be shut down or started up, as the case may require, and we expect to run our engines under fairly economical conditions. This, however, at certain times in the day, leaves us with more or less boilers on the line that are not needed for light load. In this case we do not take the boilers off the line, but bank the fires in some cases, and in others we give the furnaces less air, thus reducing the rate of combustion per square foot of grate surface.

In reference to the economizers, I take it the professor does not approve of them in railway work. Here I do not agree with him, but believe in a liberal-sized economizer for power-station work. I do not, however, recommend putting them in large enough for our maximum capacity or the peak of the load, as I would under conditions where the load is constant, as in flour mills, cotton mills, etc. I have reason to believe that under fair conditions economizers will last ten or twelve years with very little repairing and cost for maintenance. When some of our first economizers were installed primary heaters were not used and we had some trouble from sweating of tubes which undoubtedly caused rapid deterioration. Five, seven, and eight years ago we installed economizers in connection with primary heaters. These heaters gave us a temperature of 100° or more, and then passing the water through the economizers we obtained an average temperature of 220°.

Regarding heating the water with auxiliary heaters, taking the steam from the steam pump, condensers, etc., we found by some quite extensive tests that by using this steam in our low-pressure cylinder we obtained equally as good if not better results than where we put in secondary steam heaters, as 111° of heat gained in the economizer saves us 10 per cent of boilers and the maintenance on same as well as the cost of labor to operate them. I would therefore maintain that in a great many cases economizers are money savers, and if properly handled will pay a good dividend on the investment.

A Member: You mentioned the case of a steamship in which they used black diamond coal. I wonder if instead of putting on the blower, they would not have got better results by lengthening out the stack, and possibly enlarging the hatches a little. Would it not be possible for any given conditions to design a stack that would give any result that would be obtainable by a blower?

Professor Hollis: I think it would be. My last service in the navy was to assist in proving that we could put a 100-ft. stack upon a steamship without capsizing her. One hundred feet is about the limit, and beyond that, of course, you are obliged to resort to blowers to get draft and reserve power. I think with black diamond coal, where the quantities of volatile matter are so large, that you can deal with that problem by limiting the amount of coal to be burned per square foot of grate. That is the way I should attack that problem.

It is astonishing to find how much we waste in our power stations. The "L" road has a number of stations with first-rate methods of firing and handling coal, and yet I think I could gather up a pound of coal dirt at my house from the smoke of its chimney, showing that a high chimney is not sufficient to deal with the subject adequately. The draft in any chimney is dependent to some extent upon the state of the barometer and the weather. If you have a bright, clear, cool day, and a temperature around 600° in the chimney, you will have a good draft and can burn coal economically. On the other hand, if the atmosphere is heavy you cannot burn the coal well.

There is another question which Mr. Baker raised, whether it was better, when the plant shuts partially down, to keep steam on a large number of boilers, burned very moderately, or to shut down some and keep steam on the others, with some forcing of the fires. Without a full solution of that, I do not think a power station can be run with the highest intelligence.

Mr. Baker: I would like to say a word about rapid combustion. If we had less of it the professor would have less dirt on his house from our chimneys. I would like to ask what he thinks is the most economical, 5 pounds per sq. ft., or 25, or 60.

Mr. Conant: I have read somewhere that the amount of carbon dust thrown off from a chimney is a very small per cent of the amount of coal burned. Do you know anything about patent combustion powders in relation to their use in burning cinders? One consists mostly of slacked lime. You mix it with the cinders and water. They say it makes a very good fire.

Professor Hollis: A question was once asked of a student, what is polarized light? He answered it by saying: "Polarized light, as I understand it, is very little understood." I think I am pretty much in the same boat with these combustion powders.

In reference to the dirt that comes out of a chimney, the dirt is only an indication of loss. As a matter of fact, the loss of smoke is probably less than 1 per cent. The volatile gases must escape in the smoke and cause considerable loss. Another point is with regard to smoke prevention. Of course smoke prevention is not necessarily economy of coal. It can, however, be made to promote the economical use of coal because there is less smoke where there is careful firing. Some firemen will make little smoke, and that indicates that the gases are being consumed in the furnace. Smoke prevention does not seem to have been accomplished at present.

A Member: I should like to be enlightened upon the question of the deterioration of coal due to the weather. I have always thought it was due to the distilling out of the volatile matter, leaving nothing but carbon, and that anthracite coal, containing so little volatile matter, would not deteriorate so much as bituminous coal.

Professor Hollis: One of the reasons is that anthracite absorbs a great deal more moisture than it is usually credited with, and that which we attribute to the weather may be the slow absorption of oxygen.

Mr. Moultrop, of the Edison Electric Light Company: In using patent stokers in large power stations there is no question but what the repair bill is pretty big and there are some other disadvantages, but there is a big advantage in the freedom from labor troubles. It requires a better grade of men to handle these stokers, and that is something the station managers do not take sufficiently into account. With the stoker installation you want a pretty good class of men.

Professor Hollis: There is another question of economy, and that is superheated steam. Twenty years ago it was impossible to use it on account of the poor oil. With the improvement in the oil the value of superheated steam has been increased.

Mr. Baker: One of our engines was put in under a guarantee and did not meet it. On the second test the reheater coils were cut out and it did better than the guarantee. We do not steam-jacket our cylinders any more. I don't believe, for railway work, it would pay to jacket them.

Mr. Moultrop: Most of our engines were equipped with reheaters, but we cut them off. The matter of repairs seems to be a big one with us. We have made some tests with regard to the efficiency of them, and the results have indicated that we will get better economy to dispense with reheaters between the cylinders, use reheated steam, and if possible have enough superheated steam go into the cylinder so that the exhaust comes out dry.

Professor Hollis: I think that is so. I found at the Cambridge electric light station that the reheaters gave a gain of 10 per cent. On the other hand, four years ago I had occasion to test a triple-expansion engine which had reheaters. We had jackets on all the cylinders. I tried the engine with steam on all the jackets and reheaters, and we got a horse power on 12.09 lb. of steam. Then we cut the steam off of all the jackets and the reheaters and we got a horse power on 12.1 lb. and we were convinced that the jackets did not work well. Then we tried them with no steam on the high-pressure jacket and simply steam on the intermediate jacket and the first reheater, and we got a horse power on 11.3 lb. of steam. I think there is very great danger of overdoing the matter of jackets and reheaters.

The Indianapolis & Northwestern Traction Co. on December 18th inaugurated a freight and express service between Indianapolis and La Fayette, Ind., new special cars being employed for the purpose. During the first 15 hours the new line, through the agent, Mr. E. B. Cuyler, handled and shipped 7,400 lb. of freight and express matter.

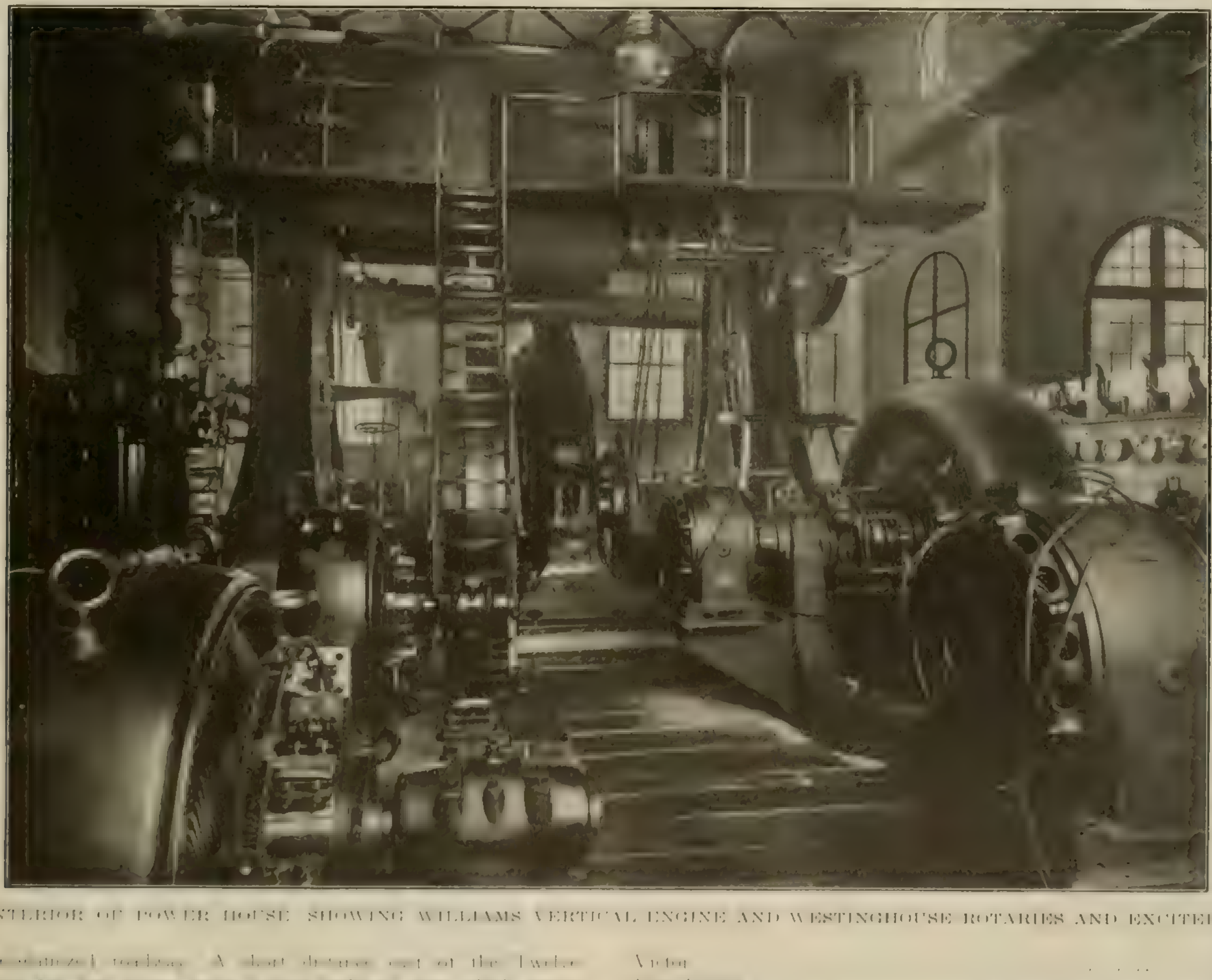
Rochester & Eastern Rapid Ry.

Route — Distance — Tributary Population — Prospective Earnings — Construction, Equipment and Power Plant.

The Rochester & Eastern Rapid Ry. is a high speed electric interurban operating upon its private right of way and serving the prosperous communities between the Genesee valley and Canandaigua, Seneca and Cayuga Lakes. This route includes a number of prosperous cities, villages and fertile farming lands and is, in many respects, the finest country in Western New York. The road starts at the Four Corners in the center of Rochester and continues eastwardly over the tracks of the Rochester Railway Co. to the city limits, and from this point to the hamlet known as Twelve Corners the line is located upon the northerly side of Monroe Ave., entirely rebuilt with 73-lb. girder rail and provided with new overhead equipment. The latter company is owned and controlled by the Rochester & Eastern which also has its own franchise through the village.

The urban population served is as follows:

Rochester	175,000
Twelve Corners	200
Pittsford	1,000
Fairport	2,500
Bushnell's Basin	200



INTERIOR OF POWER HOUSE SHOWING WILLIAMS VERTICAL ENGINE AND WESTINGHOUSE ROTARIES AND EXCITERS

[illegible] macadamized roadway. A short distance east of the Twelve Corners the line passes upon private right of way which [illegible] in width. The private right of way [illegible] [illegible] except for a short distance [illegible] the village of Pittsford, the hamlet of Bushnell's Basin, the villages of Canandaigua and the city of Geneva [illegible] Seneca Lake. A short distance [illegible] of Pittsford the line passes over the Erie Canal on a through [illegible] steel truss bridge [illegible] concrete [illegible] [illegible] passes under the tracks of the New York Central Railway, through a [illegible] [illegible] [illegible] [illegible] passes under the steel bridge of the [illegible] [illegible] Pittsford. [illegible] Canandaigua over the tracks of the [illegible] Light & Power Co. [illegible]

Victor	800
East Victor	200
West Farmington	50
Canandaigua	7,300
Seneca Castle	250
Dunkel's Corner	40
Geneva	11,800

Total urban population [illegible]

To this must be added the population of the towns (townships) passed through exclusive of villages, etc. mentioned above which gives a total [illegible] population of [illegible] which, added to the urban population makes the population directly tributary to the road [illegible]. In addition to this [illegible] population of [illegible]

located at the various villages around Canandaigua Lake. The lake is traversed by two boats and is a main artery of travel during

TRACK, LOOKING TOWARDS VICTOR

the season of navigation. There are about 450 summer cottages on the shores of this lake. In addition to this there is a large tributary population by way of Seneca Lake and also by way of the Geneva, Waterloo, Seneca Falls & Cayuga Lake Electric Ry. This indirectly tributary population to the Rochester and Eastern aggregates about 100,000.

The total mileage of the Rochester & Eastern is 51.55 miles, including 2¼ miles in the city of Rochester over which the company operates its cars. The distance between Rochester and Geneva is 43.3 miles via the Rochester & Eastern and 52 miles via the New York Central, and the electric line carries its passengers into the heart of Rochester while the New York Central depot is 15 minutes ride from the Four Corners. The amount of travel through this region is indicated by the fact that the New York Central runs 22 passenger trains per day through Canandaigua six of them starting from that village.

Estimate of Earnings.

Perhaps the best way to forecast the earning power of an electric railway is to take the population directly contributory along the line but exclusive of the population of the terminal city, divide it by the total mileage and multiply this amount by the sum that experience shows will be expended per capita per annum for railway fares and freight and express service. Proceeding by this method we have the following:

Direct population	219,640
Less population of Rochester	175,000
Mileage from Rochester to Geneva	43
Direct population per mile exclusive of Rochester	1,038

Experience has shown that a population figured in this manner will pay for electric railway passenger service from $4.00 to $6.50 per capita each year. The following amounts are given as per capita annual earnings of the roads named upon the basis here indicated.

Rochester & Sodus Bay Railroad Co.	$5.00
Detroit, Ypsilanti, Ann Arbor & Jackson Railway Co.	4.97
Detroit United Ry. (Detroit & Pontiac line)	5.27
Detroit & Port Huron Shore Line Ry. (Detroit & Mt. Clemens line)	6.21

It seems conservative therefore to estimate the earnings of the Rochester & Eastern at $5.00 per capita for passenger service exclusive of its freight and express earnings. It is believed, however, that after the road has been running a sufficient time to develop its normal patronage its passenger earnings will exceed this figure. Taking the population at 1,000 per mile (38 less than shown) and the passenger earnings at $5 per capita gives:

Annual passenger earnings per mile	$ 5,000
Total annual passenger earnings	235,000
Freight earnings, $100 per day for 300 days	30,000
Total gross earnings	265,000
Less operating expenses, 55 per cent	145,000
Net income	120,000
Fixed charges 5 per cent on $1,500,000 bonds	75,000
Left for sinking fund, stock dividend, etc.	45,000

This statement shows at least that the fixed charges are amply secured, and the earnings of the line between Rochester and Canandaigua which has been opened for traffic since Oct. 15, 1903, has been more than satisfactory to the owners and fully justifies their estimates of the earning capacity of the road.

STANDARD PASSENGER COACH

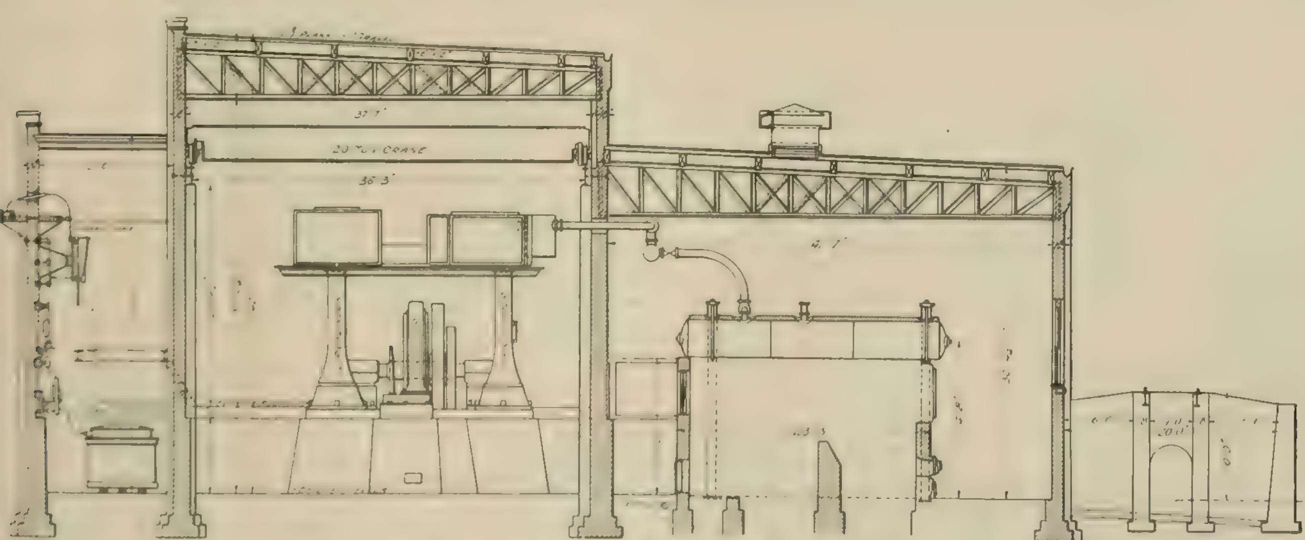
BOILER ROOM

Character of Construction

As stated before the road is built on private right of way averaging 60 ft. in width which has been bought outright in fee simple at an approximate cost of $100,000. The track is of 70 lb. T rail of A. S. C. E. section joined with six-bolt splice bar. It is laid on cedar ties on tangents and yellow and white oak on curves, the

VIEW OF POWER PLANT AND CAR BARNS

ties being spaced 2 ft. between centers and on 14-in. centers on bridges. Rails are bonded with No. 000 "Protected" bonds, 8 in. long and with ¾-in. terminals expanded in hand drilled holes by a hydraulic press, after the standard practice of the Mayer & Englund Co. Steel guard rails are placed on all bridges, curves and outside of switches. The road is ballasted with gravel with a minimum of 6 in. beneath the ties. This gravel is secured from



TRANSVERSE SECTION THROUGH POWER HOUSE

ballast pits aggregating 13 acres which are owned by the company. The pits contain sufficient ballast to last the road for all time. The roadbed is 14 ft. wide on embankments with slopes of 1½ to 1 and is 20 ft. in cuts, the slopes being the same.

Bridges and Culverts

The bridges are all built with steel on concrete abutments, there being 16 between Rochester and Geneva, exclusive of those for steam railroad crossings. Two of the bridges are 123 ft. long and are pin connected steel trusses. There are also five railroad crossings with a separation of grade with steel bridges on concrete abutments. All bridges are designed for a rolling load consisting of a train with 20,000 lb. per axle on a 6 ft. 3 in. wheel base, 26 ft. center to center of trucks; also a dead load of 800 lb. per lineal foot with an impact of 80 per cent. All culverts with over 4 ft. openings in the clear are concrete arches and those with less than 4 ft. are of extra heavy cast iron pipe. The drains are of extra heavy vitrified fire clay sewer pipe.

Overhead Equipment.

The poles are of cedar, 7 in. at the top and from 30 to 50 ft. in length. Extra heavy yellow pine cross arms are used with galvanized iron braces. The transmission line is of stranded aluminum carried on Locke glass insulators with extra long paraffined oak pins and special galvanized ridge iron. The feeder is also stranded aluminum equivalent to 500,000 and 400,000 c. m. copper. The trolley wire is No. 0000 grooved copper carried on 8-ft. 6-in. brackets with flexible connection, by means of Ohio Brass Co. hangers and clamps. The trolley is tapped to the feeder every half mile. The distributing system is designed to distribute 450 amperes each way from each sub-station. In villages where required, span wire con-

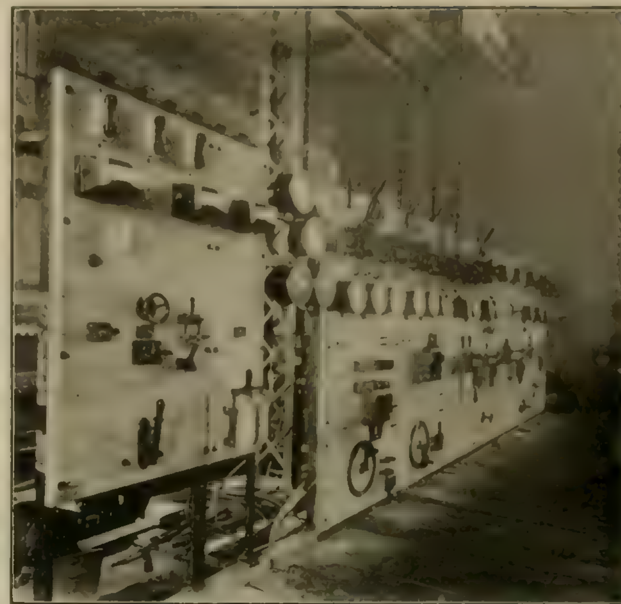
structure is strung with a [illegible] galvanized steel stranded span wire. A telephone circuit is carried on the poles by means of brackets with porcelain insulators.

Rolling Stock.

Up to the present time the company has received six 52-ft. passenger coaches from the John Stephenson Co. which are of the most modern type. They are double vestibuled and finished in mahogany with smoking compartment and toilet rooms. The upholstering is of plush and they are heated by electricity. There are also under order eight more passenger coaches, six of them being 45 ft. long which will be used for summer service. These are equipped with four G. E. 74 motors and type M control, and are of the same general style and finish as the former. The company also has two 50-ft. express cars and one 36-ft. construction and repair car. All the cars are equipped with telephones, electric lights and other modern appliances. For keeping the tracks clear of snow a Ruggles patent double action high speed snow plow has been ordered from the Peckham Manufacturing Co. The cars are mounted on extra heavy high speed M. C. B. trucks, Barney & Smith class F type, with 5½-in. axles and steel-tired wheels. Westinghouse straight air brakes are used with motor driven air pump on each equipment. The long cars are equipped with four G. E.-73 motors, L-4 controllers.

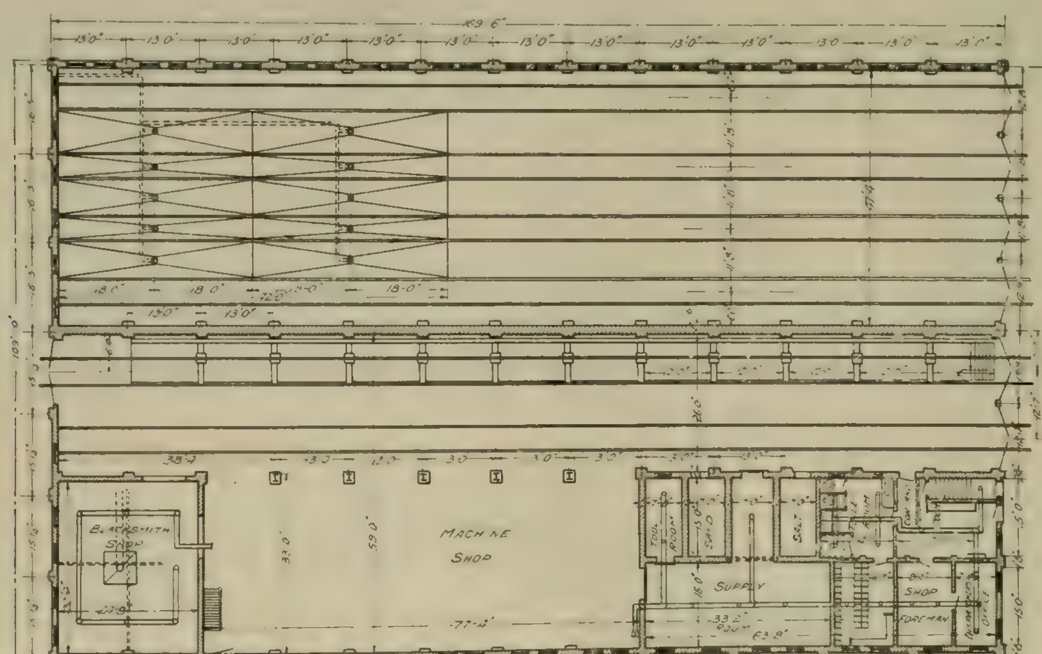
Power House.

The power plant is situated at the foot of Main St. in Canandaigua where the company has two buildings. One of the buildings is 117 ft. 8 in. x 65 ft. 9 in. and 44 ft. extreme height. It contains



SWITCHBOARD AT POWER HOUSE.

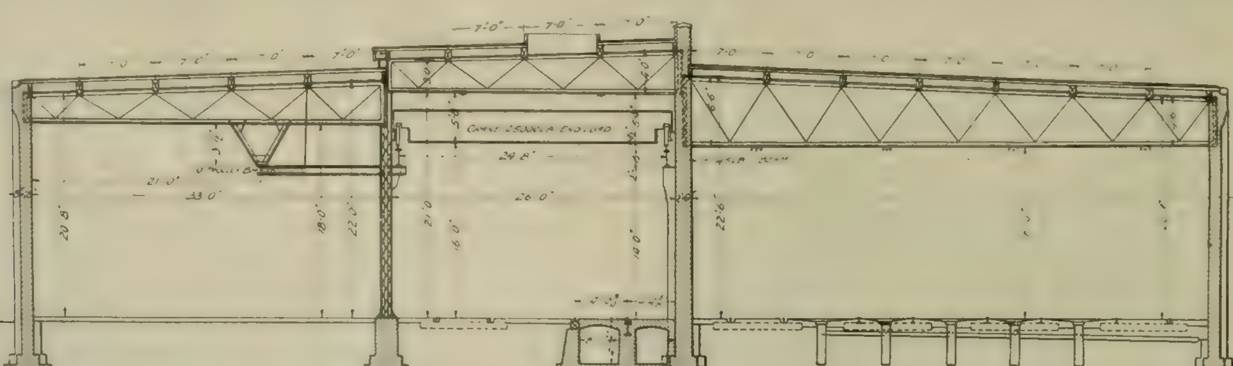
transformer tower and for the entrance of the overhead wires into the building. The boiler room has an extension built of concrete



FLOOR PLAN OF CAR BARN.

an engine room and boiler room separated by an 18-in. party wall. A wing 15 ft. 6 in. x 39 ft. 5 in. off the engine room is used for a

the full length of the room used as a coal vault. The foundations of the building are of concrete, the walls of pressed brick, averaging



TRANSVERSE SECTION THROUGH CAR BARN.

18 in. thick, and the floors are steel and concrete throughout. The roof is of four ply felt with tar and gravel filling and is supported on steel trusses.

The engine room contains two Williams vertical cross compound engines 22 and 43 in. x 32 in. stroke built by the Quincy Engine Works, of Quincy, Ill. They are rated at 1,050 h. p. running at 150 r. p. m. with 150 lb. initial steam pressure and exhausting into

VICTOR SUB-STATION

a pressure of 2½ lb. absolute. These engines are direct connected to two 650-kw. Westinghouse alternators of the revolving field type. All of the electrical apparatus of the power house was furnished by the Westinghouse company. The engine room equipment also includes two rotary converters of 300-kw. capacity; four 500-kw. transformers placed in the basement of the transformer tower, and two Westinghouse compound automatic engines 9 and 15 in. by 9 in. stroke, direct connected to two 37½ kw., 125 volt d. c. generators used for exciting the main generators.

There will be a nine panel switchboard containing two generator panels, one transformer panel, two a. c. rotary converter panels, two d. c. rotary converter panels, one d. c. two-circuit feeder panel and one double exciter panel. The engine room is spanned by a traveling crane 36 ft. 3 in. span and 32 ft. lift which travels on runways in the walls the length of the building.

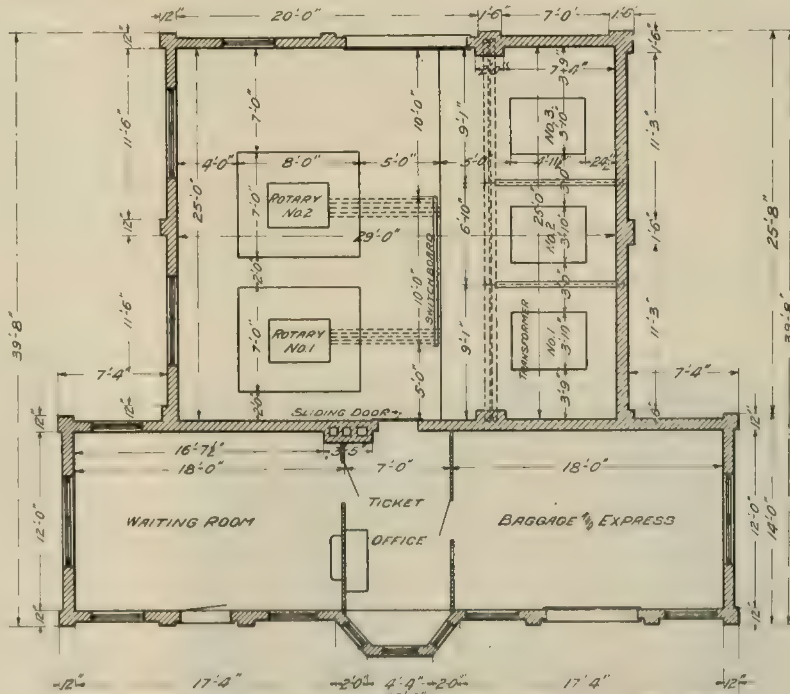
There are three Cahall horizontal sectional water tube boilers aggregating 1,124 h. p., built by the Aultman & Taylor Co., of Mansfield, O. These contain 11,240 sq. ft. of heating surface and 227.43 sq. ft. of grate surface. These boilers are tested to carry 225 lb. steam pressure if desired. There is a Baragwanath horizontal water tube type feed water heater 36 in. x 14 ft. 6 in., a Green fuel economizer containing 32 sections of 10 tubes, each tube being 9 ft. long by 4 9-16 in. diameter, giving a heating surface of 3,840 sq. ft., two blower fans 85 in. in diameter made by the New York Blower Co. The latter are full housed and use 40,000 cu. ft. of air per minute at 250 r. p. m. They are driven by two central vertical engines of 16 h. p. each.

The condensing apparatus consists of one 24-in. elevated cone condenser of the jet type with a capacity of 60,000 lb. of steam per hour, one rotative fly wheel air pump and one horizontal duplex direct acting circulating pump. There are two 8-in. horizontal receiver separators made by the Harrison Safety Boiler Works of Philadelphia, and two boiler feed pumps, one duplex fire pump of the plunger and ring pattern with a capacity of 600 gallons per minute at a steam pressure of 125 lb., and one duplex high pressure outside packed pump and receiver. The steam piping was furnished by W. T. Hiscox & Co., of New York, and the stack which is of ⅜ in. steel, 7 ft. 9 in. in diameter and 24 ft. long was furnished by the New York Central Iron Works Co., of Geneva, N. Y.

Car Barn and Shops.

The other one of the buildings mentioned above contains the car barn and shops and is 160 ft. 6 in. by 160 ft. 10 in. and 27 ft. 4 in. extreme height. This building is of pressed brick with concrete foundations, steel beams, channels and columns being used throughout for support. The roof is a four-ply wool felt with tar and gravel filling supported on steel trusses. The building is divided by a party wall into a car storage side 48 ft. 4 in. wide and a shop side 60 ft. wide. The former contains four tracks capable of storing 12 large cars and the latter is devoted to repair shops, general supply department and offices. Two tracks run through this part of the building, one leading direct to the repair shops where the machine tools are located, and the other over an inspection pit 156 ft. 6 in. by 8 ft. 10 in. and 4 ft. 3½ in. deep, built of concrete. Over the inspection pit are two hand power traveling cranes on runways with a span of 24 ft. 8 in. and a lift of 16 ft. These are used for raising car bodies from trucks and other heavy repair work.

In one corner of the shop side of this building a space 24 x 32 ft. is enclosed by a brick wall and is used for a blacksmith shop. The second story of this space is used as an armature winding room. The armatures are hoisted from the shop floor and carried into the armature room on traveling hoists. Another space on the shop side 63 ft. 8 in. by 32 ft. is also separated from the rest of the shop by a party wall and the ground floor is devoted to supply and store rooms, employes' waiting rooms and wash room, shop foreman's office and train dispatcher's room. The second story of this space is devoted to the general offices of the company. There are five commodious offices of which the general auditing room is furnished with a fireproof vault and large voucher room. The offices are finished in yellow pine, natural finish. The shop tools are operated by a 15-h. p. compound-wound direct current motor of General Electric make, and the tools are made by the Niles-Bement-Pond Co., and are as follows: One 12-in. 6-ft. Niles engine lathe; one 22-in. 14-ft. Niles engine lathe; one 16-in. shaper; one 14-in. Washburn drill; one 36-in. x 4-in. grindstone; one 20-in. Whitney water



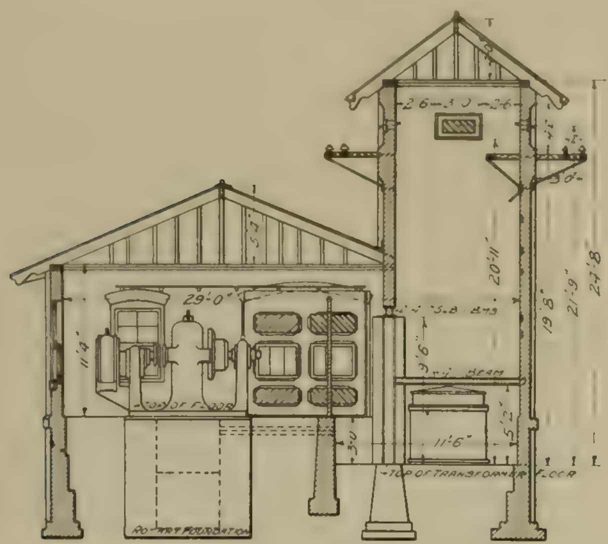
FLOOR PLAN OF VICTOR SUB-STATION

tool grinder; one No. 1 Niles, 100-ton hydrostatic wheel press; one 16-in. by 8-ft. pattern maker's lathe; one No. 4 power hack saw and a complement of drills, chucks, vises and miscellaneous tools.

Sub-Stations

The sub-stations are located along the line at Pittsford, Victor and Seneca Castle. Owing to their location in villages they have been designed for use as passenger and freight stations as well as for electrical distribution. They are built with concrete foundations with brick walls and slate roofs. Each station is 39 ft. 8 in. wide by 45 ft. long over all, the height of the station part proper being 15 ft. 8 in. and of the transformer tower 29 ft. Each contains a

waiting room 18 x 12 ft., a baggage room 18 x 12 ft., a ticket office 14 ft. 6 in. x 7 ft. and a rotary converter room 20 ft. 6 in. x 25 ft. The transformer tower for the entrance of the overhead wires is 8 x 25 ft. Each of these stations will contain two 300-kw. rotary converters, three 200-kw. static transformers, three fuse switches and circuit breakers for 20,000 volts, three lighting arresters with choke coils and a switchboard. The latter consists of two a. c.

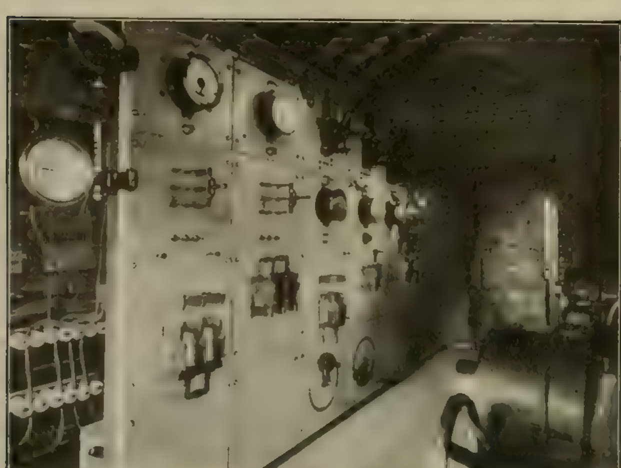


SECTION THROUGH VICTOR SUB-STATION

rotary converter panels, one d. c. rotary converter panel and one double feeder panel. The Victor station is designed for the equipment just enumerated but until contemplated extensions are made only one rotary converter will be installed. Passenger stations of neat design built of either brick or wood are located at all points along the line where needed in addition to the waiting rooms connected with each sub-station.

Rates of Fare.

The basis of cash fare rates is 2 cents per mile and of ticket rates 1½ cents per mile. No tickets of any kind are sold by conductors except 100-mile books. These books are sold for the accommodation of passengers to points at which there are no ticket offices. In addition to these tickets are monthly commutation tickets


SWITCHBOARD AT PITTSFORD SUB-STATION.

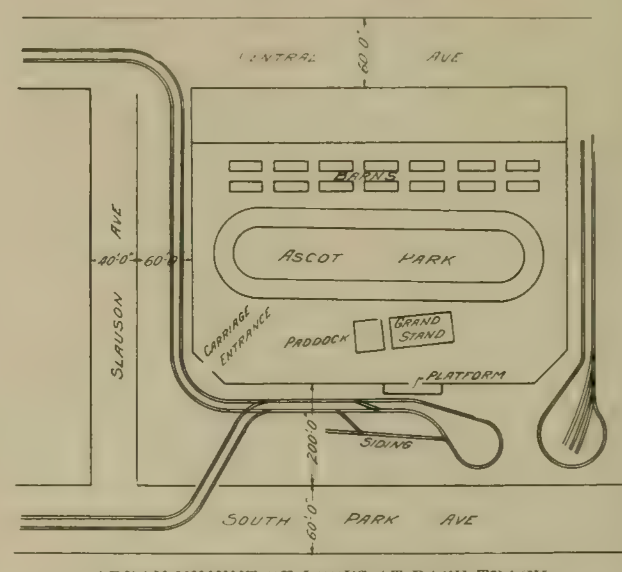
of 54 rides, monthly school tickets of 46 rides and mileage books of 1,000 and 500 miles. The freight and express service has not yet been inaugurated but it is expected to be started during January. The portion of the road between Rochester and Canandaigua now in operation is run according to a regular schedule, there being 36 trains daily.

Personnel.

The officers and operating staff of the company are: President, W. B. Comstock, Alpena, Mich.; vice-president, A. L. Parker, Detroit, Mich.; secretary, W. A. Comstock, Canandaigua, N. Y.; treasurer, Henry A. Haigh, Detroit, Mich.; chief engineer, F. W. Walker, Canandaigua, N. Y.; general manager, J. H. Pardee, Canandaigua, N. Y.; superintendent, W. R. W. Griffin, Canandaigua, N. Y.; chief dispatcher, W. G. Park, Canandaigua, N. Y.; auditor, E. E. Lentz, Canandaigua, N. Y.

Los Angeles Notes.

The street railway companies are making a determined fight against the ordinance recently passed by the city council, compelling the companies to sprinkle their roadbeds and the street for two feet outside of the outer rails. After the ordinance went into effect the city ceased to sprinkle the tracks, and as a result the dust became so thick that many persons preferred to walk rather than ride in the dust. Many protests were entered to the city council, and in order to bring the matter up in a formal way a representative from each of four companies owning tracks in the city has been arrested. Further, the city attorney sought to secure an injunction against the Los Angeles Railway Co. to prevent it from operating cars on Seventh St., unless it sprinkled the tracks



ARRANGEMENT OF LOOPS AT RACE TRACK.

or laid the dust by some other means. The injunction was not granted, and in the meantime, while other matters are being settled, the city sprinkling wagons are out again keeping down the dust.

Two street railway franchises will be offered for sale February 1st, as requested by the Los Angeles Railway Co. One is for an extension of a franchise on Monte Vista St., for a distance of 650 ft. in a southerly direction. The term of the franchise is 40 years; bond, $1,000.

The second franchise is on Sixth St., and is an outlet onto a private right of way to the Bimini Baths. Term, 37 years; bond, $5,000.

Beginning January 1st, the Pacific Electric Railway Co. took over the operation of its East Ninth St. line, which has hitherto been operated by the Los Angeles Railway Co. Simultaneous with this action, the practice of issuing transfers from this line to all connecting lines of the Los Angeles Railway Co. was discontinued. The Pacific Electric Railway Co. now runs cars over this line and over the main line to Pasadena, as far as Garvanza.

A limit of 10 days is placed on all round-trip tickets purchased from conductors or other agents of the Pacific Electric Railway Co.

The Pacific Electric Railway Co. has completed rebuilding the road from Altadena to Rubio Canyon. The road is now standard gage the entire distance, and is double track as far as the mouth

of the canyon. Cars have been fitted with Westinghouse magnetic brakes, and the trip from Los Angeles to Rubio Canyon can be made without change of cars.

On its Long Beach line the Pacific Electric Railway Co. has had semaphore signals erected where the line crosses the Southern Pacific Ry. This is an especially dangerous point, as the Southern Pacific tracks cross the electric tracks on a curve, so that only a few feet are in view in either direction. The signals are operated from one of the Southern Pacific towers, and considerable time is saved by the electric cars when the signals are clear, as it does away with stops at the crossing.

December 30th an engine and three flat cars on the Salt Lake road ran into a Brooklyn Ave. car belonging to the Pacific Electric Railway Co., killing one man and injuring several other passengers. The accident took place at a dangerous point on the line and the steam cars have the right of way. The motorman and conductor were new men, and in the coroner's verdict the electric company was severely censured for allowing two inexperienced men to operate on the same car.

The new race track at Ascot Park was opened for a 90 day meet December 24th. In order to handle the immense crowds who attend the races both the Los Angeles and Pacific Electric railway companies have made special provisions. The Pacific Electric Railway Co. has built a double track spur to the grounds from its Long Beach line, and the Los Angeles Railway Co. has extended two of its city lines. Both companies have loops and sidings at the entrance, so that there are no delays such as would be occasioned by turning trolleys. On the sidings there is ample room for reserve cars, and the crowds are handled with ease.

The Electric Club Journal.

The Electric Club, of Pittsburg, Pa., announces that on February 1st, 1904, will be issued the first number of an illustrated monthly magazine to be published by the club and which will be styled the Electric Club Journal. It is further stated in the announcement that the immediate purpose of the new publication is to put into permanent form the engineering papers and technical discussions that form a regular part of the work of the club. Many of the papers will be written by members of the engineering staff of the Westinghouse company, and much of the material will pertain to the latest apparatus and to the newest problems in engineering work. This matter will be published in a form suited to the needs of intelligent young men. The Journal will also publish other material of special value and interest to the members of the club.

ASSEMBLY HALL, ELECTRIC CLUB, PITTSBURG.

The circulation of the Electric Club Journal will not be restricted to the members of the club, but the privilege of subscribing is to be extended to others.

The Electric Club, which was organized March 19th, 1902, draws its membership largely from the engineering, apprentice and other departments of the Westinghouse Electric & Manufacturing Co. The Journal is not to be, however, a trade publication of that company, but an engineering paper published by young engineers for young engineers, enabling college students and others to share in the club's technical work. While much of the material in its pages will be of a general nature, some will apply definitely to the particular apparatus with which the men are working, and as the representation is by Westinghouse engineers, it follows that Westinghouse methods will be set forth. But the view point will be that

READING ROOM, ELECTRIC CLUB, PITTSBURG.

of the young engineer. The Journal will also reprint papers read before societies or conventions which are appropriate in character.

The Journal is conducted by a publication committee consisting of an editor, Mr. Frank D. Newbury; a business manager, Mr. John H. Smith, and a representative of the club's directors, Mr. Charles F. Scott. There is also a class of assistant editors.

The Electric Club has 402 members. It is governed by a board of nine directors, comprising two general representatives, two engineering department representatives, two apprentices' representatives and three representatives of the company. The officers of the board of directors are: President, Mr. E. M. Olin; vice-president, Mr. H. W. Peck; treasurer, Mr. L. A. Osborne; secretary, Mr. C. E. Downton.

The club quarters, which are conveniently situated, occupy the whole of the second floor and part of the third floor of the Hammett Building, 735-737 Penn Ave., Wilkinsburg (Pittsburg), Pa. There are an assembly hall and a reading room, which are illustrated herewith, together with three class rooms and five rooms which are used for games and smoking rooms. The assembly hall has seating capacity for about 300 persons.

Interurbans are Trunk Lines.

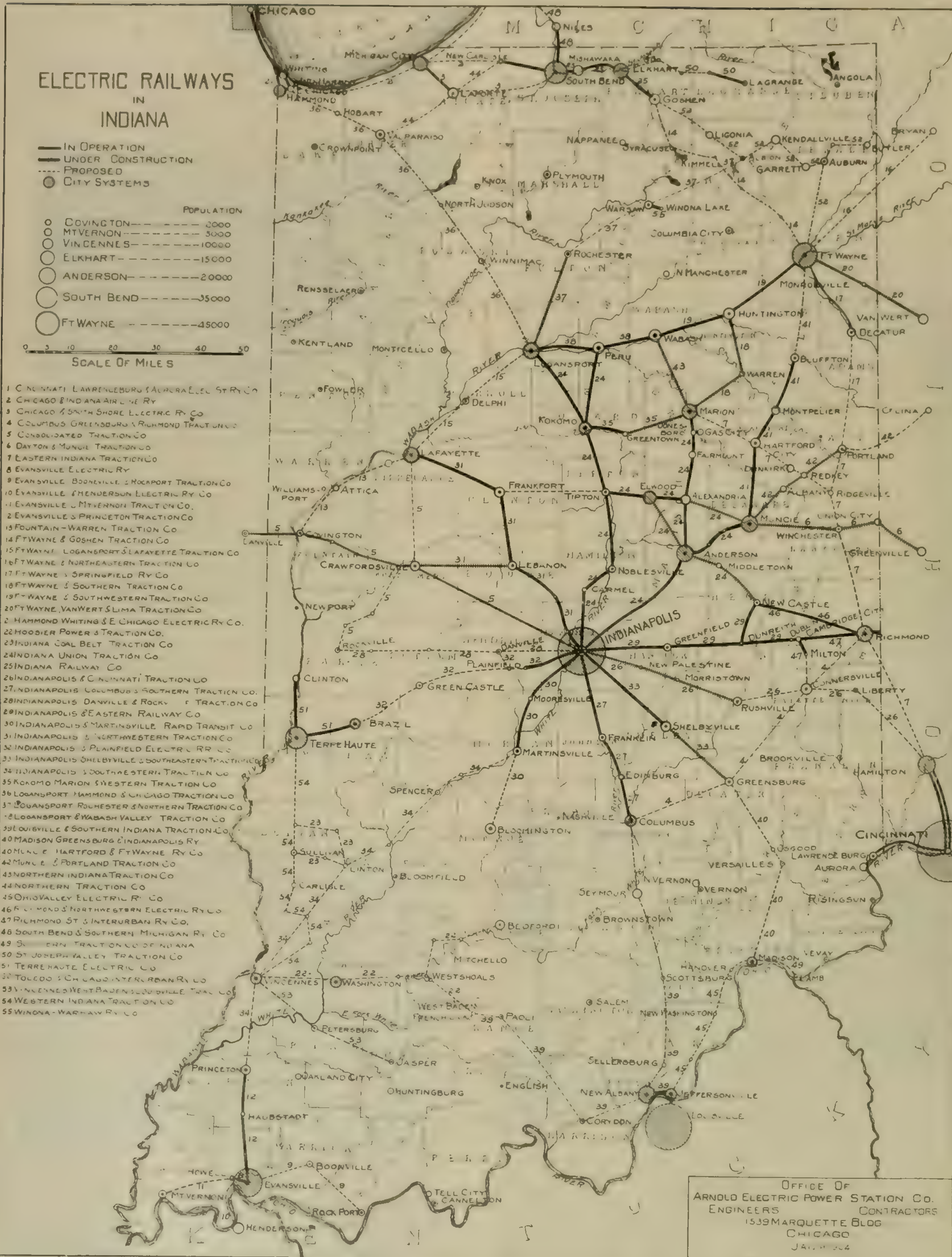
At Louisville, Ky., the Court of Appeals has rendered a decision to the effect that interurban roads are trunk lines and that, therefore, perpetual franchises may be granted to them. It had been contended, in a case in which the Kentucky Traction Co. was defendant, that the state constitution, which forbids granting a franchise for longer than 25 years, except to trunk lines, debarred the proposed road from obtaining a long-term franchise.

Robber Kills Motorman and Conductor.

A motorman on a Consolidated Railway & Power Co. car at Salt Lake City was shot and instantly killed and the conductor on the same car was fatally shot shortly after midnight January 7th by a masked highwayman who was attempting to rob them. The murderer escaped without securing any booty. There were no passengers.

A conductor on the Brighton St. line of the same company was robbed of $15 on the night of January 2nd by a masked robber.

The Interurban Street Railway Co., New York City, will convert the remaining horse-car lines in its system to the underground trolley in 1904. Forty miles of street railway will be rebuilt.



MAP OF THE ELECTRIC RAILWAYS OF INDIANA, CORRECTED TO JAN. 1, 1904

Electric Railways of Indiana.

The "Review" presents this month a map, corrected to Jan. 1, 1904, showing the electric railways in Indiana, which is just now the center of electric railway activity in the United States. This map was prepared in the office of the Arnold Electric Power Station Co., Chicago, and it is reproduced by courtesy of the officers of that company. As will be noted, the map shows the routes of 55 interurban lines, including those in operation, under construction and proposed, only those projected roads being shown which have every likelihood of being pushed to completion in the near future. The title of each road is given in the margin of the map, with its designating numeral, so it may easily be found on the map. Another useful feature of the map is the manner in which the size of the cities is shown by circles graduated according to population, those cities having city railway systems being designated by a shaded circle.

Naturally the greatest interest attaches to Indianapolis, which is practically in the center of the state, and to which all roads, built and in process, tend to lead.

During 1903 the number of electric interurban roads entering Indianapolis increased from six to eight, and the mileage, not including connections, from 273 to 524 miles; the number of daily passenger trains entering the city increased from 113 to 153, making a total of 306 in and out. During the year, also, a freight business aggregating $150,000 was established. The notable features of the year were the connection of Indiana with Ohio; the introduction of sleeping and buffet cars; the equipment of the roads with heavier and longer cars, 60-ft. lengths having been reached, and the more general adoption of 4-motor equipments. Indianapolis promoters are now planning on long-distance, high-speed lines between large centers, and the present through service between Indianapolis and Columbus, together with direct connections as far east as Zanesville, 250 miles, points the way to through service to Chicago, Cincinnati, Louisville, Wheeling, Detroit, Pittsburg, Cleveland, Buffalo and St. Louis. The Chicago and Cincinnati roads are now under construction.

Five coal-carrying roads have been incorporated, or are planned, and it is proposed to handle coal on standard cars drawn in trains by electric locomotives, and to deliver the cars to steam roads. Two of the five roads are under construction, one with a capital of $5,000,000; two at least of the other three will be built in 1904.

It is estimated that the interurban roads have added 1,000,000 population to Indianapolis for trading purposes, and that these roads carried a total of 2,300,000 passengers into and out of the city in 1903, as against the 1,000,000 handled by the steam roads. Real estate values have appreciated along the lines of the Indianapolis interurbans in every instance and many homes have been built in consequence of them.

Conservative estimates for 1903 indicate that the eight interurban roads' gross earnings amounted to $1,850,000; operating expenses have ranged from 45 to 52 per cent, and the interest payments for the year aggregated $783,500. The total outstanding capitalization of these companies is [illegible], of which $33,335,000 is common and $20,670,000 is preferred stock, or bonds.

A recapitulation of the principal roads entering Indianapolis follows:

Indianapolis, Columbus & Southern—Total mileage 40 miles, capitalization $32,125 per mile, of which [illegible] is stock and $1,000,000 bonds.

Indianapolis & Northwestern Traction Co.—Total mileage operating and building, 94 miles; capitalization [illegible] a mile, of which $3,000,000 is stock and $1,920,000 bonds outstanding.

Indianapolis & Eastern Railway Co.—Total mileage 63 miles, capitalization [illegible] a mile, of which [illegible] is stock and [illegible] bonds.

Union Traction Co. of Indiana—Total mileage, 280 miles, including the Marion, Anderson, Muncie and Elwood city lines and the 120 miles of the Indianapolis Northern being completed into Peru and Logansport and headed for Chicago; capitalization [illegible] per mile, of which $7,000,000 is common stock, [illegible] preferred and [illegible] bonds. [illegible] Traction Co. of Indiana are operated by the Indiana Union Traction Co., $5,000,000 capital stock and $1,000,000 bonds outstanding. The $1,080,000 of bonds, interest on which has to be paid by the operation of the property, raises the total capitalization to $64,280 a mile.

Indianapolis & Martinsville Rapid Transit Co.—Operating 30 miles of road, capitalization, $50,000 a mile, of which $750,000 is common stock and $750,000 bonds.

Indianapolis, Shelbyville & Southeastern, just submerged in the Indianapolis & Cincinnati Traction Co.—Total mileage 27 miles, capitalization, $40,740 a mile, of which $600,000 is stock and $500,000 bonds.

Indianapolis & Plainfield Electric Railroad Co.—Total mileage 14 miles; capitalization, $7,144 a mile, consisting of $100,000 capital stock; no bonds. This company has just been absorbed by the Indiana Coal Traction Co. with $5,000,000 bond issue and $5,000,000 stock, which proposes to build a system of 165 miles, tapping the coal fields in several localities and reaching into Terre Haute.

The first interurban road to enter Indianapolis was the Indianapolis, Greenwood & Franklin, now the Indianapolis, Columbus & Southern Traction Co. It was opened January, 1900, from Indianapolis to Greenwood, 12 miles, and has since been extended to Franklin, 40 miles. The latest line to be put in operation from Indianapolis is the Indianapolis & Northwestern Traction Co's. line to Lebanon, Frankfort and La Fayette, 64 miles. The line was opened to La Fayette, Dec. 7, 1903, as mentioned in the "Review" for December.

The Indianapolis, Danville & Rockville Traction Co. has progressed from the preliminary formation of its plans to construction, and has increased its capital from $100,000 to $700,000. It is intended to carry coal as well as passengers, and the line will extend directly from Indianapolis to the Parke County coal lands, 40 miles due west.

The development of the electric interurban railways in Indiana is admirably illustrated by the following taken from the railroad advertisements which appear regularly in all the Indianapolis daily papers:

INTERURBAN TIME-CARD

INDIANA UNION TRACTION COMPANY

Time Table, Effective Sunday, Nov. 1, 1903.

LOCAL TRAINS for Anderson, Muncie and intermediate points leave Indianapolis at 4:15 a. m. and each hour thereafter until 9:15 and 11:30 p. m. These trains make direct connection at Anderson with trains for Alexandria, Elwood, Marion and intermediate points.

LIMITED TRAINS for Anderson and Muncie leave Indianapolis at 8:00 and 11:00 a. m. and 2:00 and 5:00 p. m., arriving in Anderson in 1 hour and 25 minutes, and in Muncie in 2 hours.

Commencing December 23, 1903, trains for Noblesville, Tipton, Kokomo and intermediate points will leave Indianapolis as follows:

Limited trains will leave Indianapolis at 4:45 a. m., and every two hours thereafter until 8:45 p. m.

Local trains will leave Indianapolis at 5:30 a. m. and every two hours thereafter until 7:30 and 11:00 p. m. Trains leaving Indianapolis at 9:30 p. m. run only as far as Tipton.

Express Department Consignments received until 12:00 o'clock noon, for delivery the same day to all points between Indianapolis and Muncie; until 8:00 p. m. for delivery to all points between, before 6 o'clock the next morning, including Muncie, Anderson, Alexandria, Elwood, Tipton and Marion.

INDIANAPOLIS & EASTERN RAILWAY CO.

GREENFIELD LINE

General Office, Franklin Building.

Time table, effective January 1, 1904.

All cars depart from Meridian and Georgia streets.

For Richmond, Newcastle and intermediate stations, passenger cars leave on the following hours: [illegible] a. m., [illegible] a. m., 10:[illegible] a. m., 12:[illegible] p. m., [illegible] p. m., [illegible] p. m. and [illegible] p. m.

Limited trains for Greenfield, Knightstown, Cambridge City and Richmond leave Indianapolis at [illegible] a. m., 11:40 a. m. and 3:40 p. m. The above cars make direct connections for Eaton, Dayton, Lima, Greenville, Columbus, Newark, Hamilton and Cincinnati, O.

For Greenfield, Knightstown and intermediate stations, first car [illegible] at [illegible] a. m. and each hour thereafter until [illegible] p. m. The [illegible] p. m. runs to Greenfield only, the [illegible] p. m. only to Knightstown, next and last car [illegible] at 11:[illegible] p. m. for Greenfield only.

Combination passenger and express cars leave at [illegible] a. m., [illegible] p. m. and 11:[illegible] a. m. for Greenfield and Knightstown.

EXPRESS CARS

For Greenfield and intermediate stations only, arrive at [illegible] a. m. and leave at [illegible] a. m. Also arrive at [illegible] p. m. and leave at [illegible] p. m. Express for Knightstown, Dublin and intermediate stations leaves at [illegible] a. m.

THE INDIANAPOLIS, COLUMBUS & SOUTHERN TRACTION CO.

Through passenger cars leave Pennsylvania and Washington streets for Southport, Greenwood, Whiteland, Franklin, Amity, Edinburg, Taylorsville and Columbus. First car at [illegible] a. m. and every hour thereafter until [illegible] p. m. Last car leaves at 11:[illegible] p. m. At [illegible] and [illegible] p. m. only cars for Franklin and intermediate points and

Combination passenger and express car leaves Georgia and Meridian streets for Greenwood only at 9:30 a. m. and 3:30 p. m.

INDIANAPOLIS & MARTINSVILLE RAPID TRANSIT CO.

Waiting-Room and Stations 47 Kentucky Ave. Schedule Effective September 1, 1903.

First car leaves from in front of No. 47 Kentucky Ave., for Martinsville and intermediate stations, at 5:30 a. m. and every hour thereafter, on the half hour mark until 6:30 p. m. The 7:30 car runs only to Mooresville, the 8:30 car runs to Martinsville, and the next and last car leaves at 11:30 p. m., running to Martinsville.

Leaving Martinsville for Indianapolis and intermediate stations, first car at 5:40 a. m., and every hour thereafter on the 40-minute mark, until 6:40 p. m. The 7:40 car runs only to Mooresville, the 8:40 car to Indianapolis, and the next and last car leaves at 10:40, running to Indianapolis.

Cars leave Mooresville for Indianapolis and Martinsville at 5:30 a. m.

Express car arrives at Indianapolis at 10:43 a. m., and departs at 12:10 p. m., also arrives at 4:48 p. m., and departs at 6:00 p. m.

INDIANAPOLIS & NORTHWESTERN TRACTION COMPANY.

General Manager's Office, Lebanon, Ind.

Indianapolis Waiting-Rooms, Ticket and Express Office, 199 W. Maryland Street, Union Block, Room 6.

First car through for Lafayette leaves Indianapolis at 4:00 a. m., arrives at Lebanon 5:10 a. m., Frankfort 5:40 a. m., and Lafayette 6:35 a. m. **Second through car leaves Indianapolis at 6:00 a. m., arrives at** Lebanon 7:31 a. m., Frankfort 8:14 a. m., and Lafayette at 9:17 a. m., and every hour thereafter until 9:00 p. m. Last car for Lebanon leaves Indianapolis at 11:30 p. m.

First through car from Lafayette leaves Lafayette at 6:25 a. m., arrives at Frankfort at 7:32, at Lebanon 8:15 a. m., and Indianapolis **at 9:45 a. m., and every hour thereafter until 9:25 p. m. Last car from** Lafayette to Lebanon leaves Lafayette at 11:25 p. m., and arrives at **Lebanon 1:15 a. m.**

Express Department—Consignments received until 10 a. m. for delivery the same day to all points between Indianapolis and Frankfort, and until 6 p. m. for delivery to all points before 9 o'clock next morning.

INDIANAPOLIS & CINCINNATI TRACTION CO.

Shelbyville Division trains are advertised by means of a time-table which shows hourly service from 5:30 a. m. to 10:30 p. m.

The Ft. Wayne & Wabash Valley Traction Co., which was formerly the Ft. Wayne, Logansport, La Fayette & Lima Traction Co., is the company operating the McCulloch-Murdock properties in Northern Indiana, which include the local system at Ft. Wayne (formerly Ft. Wayne Traction Co.), the interurban line between Ft. Wayne and Wabash, the local road at Logansport (formerly Logansport Railway Co.), and the local system at La Fayette (formerly La Fayette Street Railway Co.) The officers are: President, George F. McCulloch, Indianapolis; vice-president, James Murdock, La Fayette; treasurer, Henry Paul, Ft. Wayne; secretary, Stephen Flemming, Ft. Wayne; general manager, C. D. Emmons, Ft. Wayne. Charles Fauchler is superintendent in charge of the La Fayette road.

The Fort Wayne & Southwestern Traction Co. has increased its capital from $1,875,000 to $2,000,000 to extend its system.

The Western Indiana Traction Co., with headquarters at Vincennes, Ind., is capitalized at $100,000. It plans to build, own and operate an electric railroad from Vincennes to Terre Haute, passing

INTERIOR OF HOLLAND PALACE CAR BY DAY

through Bruceville, Bicknell, Freelandville, Oaktown, Paxton, Carlisle, Sullivan, Shelburn, Curryville, Farmersburg, Pimento and Youngstown. The country covered by the proposed line has dense population and is very rich in the production of grain, fruit, melons, live stock and coal; in fact, it will pass through the coal fields.

The road will be 50 miles long and practically all the franchises have been secured, while the company is meeting with good success in acquiring rights of way from property owners. The company has not asked for township aid or money bonus, but announces that the road will be built by the stockholders and owned by them after it is completed. The officers of the company are: President, S. W. Williams; first vice-president, F. J. S. Robinson; second vice-president, C. W. Benham; secretary, E. H. DeWolf; treasurer, J. D. Lacroix.

Among the latest interurban propositions in Indiana, which do not appear on the map because the plans have been given out since January 1st, are those of the Columbus, Hope & Shelbyville Traction Co., and the Indiana Air Line Co. The former is to connect

INTERIOR OF HOLLAND PALACE CAR WITH BERTHS MADE UP.

the cities named and form a connecting link with several other lines. The latter will connect Anderson, Noblesville and Lebanon, and in connection with the Consolidated Traction Co., the Indianapolis & Northwestern Traction Co., and the Indiana Union Traction Co. lines will make a through line from Danville, Ill., to Ohio points.

Another proposed road which is destined to connect a number of northern Indiana cities will be known as the Winona, Warsaw & Goshen Railway Co. The system, when completed, will be in the form of a cross, the main line extending from Goshen south to Winona, and the cross section from Nappanee eastward to Wawasee Lake. Messrs. J. B. Hanna, F. C. McMillen and S. G. Morris are principally interested in the line.

The Indianapolis & Eastern Railway Co., the principal line entering Indianapolis on the east, and which forms part of the connecting link with the Appleyard syndicate lines in Ohio, is preparing to handle a heavy through east and west business by sleeping and dining car service. The company placed an order January 9th for additional power house equipment, consisting of a Hamilton-Corliss compound engine of 2,000 h. p. and a 1,200-kw. generator.

The Holland Palace Car Co., of Indianapolis, recently received from Harlan & Hollingsworth, the builders, of Wilmington, Del., the first two trolley sleeping cars ever built. They are intended for service between Indianapolis, Ind., and Columbus, O., a distance of approximately 200 miles. The tracks of the Indianapolis & Eastern Railway Co., the Richmond & Interurban Railway Co., the Dayton & Western Traction Co., and the Appleyard syndicate roads will be used. There has been a delay in opening this service on account of a low bridge of the Chicago, Cincinnati & Louisville R. R., at Richmond, which, it was stated, would be raised before February 1st, to permit the sleeping cars and the cars ordered for through day service to pass under it. The running schedule for the sleeping cars provides for leaving the Indianapolis and Columbus terminals at 10:30 p. m., the cars arriving at their destination at 6 o'clock the following morning.

The two new sleeping cars are the "Francis" and the "Theodore". Interior views of the cars, which are alike, are shown herewith. These cars, which were described in the "Review" for June and again in August, 1903, have more than fulfilled anticipations as regards attractiveness. Each cost $21,000. Recently they have been exhibited on the various roads running into Indianapolis, where they have attracted much favorable comment.

The Arnold Electro-Pneumatic Railway System.

Its Application and Experiments Therewith in Connection with the Lansing, St. Johns & St. Louis Railway.

BY B. J. ARNOLD

As many of your readers know I have persistently advocated the use of the alternating current directly in the motors for electric railways for several years (see Transactions American Institute of Electrical Engineers' Joint Meeting with the British Institution of Electrical Engineers, Paris, Aug. 16, 1900; Niagara Falls Convention, Aug. 24, 1901; Great Barrington, Mass., June 19, 1902, and New York, Sept. 26, 1902). By referring to the discussions which took place at these meetings, and to the technical papers, it will be found that there were few, if any other advocates, in this country, of the alternating current motor for railway work, until recently, and that those who supported it abroad advocated the use of three-phase currents until within the last few months. Since my announcement of the principles of my system before the Great Barrington Convention, the development of the single phase alternating current railway motor has made remarkable strides, both in this country and abroad, and while at that time it had few friends, the development has been such since that it now seems destined to take its place as the leading railway motor, thereby effecting a revolution in electric railway work.

Many of your readers also know that, since announcing the principles of my system before the Great Barrington Convention, I have refrained from giving out any further information regarding it, giving as my reasons therefor my desire to test the system thoroughly, before making further public statements regarding it, and then to present a full and complete description of it, together with the results of its operation, in the form of a paper before the American Institute of Electrical Engineers. Consistently pursuing that policy I have conducted my experiments privately and at my own expense, and had so perfected my apparatus that I had hoped to be able to celebrate the incoming of the year 1904, with a public demonstration, over twenty miles of railroad, which would conclusively prove that the single phase electric railway is not only operative but efficient and less in first cost and operation than any system now in vogue, not meaning to imply thereby that the system which I have developed was necessarily the only system or the best system, for only time can prove the correctness or incorrectness of such statements, but that it was a system which would successfully do the work, and the system which was first developed and first to be put in actual operation upon the first electric railway in the world especially built for single phase alternating current motor operation.

That I would have made a demonstration on January 1st was a certainty, to me, until December 18th, when I learned by telegraph, while in New York, that the car barns, located at Lansing, Mich., of the road upon which I had been experimenting, were completely consumed by fire at four o'clock that morning. The fire, apparently, originated from a stove in the engine house and was communicated so rapidly to the car barns that it destroyed a steam locomotive and two new cars built for my system, as well as my experimental locomotive, thus leaving me unable to make the demonstration as I had planned. In view of the fact, however, that the single phase electric railway is now receiving so much attention at the hands of engineers and inventors in many parts of the world, and that I believe that the year 1904 will be a epoch making one, marking the evolution from the direct current to the alternating current motor for railway work, [illegible] the beginning, on a large scale, of the displacement of the steam locomotive on railways, by the use of a substantial form of overhead construction rather than the third rail, and from the further fact that I cannot get another machine ready in the near future, I have concluded that I will give to the technical press a record of my work up to the present time in order that it, and the [illegible] which I have developed may be proved, weighed in comparison, [illegible] leaving the more complete description of the system and the results of its operation to be presented at a later date before the American Institute of Electrical Engineers.

On Jan. 10, 1900, I rode over the country between Lansing and St. Louis, Mich., a distance of about sixty miles, with a party of gentlemen who desired to build an electric road between these points. This trip resulted in my advising them that the territory was such that I believed the road should be built as economically as possible, and inasmuch as they desired me to assist financially in its construction I told them I would do so provided I was allowed to construct the road in accordance with certain ideas that I then had in mind, for by such construction the first cost of the road could be kept sufficiently low to warrant its construction, and that if it were built on any one of the systems, standard at that time, the advisability of building it was questionable. The result was that on Apr. 23, 1900, a contract was entered into wherein I undertook to build and equip the road. Engineers were at once placed in the field to locate it, and after the plans were sufficiently completed, the grading, bridging and track work of twenty miles of the road followed, and this much of the road was completed, to such an extent that steam trains were put in regular operation over it about Nov. 15, 1901.

For financial reasons the completion of the road was delayed and in the meantime the development of my system was taking place and the parts being perfected in different offices and shops.

Since it was my intention to experiment with pressure as high as 15,000 volts on the working conductor, all of the line material had to be specially designed, but the work progressed to such an extent that the overhead and line work of twenty miles of road was practically completed and ready for operation about Dec. 15, 1902, and the power installed so that experiments began in March, 1903. On June 15, 1903, two trips were made, each about three miles long, with my first experimental machine. On the first trip seven persons were carried and on the second trip thirteen persons were aboard.

The result of the experiments with the first motor proved the correctness of the theory and that the machine would work. Inasmuch as it consisted of but one somewhat crude electro-pneumatic motor, it was impracticable to get full and efficient tests of the system, and it was thought best to conduct no further experiments until a complete new double equipped truck could be perfected. Not being connected with manufacturing establishments, I have been compelled to develop this system under trying circumstances, necessitating the construction of parts in different shops and assembling them at far distant points with crude facilities. This fact, combined with the financial difficulties that have arisen, and the necessity of my having to give the main part of my attention to other matters, have been the causes of the delay in completing the road and the system.

A new double motor equipment, in the form of a locomotive, was finally built and brought to perfect working condition on the evening of December 17th, and it was this locomotive with the necessary instruments for testing purposes that was destroyed by fire the following morning. Since it is going to be impracticable for me to get a new one constructed for some time, I have thought best to state the facts as outlined above, and give to the technical press a description of the apparatus and the road, reluctantly omitting the records of operation and the tests which I had hoped to have accompany any future statements I made, but which through "the irony of fate" must now be left for the future.

The following hastily prepared description of the road and the system, I trust will be found sufficiently comprehensive to interest your readers.

ROADBED AND TRACK

The Lansing, St. Johns & St. Louis Railway was originally projected to extend from Lansing, the capital of Michigan, northward

through St. Johns, Alma and St. Louis, a distance of about sixty miles, but up to the present time only that portion extending from Lansing to St. Johns, a distance of twenty miles, has been constructed. This road was built in accordance with steam railroad practice, with easy grades and curves, so that steam locomotives could be operated over it until such time as electrical equipment could be put upon it, the idea being to complete the road in such a manner that it could be utilized for both freight and passenger service, and thus secure all the business available from the territory through which it passes.

The road is equipped with 67-lb. T rail, laid on ties spaced 2 ft. between centers, and as alternating high tension current was to be used but one of these rails was bonded with 38-in. No. 0000 bonds extending entirely around the splice bars. As it was impossible to secure rails from the rail manufacturers in time rails and splice bars were secured from one of the leading steam railways, and this necessitated the adoption of a supported joint and a long bond, as there was not room under the splice bars for concealed bonds.

The road as at present constructed between Lansing and St. Johns has no grades exceeding 1 per cent and no curves exceeding 7 degrees, except in the cities themselves, where the terminals of the road run over the streets and make such curves as ordinary street cars make, the minimum radius being 50 ft. At each city a terminal was planned so that all freight would be diverted to connecting steam roads, thus making it unnecessary for the freight service to pass over the city streets or curves.

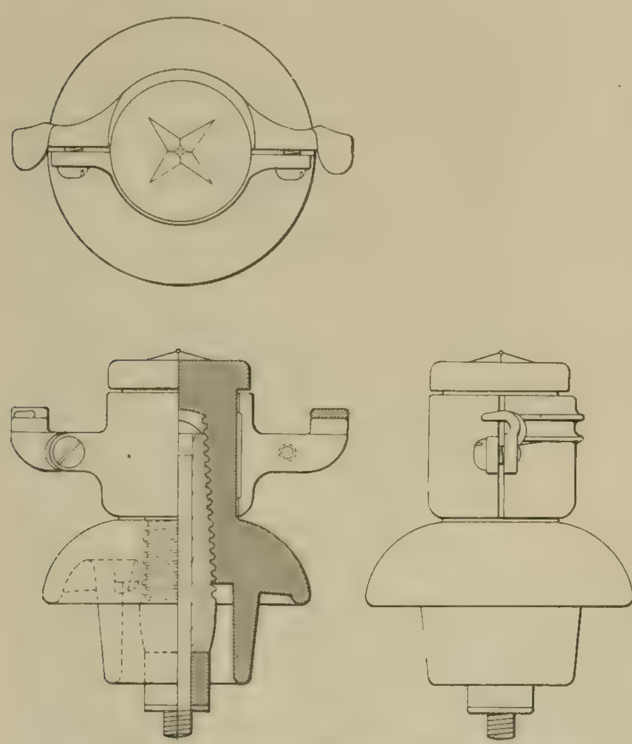


FIG. 1 ARNOLD SYSTEM SPECIAL INSULATORS

At the Lansing end it was necessary to pass over the steam railway tracks of the Pere Marquette Railroad, and this necessitated the construction of a bridge, with pile approaches; the grade as approached from the Lansing end being 4 per cent for a distance of about 700 ft., and after passing over the bridge the descending grade is 2.3 per cent for about 500 ft. At the St. Johns end there is a grade on the principal street of the town averaging about 2 per cent for about 1,500 ft.

OVERHEAD CONSTRUCTION.

Considerable care was taken in planning a suitable insulator for carrying the trolley wire, and Fig. 1 shows the construction of the annealed glass insulator used.

Fig. 2 shows a typical arrangement of the straight line overhead construction, and it will be noticed that wood is used for the pole, cross arm and brace, and that the insulator is supported by means of a short span wire from iron brackets secured to the wooden cross arm. This construction insured a high insulation at a low first cost, the entire line having been constructed for but a slightly increased expense over the cost of standard construction, and at the same time so built that in case of failure of the alternating motor system the standard direct current motor system could be put into service without changing any parts; even holes for the pins for carrying the extra feeders which would be required were provided, as shown.

It will thus be seen that the line and track work were constructed in such a manner that no expense was incurred for any parts which would not be required for standard construction in case it became necessary to ultimately adopt the standard direct current motor system; the entire idea in the construction of the road being to save first cost and to invest all that was invested in such a manner that all material purchased would be utilized in case either system were adopted, and should the alternating system prove successful the additional investment for a direct current motor system need not then be installed.

The working conductor was placed 22 ft. above the top of the rails in order that trainmen when standing upon the tops of the

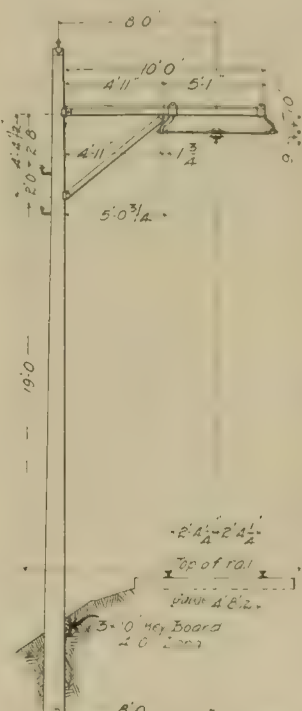
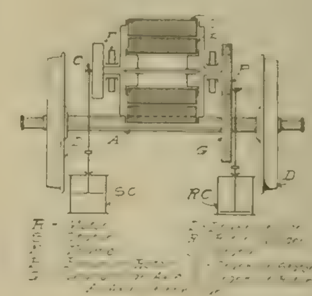


FIG. 2 TYPICAL STRAIGHT LINE OVERHEAD CONSTRUCTION.



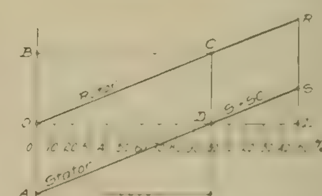


FIG. 3—DIAGRAMMATIC ARRANGEMENT OF ELECTRO-PNEUMATIC MOTOR.

FIG. 4 DIAGRAM OF OPERATION.

freight cars going over the road could not come in contact with the working conductor.

It was planned to operate the entire road from a single No. 00 trolley wire and with one rail bonded, as hereinbefore mentioned; this amount of copper being sufficient to operate four 40-ton cars at an average speed of 30 miles per hour, with power house located 1½ miles from one end of the line, and operating with from 6,000 to 10,000 volts on the working conductor.

The power house is located at one end of the line, owing to the electric company, from which power is purchased by the railroad, having a water power at this point. Current is transmitted to the nearest end of the line over two No. 3 wires. The power is furnished from a 300-kw. rotary converter generating at 380 volts, at 25 cycles, the energy from which is stepped up to the working pressure of the line. It was the intention, after experimenting a sufficient length of time, to determine the best voltage for the working conductor, to have the generators for the permanent plant constructed so as to generate at this determined voltage, and it was for this reason that a temporary rotary converter was first installed to conduct the experiments with.

During the preliminary experimental period upon the apparatus hereinafter described all power was transmitted, from the above

mentioned power house, to a point about two miles distant, where were located the car barns in which the preliminary experiments were made.

The conditions under which the first application of the system took place having thus been set forth, it may be well, in order to get clearly before the reader, the principles on which the system is based to quote here the statements made before the Great Barrington Convention on June 10, 1902, as follows:

The principles underlying the system I advocate and which I call an electro-pneumatic system, are as follows:

1. A single phase or multiphase motor, mounted directly upon

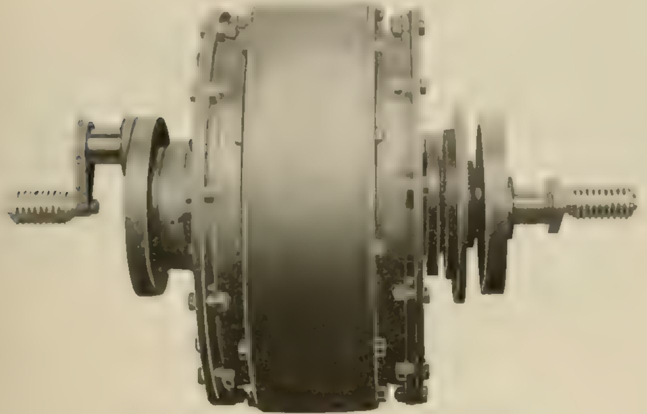


FIG. 5. EXTERIOR OF ELECTRIC MOTOR

the car, designed for the average power required by the car, and running continuously at a constant speed and a constant load, and, therefore, at maximum efficiency.

2. Instead of stopping and starting this motor and dissipating the energy through resistances, as is customary with all other systems known to me, I control the speed of the car by retarding or accelerating the parts usually known as the rotor and stator of the motor, by means of compressed air, in such a manner that I save a portion of the energy which is ordinarily dissipated through resistances, and store it to assist in starting the car, helping over grades, for use in switching purposes, and for the operation of the brakes.

3. By this method of control I secure an infinite number of speeds from zero to the maximum speed of the car, which may or may not be at the synchronous speed of the motor, for with the air controlling mechanism working compressing, the speeds below synchronism are maintained, and by reversing the direction of the air through the controller speeds above, synchronism may be attained for reasonable distances. This feature gives to the alternating current motor the element absolutely essential for practical railway work, for it permits a car or train to ascend a grade at any speed with the motor working at its maximum efficiency and imparting its full torque to the car. When descending the grade the motor may utilize its full power drawn from the line in compressing air, or it may be used to compress air with the stored energy of the train, thereby acting as a brake.

4. By means of the air storage feature each car becomes an independent unit and capable, in case of loss of current from the line, of running a reasonable distance without contact with the working conductor. This feature will enable a car to work on a high tension trolley wire or active conductor over private right of way, and allow the active conductor to be stopped where the private right of way ceases, and the car to proceed through a city or town on any tracks, whether electrically equipped or not, until it reaches the outskirts of the city or town where it can take up the working conductor again on private right of way. This feature is also valuable in switching work, for each car being independent it can leave the main line track and operate over switches or sidings without complicating the yards with additional overhead or third rail conductors, thus necessitating through line conductors over main line [illegible]

5. Since a single phase motor may be used, the system can be supplied with current from a single overhead wire or third rail, and with a single rail return circuit, thus permitting the overhead conductor to be of the same construction as is used now as the standard of to-day, except that a much higher working voltage can be used, provided the insulation is taken care of. Furthermore, in steam railway work this system, by virtue of its single phase feature, will only require the use of one of the track rails for the return circuit, thus leaving the other rail for the use of the signal system, which, up to the present time, does not seem to have been satisfactorily solved without the use of one of the track rails.

6. The current will be taken from the working conductor at any voltage up to the limit of the insulation, and in case this voltage is high (I am building my line for 15,000 volts), a static transformer will be carried upon each car and the pressure reduced from the line voltage to the voltage of the motor, which in the case under construction is designed for 200 volts. Where it is unnecessary to utilize so high a line pressure the motor may be designed for the working voltage, and the current fed directly from the working conductor into the motor, thus eliminating the static transformer. When a high voltage working conductor and static transformer is used, and it is thought advisable to use a working conductor through cities or towns, this working conductor will be supplied with energy through a stationary transformer at each city limit, thus making the working conductor through the cities or towns safe.

7. By virtue of the speed of the motor and its constant load, either when the car is in motion or when it is standing still, and the motor is compressing air, the variable load now customary in electric railway power plants is eliminated, and the power station works at practically a constant load, thereby eliminating a large part of the investment at present requisite in power station and line construction. Furthermore, by virtue of the air storage feature, each car, in the particular apparatus I have designed, is capable at any time when current is on the working conductor, of delivering to the car wheels a much greater torque in proportion to the capacity of the motor than is possible with any electrical system known to-day.

I believe that by the adoption of this system the following results will be accomplished:

1. The entire elimination of the present standard system of rotary converter sub-station plant, together with the maintenance thereon, and the cost of the necessary attendants.

2. The absorbing and rendering available for useful work in starting, or otherwise, a large percentage of the energy stored in the moving mass which under the present methods of operation is dissipated at the brake shoes.

3. A large reduction in the first cost of electrically equipping long-distance railroads, thereby making it feasible, from an engineering and business standpoint, to equip many roads which cannot now be shown advisable, thus opening up the steam railway field to the industry in which we are now engaged.

The following description will explain more in detail the application of the principles of the system and the mechanism of its working parts:

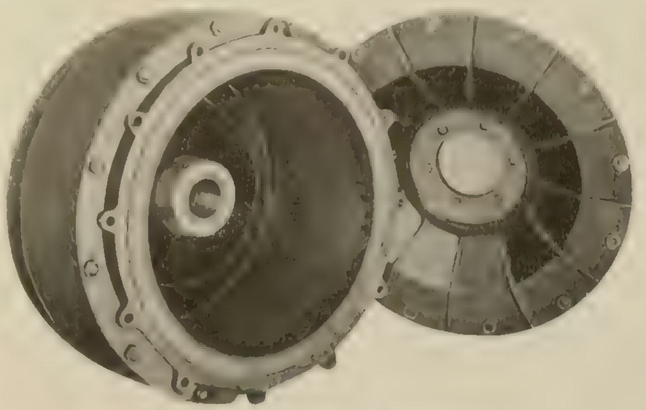


FIG. 6. INTERIOR OF STATOR

Fig. 8 represents diagrammatically the working parts of one form of the system. The rotor R of a single phase induction motor is geared to the axle of the car and by means of crank pin C located in pinion P also drives the compressor cylinder R C, while stator S, being free, revolves around the rotor and drives by means of crank pin C the compressor cylinder S C. Both cylinders are piped to air

reservoirs located under the car and are also provided with a suitable valve manipulated from a single controller on the car platform for making them perform their various functions, thus the entire regulation of the speed and power of the car are controlled by the air cylinders and no other regulating devices are necessary. The cylinder valves are electrically operated, which makes it possible for each cylinder when driven by the electric motor to compress air into the tanks and when operated by compressed air to furnish mechanical energy for moving the car. When, for instance, the cylinder is compressing air, the valves work like inlet and outlet poppet valves of a common air pump, while on the other hand if the cylinders are supplied with compressed air each valve is operated electrically by a pilot solenoid connected with the valve seat in such a manner that the energy for moving the valve is supplied by the compressed air, thereby making the valve practically self-actuating. The time of operation of the valves is controlled by a series of collector rings revolving with the engine shaft, and their regular operation is interrupted and varied to suit the requirements by means of the motorman's controller.

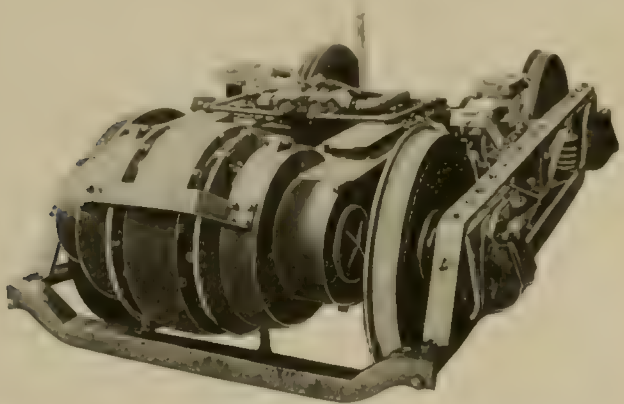


FIG 7 FIRST EXPERIMENTAL MOTOR, WITH MOTOR FORWARD.

When a rotary or turbine type of air engine is used all of the above valves and reciprocating parts are eliminated and the entire controlling mechanism consists of two air valves operated from a single engineer's valve which may be located upon the platform of the car or in the cab of the locomotive, and so arranged that one or more units may be operated from the platform or cab of any unit without the necessity of connecting wires between the units.

Since the motor may be of the simplest type of induction motor without a commutator, and the system does not require the manipulation or breaking of the main current, the motor may be designed for any working voltage and be of any type which will maintain a constant speed when provided with a constant load. This eliminates the necessity of all step-down transformers, resistances or other regulating devices and confines the current to the motors themselves, and as these are below the car floor the danger from the current is reduced to the minimum.

At the same time the air cylinders, in addition to performing all the functions of speed control, give to the machine the independent unit element, and the ability to store the kinetic energy of the train in stopping and utilize it in starting. On account of these and other features the electric motors of this system can be much smaller in capacity, when rated as continuous working motors, than those of other systems not possessing this equalizing load feature, and the capacity of the power house and line can be reduced to about one-half of what would be required with systems where the fluctuating starting loads of the cars are transmitted back to the power house.

In order to better understand the different operations of the system, Fig. 4, showing a speed diagram, has been prepared, in which on the axis of abscissæ O D L are represented the different car speeds in per cent of the synchronous motor speed, while the coordinate axis A O B represents the rotor and stator speeds corresponding to the car speeds shown.

The operation of the car may be divided into the following periods:

1. Standing in the Station: Referring to Fig. 3 the rotor R is standing still, while the stator S runs with full synchronous speed. The stator is then transferring the full energy of the electric motor through crank C to the compressor cylinder S C, which energy is being delivered in form of compressed air into the air reservoir.

Since the relative velocity between the stator and the rotor is, under all conditions of operation, constant, the speed curves of stator and rotor may be represented by two parallel lines O C R and A D S in Fig. 4. The origin O of the given co-ordinate system represents the period of rest of the car, and, therefore, indicates zero rotor speed and full stator speed in a negative or downward direction, as the stator is now revolving in the opposite direction from that which the rotor must revolve to drive the car forward.

Let it be further assumed that for an instant O A equals the active torque of the stator, then it will be easily understood that O B, which equals O A, represents the reactive torque of the rotor exerted on the car axle, meaning that if the car is free to move the reactive torque can be used advantageously for the starting and acceleration of the car.

When the car is standing in a station it is held at rest by moving the controller to such a position that the outlet pipe from rotor cylinder R C is throttled, thereby increasing the pressure behind the piston to such an extent that it overcomes the effort of the rotor R to revolve, thus tending to cause the stator S to revolve and at the same time holds the car at rest without the use of wheel brakes.

2. Starting and Acceleration: To start the car the air cushion behind the piston of R C is removed and the air which is being compressed by cylinder S C supplemented by the stored air from the tanks, is admitted to cylinder R C with the controller at the position of maximum cut-off. The rotor then begins to revolve and as it accelerates the stator slows down by exactly the same amount that the rotor has increased its speed, and as the rotor and car speed increase the controller is gradually moved to a smaller percentage of cut-off until the car speed corresponds to the full synchronous speed of the motor, at which time the stator comes to rest.

During this period of acceleration the air compressed by cylinder S C, instead of being delivered to the tanks to lose its heat, is delivered, hot, directly to the rotor cylinders, thus greatly increasing the efficiency of the combination, as the heat usually lost in air systems is utilized and the advantages of heated air gained without a

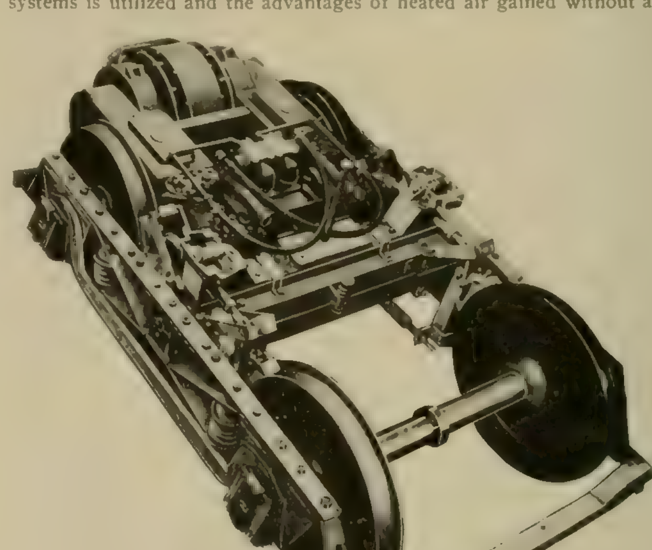


FIG. 8 FIRST EXPERIMENTAL MOTOR, WITH MOTOR IN REAR.

re-heater, and as the pressure used is low many of the ordinary difficulties in the use of compressed air disappear. If the rate of acceleration is such that cylinder R C uses all of the air supplied by cylinder S C, no exhaust to the atmosphere from cylinder R C takes place.

Referring now to Fig. 4, which graphically represents this process, since the electric motor runs always at a constant speed and a constant load, it has a constant torque, and, therefore, the distance between lines O C R and A D may be considered as representing the energy delivered by the electric motor.

The length of any ordinate extending from O D to O C represents the proportionate amount of energy derived from the electric motor, which is applied directly through pinion P and gear G of Fig. 3 to the propulsion of the car, while the corresponding ordinate extending below O D to A D represents the proportionate amount of the energy of the electric motor which is absorbed in compressing air through cylinder S C, which energy, in the form of air, is immediately transferred to cylinder R C and is utilized in accelerating the car.

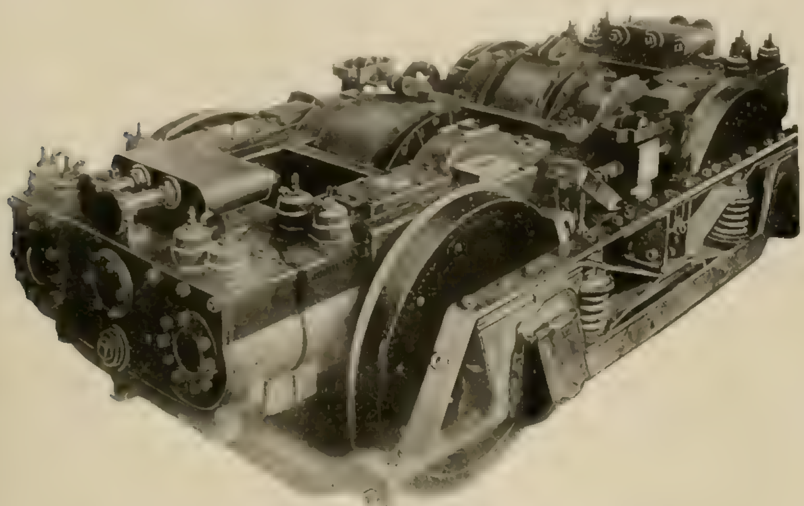


FIG. 9—LATEST DOUBLE MOTOR EQUIPMENT WITH TRUCK

In practice, however, since there will be a loss in transferring the energy from electrical energy into energy in the form of compressed air and back again into mechanical energy, this loss, whatever it may be, must be drawn from the storage tanks, and the requisite amount of air from these tanks supplied to rotor cylinder R C in during acceleration, in which case this total power would be represented for any given instant by a point above line B C.

3. Full Speed: When the rotor has reached full synchronous speed by the previous operation, this speed can be maintained by moving the controller to another position which will throttle the outlet pipe of cylinder S C until the reaction due to the pressure behind the piston equals the full capacity of the electric motor. An overload or underload may be placed upon the motor by varying this pressure, but under normal conditions of operation cylinder S C is provided with an automatic valve, which keeps a constant pressure behind its piston, thus maintaining an absolutely constant load upon the electric motor and consequently a uniform demand of electrical energy from the line. This uniform load is represented by the parallel lines O C R and A D S of Fig. 4.

With the controller set at full speed position the inlet valves of rotor cylinder R C are held open and the piston runs free and the electric motor now gives its full power to the car axle, and the stator and its air mechanism will remain at rest as long as the car runs at the speed corresponding to the synchronous speed of the motor.

4. Speed Variations: There are usually certain places on any road where high rates of speed can be maintained for short distances and as these speeds might be higher than the synchronous speed for which the motor was designed they are provided for as follows:

Assuming that the car is running at synchronous speed the controller may be moved to such a position that the valves of stator cylinder S C operate in such a manner as to cause it to act as an engine and revolve stator S in the same direction as rotor R is revolving. This now causes, owing to the constantly electrically maintained relative difference in speed between the stator and the rotor, an increase of speed of the rotor and car axle, due to the motor automatically working as a magnetic clutch, without mechanical contact, and if the resistance of the car or train is less than the capacity of the electric motor the air necessary for revolving the stator can be obtained, hot, from the rotor cylinder R C without drawing from the tanks and a speed above synchronism indirectly proportioned to the resistance of the train maintained indefinitely. When the resistance of the train is greater than the capacity of the electric motor speeds above synchronism can be

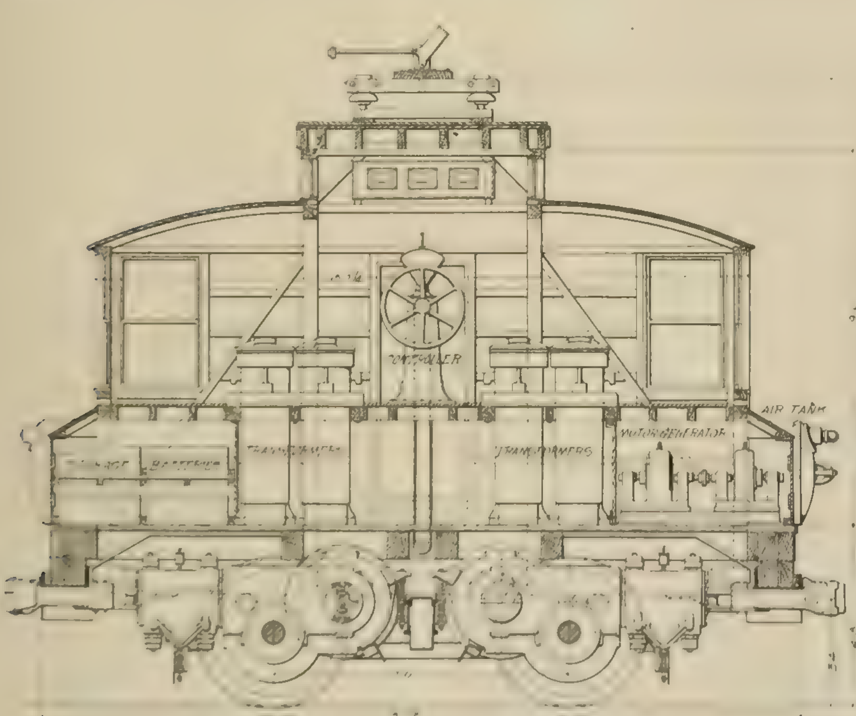


FIG. 10—LONGITUDINAL SECTION OF LOCOMOTIVE

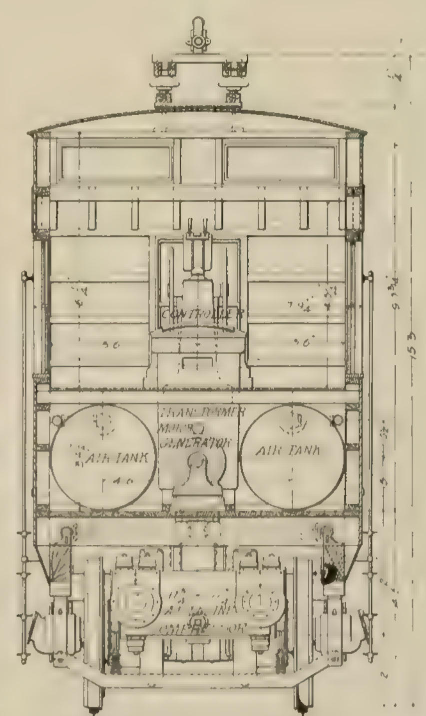


FIG. 11—TRANSVERSE SECTION OF LOCOMOTIVE

order to maintain the full power of the electric motor upon the car axle during the period of acceleration. Should it be desired to accelerate at a greater rate than the full power of the electric motor is capable of giving to the car, the additional energy may be supplied in the form of air from the storage tanks through cylinder R C, thus increasing the total energy given to the car

[illegible] rotor cylinder R C [illegible] steam locomotive when working above the steaming capacity of the boiler. The distance from the line O D L to that portion of the line A D S above O D L in Fig. 4 represents, at any given speed, the proportionate amount of energy which must come from the

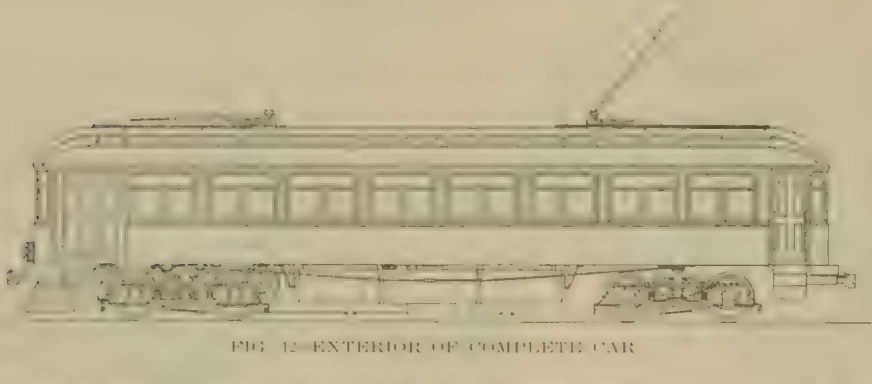


FIG. 12. EXTERIOR OF COMPLETE CAR

tanks and be supplied through cylinder S C, and the distance from D L to C R represents the total energy given to the car by the combined action of the electric motor and the stator cylinder when operating under these conditions.

The energy delivered to the car can be still farther increased by admitting air into rotor cylinder R C and allowing it to work as an engine.

5. Retardation: To bring the car or train to rest, instead of applying mechanical brakes to the wheels in the ordinary manner and thereby dissipating the entire stored energy of the car or train in the form of heat. This energy is saved in the form of compressed air, to assist in starting the car or train, by setting the controller in such a position that rotor cylinder R C compresses air and delivers it into the storage tanks. Any desired rate of retardation can be secured by throttling the delivery pipes from rotor cylinder R C and in practice this pipe is provided with an automatic valve which releases, just before the slipping point of the wheels, thus allowing the motorman to brake as rapidly as he desires without liability of flattening the wheels. Supplemental wheel brakes are provided for emergency, but need not often be used, and the ordinary wear and tear on them is saved. When the car is again at rest the cycle of performance as above given is repeated for the next run.

6. Reversing: When it is desired to run the car backward for short distances the electric motor is not disturbed and the power is furnished by the rotor cylinder R C by reversing the action of the valves, but if it is desired to run backward for any great distance the current is thrown off the motor, the stator engine reversed, and the stator brought to speed by the air, when the current is again thrown on to the motor, and the cycle of operation is the same as when running forward.

Fig. 5 represents the exterior of the electric motor, showing the cranks of the stator and rotor, also collector rings for operating the valves of the air cylinders when working as engines.

Fig. 6 shows an interior view of the stator of the motor with the flange removed, the rotor of the motor being of the standard squirrel cage induction type.

Figs. 7 and 8 show, mounted upon a truck, two views of the first electro-pneumatic motor constructed, and upon which the first experiments were conducted.

Since the single motor represented in Figs. 7 and 8 was too small in capacity to propel so large a car, it was decided to experiment with an improved locomotive, consisting of the truck and motor shown in Figs. 7 and 8, carrying suitable air tanks and transformers upon a temporary frame structure. This locomotive was the one upon which the trial runs were made and passengers carried on June 15, 1902.

Fig. 9 shows the new electro-pneumatic motor constructed after the preliminary experiments had been made on the first motor. For experimental purposes this truck was fitted up in the form of a locomotive, as shown in longitudinal and transverse section by Figs. 10 and 11, and it was this locomotive that was recently destroyed by fire. In order that the locomotive might operate as an independent air unit upon tracks not equipped with overhead electrical conductor it was provided with a small storage battery and small motor generator for charging the batteries and for operating the headlight. These auxiliaries are not necessary for the successful operation of the system, provided the locomotive can always be supplied with electric current from the working conductor, for then the valves can be made to operate from alternating current and thus eliminate the use of motor-generator and batteries. When, however, it is desired to operate independently of the electric conductor these auxiliaries are necessary, and one set may supply an entire train. It will be seen that the locomotive is also provided with transformers, another auxiliary which is unnecessary in case the motors are designed for the voltage transmitted over the working conductor, but in this case transformers were used because the manufacturer of the motors could not be induced at the time they were purchased to build a high tension motor for railway work, consequently the parts of a standard motor were utilized, and a pressure of 200 volts adopted for the motors, as this was the most economical voltage that could be used with the particular parts selected. This locomotive was provided with all necessary testing instruments and had been operated in the barns for sometime and found to perform all its functions successfully and would have been placed on the road and experiments with it would now be in process had it not been destroyed.

The Fire Record.

The car houses of the Lewiston, Brunswick & Bath Street Railway Co. at Lewiston, Me., were destroyed by fire December 19th, together with 23 cars and three snow plows, the loss being estimated at $50,000. There was $8,500 insurance on the building and the rolling stock was fairly well covered. The fire was supposed to have been caused by defective insulation. The building was new and had a steel roof.

The Cleveland & Southwestern Traction Co. suffered from two fires during the month. Its car barn at Berea, O., was partially destroyed December 24th. The loss was placed at $30,000, including $15,000 on cars and $15,000 on the floating battery sub-station. The company will rebuild at once. December 27th the company's office and waiting room at Seville, O., was burned to the ground. Books, papers and furnishings were a total loss. The building was insured.

Fire destroyed the car shops of the Lansing, St. Johns & St. Louis Railway Co. at Lansing, Mich., December 18th, causing a loss on the building of about $10,000. Mr. B. J. Arnold's electro-pneumatic traction system apparatus, valued at $30,000, was also destroyed.

The old car barn of the Coney Island & Brooklyn Railroad Co., at Brooklyn, N. Y., was burned January 15th, together with 50 cars, the loss being estimated at $100,000.

Columbus, Greensburg & Richmond Traction Co.

The Columbus, Greensburg & Richmond Traction Co., mentioned in the "Review" for December, has increased its capital from $1,000,000 to $2,500,000, and contracts have been signed with Jeup & Moore, engineers, of Indianapolis, to begin the preliminary work before the first of February. It is expected that the specifications will be ready by April 1st. The company intends to build 96 miles of road from Columbus through Greensburg and Connersville to Richmond, double track and third rail, all wires to be laid in vitrified conduits underground. The John Blair MacAfee Co., of Philadelphia, has made an inspection in the interest of bondholders, and reported most favorably concerning this project. The company is arranging for other intersecting lines in southern Indiana, with Louisville and Cleveland as objective points, the system to aggregate 325 miles.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

CARE REQUIRED IN PREPARATION AND MANAGEMENT OF MEANS OF CONVEYANCE.

Metropolitan Street Railway Co. vs. Hanson (Kan.), 72 Pac. Rep. 773. June 6, 1903.

A street railway company in the transportation of passengers, the supreme court of Kansas holds, must use the utmost degree of care and skill, for the protection of passengers, in the preparation and management of the means of conveyance.

CARE TO BE USED IN KEEPING CAR UNDER CONTROL.

Westphal vs. St. Joseph & Benton Harbor Street Railway Co. (Mich.), 96 N. W. Rep. 19. July 14, 1903.

The care to be used in keeping a car under control, the supreme court of Michigan holds, depends upon the circumstances of each particular case. Greater care would be required in some cases than in others.

UTMOST CARE REQUIRED TO PREVENT BREAKING AND FALLING OF WIRES.

Memphis Street Railway Co. vs. Kartright (Tenn.), 75 S. W. Rep. 719. May 23, 1903.

In view of the danger attendant upon the breaking and falling of overhead electric wires in the streets, and the results to be apprehended to persons in the streets, the supreme court of Tennessee is of the opinion that the company should be held to the highest or utmost degree of care in the construction, maintenance, and operation of its lines.

DUTY OF CONDUCTOR WHEN CAR STOPS PREMATURELY AFTER CALLING OF STREET—CARE REQUIRED

United Railways & Electric Co. of Baltimore vs. Woodbridge (Md.), 55 Atl. Rep. 444. July 1, 1903.

If after the conductor had called a street and to transfer there the car stopped before it was safe to attempt to transfer, the court of appeals of Maryland holds that his attention should have been attracted thereby, and he should have suspended the collection of fares, in which he was engaged on the forward part of the footboard, and should have warned passengers to keep their seats till further direction was given. The duties of a conductor upon rapid transit cars, the court says, are numerous and exacting, and it should be said to their credit that they are generally discharged with commendable care and skill, but the safety of the public demands that carriers be held to the rule requiring them to exercise the highest degree of care and diligence practicable under the circumstances.

HAND OF CONDUCTOR COMING IN CONTACT WITH PASSENGER'S FACE—DOCTRINE OF RES IPSA LOQUITUR APPLIED—CONDUCTOR PLACING HIMSELF IN SUCH POSITION ON SIDE STEP AS TO BE IN DANGER OF FALLING OFF.

Kohner vs. The Capital Tracton Co. (D. C.), 31 Wash. Law Rep. 342. [illegible]

[illegible] injured by the right hand of the conductor coming in violent contact with his face, lacerating and bruising his nose and right eye. The court of [illegible] applied, and threw upon the the defendant the burden of proving [illegible] result of unavoidable accident. On behalf of the defendant, the testimony of the conductor, which was not controverted, was to the effect that while he was moving forward on the side step of the car, holding some punched transfers in his hand, he, in some unaccountable way, lost his balance and was about to fall from the car; and that, in trying to regain his balance, he threw his other hand forward to grasp the stanchion, or upright post of the car, against which the plaintiff, as he stated, was reclining his head, and in so doing struck the plaintiff in the eye. Whether this explanation was sufficient in law to rebut the presumption of negligence raised by the prima facie case of the plaintiff, since it left untouched the question whether the conductor was not guilty of negligence in placing himself in such position as that he was in danger of falling off, the court says might perhaps be doubted. But, assuming the explanation, if well founded in fact, was sufficient in law to rebut the presumption of negligence, yet the question remained whether it was well founded in fact, and that presented a question for the jury.

RIGHT OF ABUTTER ON COUNTRY ROAD TO INJUNCTION AGAINST STREET RAILWAY—RAILROAD CROSSING TURNPIKE NOT AN ABUTTER—RIGHT TO USE HIGHWAY BRIDGE BUILT BY RAILROAD.

North Pennsylvania Railroad Co. vs. Inland Traction Co. (Pa.), 55 Atl. Rep. 774. May 4, 1903.

In the case of the occupation of a township road maintained by supervisors, the supreme court of Pennsylvania says that the rule goes no further than that while an injunction, if applied for in time, will issue at the instance of an abutting owner to protect his own land from an additional burden on it, it is none of his concern that his neighbors on the opposite side of the road consent to the use of their lands by a passenger railway company, so long as, from such use, no injury results to him. The protection by injunction to which each landowner is entitled is confined to his own property.

At the point where a railroad crossed a turnpike it ran through a deep cut, over which there was a bridge, erected by the railroad company as a part of the turnpike for the accommodation of travel, and the court holds that, although the railroad company was a landowner on each side of the turnpike where the railroad crossed it, it was not at that point an abutting landowner having a right to complain of a traction company's imposition of an additional servitude upon its land. The crossing of the turnpike by its tracks made the bridging of a deep cut necessary, and the bridge became a part of the highway; but the railroad company was not, at that crossing, an abutting landowner to the passenger railway. And the court holds that, in view of the expressed readiness and willingness of the traction company to so reconstruct and strengthen the bridge as that it should be amply safe for the transportation and carriage of its traffic and cars over and across the same, the only objection that the railroad company could make to the use of the turnpike at that point disappeared.

FRANCHISE AND RIGHT OF WAY ARE REALTY—NO WARRANTY BY VENDORS TO BE ASSUMED—DISTINCTION IN MEANINGS OF TERM "FRANCHISE"—RIGHT TO RUN OVER STREET MAY BE ABANDONED WITHOUT CONSENT OF STATE.

Thompson vs. Schenectady Railway Co. (U. S. C. C.), 124 Fed. Rep. 274. July 16, 1903.

Certain parties who purchased at foreclosure sale all the property, including "all the franchises," of a street railway company having in turn sold to a railway company, which they in fact organ

ized, the United States circuit court, N. D. New York, holds that their transfer of the right to run over a portion of a certain avenue was one of real property; for a franchise, both at common law and by New York statute, is real estate, being classified as an incorporeal hereditament. So, also, the right of way over the property of abutting street owners is an easement, and thus real estate. And the court declares that it could not assume that the vendors gave a full covenant or warranty deed. Indeed, it says that if there was any presumption, it was that they granted no more than they had a right to convey. It would be preposterous for the court, having before it the simple fact that a conveyance of realty had been made, to read into it a covenant of title.

The point that the right to run over a portion of a certain avenue could not be abandoned without the consent of the state the court holds was not well taken. It says that counsel fell into error as to the meaning of the word "franchise." It may be true that a corporation cannot abandon its franchise—cannot commit suicide—without the consent of its creator, the state. But "franchise," i. e., the right to exist and perform certain acts, is a thing distinct from the property rights which the corporation when created may acquire from individuals. The "franchise," the charter granted by the state, is one thing; the property rights, including rights of way which the chartered body may acquire from private individuals, is quite another. These latter may be lost by acts of the corporation, and the approval of the state is not necessary.

DUTY TO PASSENGERS IN ATTEMPTING TO RUN CAR THROUGH MOB OR IN APPROACHING ANY PLACE OF DANGER—CARE REQUIRED AS TO APPLIANCES.

Bosworth vs. Union Railroad Co. (R. I.), 55 Atl. Rep. 490. May 13, 1903.

The plaintiff alleged that it was the duty of the defendant company to exercise the utmost vigilance and care in guarding and protecting him, as and while a passenger, against violence and risk of injury; and that the company was negligent in not exercising proper and adequate care and vigilance in guarding and protecting him, while he was its passenger, against mob violence, and in attempting to run its car through a mob without warning him of the dangers to which he was being exposed thereby, in consequence of which he sustained the injury complained of. The supreme court of Rhode Island overrules a demurrer to such statement of the company's duty.

The court says that it recognizes the distinction in the law between the degree of care to be used in the company's stationary and in its locomotive appliances. The more stringent rule is established for the protection of passengers while in transit. During their passage they are to be guarded not only against accidents resulting from defects in the running appliances, but also from dangers arising out of the recklessness or carelessness of the servants of the common carrier. With the best appliances it would be possible for a careless or reckless servant to propel a car into danger; as, for instance, into an open draw on a bridge, into a blazing station, or into a drove of infuriated cattle. In approaching any place of danger it is the duty of the common carrier of passengers and its servants to exercise the utmost care, caution, vigilance, and skill which prudent men would use under like circumstances.

Whether the servants and agents of the company did exercise that degree of care and skill at the time and place alleged by the plaintiff was a question of fact, which must be determined by a jury.

PRIORITY OF CLAIMS AGAINST FUND DERIVED BY FORECLOSURE.

Mersick vs. Hartford & West Hartford Horse Railroad Co. (Conn.), 55 Atl. Rep. 664. July 24, 1903.

August 1, 1894, the company mortgaged all its property and franchises, as permitted by statute to do, to the state treasurer, as trustee, to secure the payment of its bonds. August 1, 1897, it made default of payment of interest on said bonds, and no interest was afterwards paid thereon. February 4, 1899, the trustee, at the request of certain bondholders, and in accordance with the terms of the mortgage, which expressly empowered him to "operate and conduct the business of said railroad company," assumed the possession and management of the road, placed one of the bondholders in control as his agent, and, March 4, 1899, commenced an action for the foreclosure of the mortgage and the appointment of a receiver. After the sale of the mortgaged property in such action, the question was raised as to the priority allowance of certain claims from the proceeds in the hands of the receiver. There were no earnings of the railroad in his hands, as the operating expenses during the receivership had exceeded the receipts; and there had been no diversion of the current income for the benefit of the mortgagees.

The supreme court of errors of Connecticut holds that the trustee was entitled to have allowed a claim for wages paid while he was in possession, and one for wages due employes for about three months before he took possession, which he had paid because it was practically impossible to resume the operation of the road without first paying same, the employes having struck because of nonpayment of wages. It also holds that a claim for rent paid for another line operated during the period the trustee was in possession was entitled to priority of payment over the mortgage debt. But it holds that a claim for money advanced by a bondholder, April 14, 1898, to the railroad company to pay taxes was not entitled to such priority; nor was one for money advanced by him, in April, 1898, to pay wages of employes and other pressing claims against the company; and a claim for rental of the other road prior to the time the trustee took possession was not privileged over the claims of bondholders. The court says that it is not prepared to accept as law the rule, which seems to have been adopted in some cases, that those who have rendered services or furnished supplies to keep a railroad in operation, after the mortgage interest is in arrear, and the bondholders have the right to take possession under their mortgage, are entitled to priority of payment over the mortgagees from the body of the mortgaged property, or the proceeds of the sale thereof, when there has been no diversion of the earnings of the railroad to the benefit of the bondholders.

BURNING OUT OF FUSE—NOT ORDINARILY EVIDENCE OF NEGLIGENCE—IMPROPER LOCATION OF FUSE BOX.

Cassady vs. Old Colony Street Railway Co. (Mass.), 68 N. E. Rep. 10. Sept. 3, 1903.

When a fuse burns out, it cannot be said, according to the supreme judicial court of Massachusetts, that the connection between the occurrence and negligence is such as, in the absence of other evidence, to justify the conclusion that the result was due to negligence. The ordinary burning out of a fuse, therefore, is not prima facie evidence of negligence.

But the court says that the jury may properly have found that there was something else in this case. The plaintiff testified that she was sitting on the car, and all at once a large flame of fire, or a blaze, came all over her, and she sprang off her seat, and started to go out of the car on the other side of it, when a lady pushed her back, which was the last she remembered until about three weeks afterwards, when she found herself in bed. It was true that the expert testimony for the defense tended to show that there could have been no such flame, and hence that there could have been no such burning as was further described. Still, the court says that the jury, upon the evidence, may have found that the flame in this case was not the instantaneous and harmless flame which results from the burning out of a fuse when in proper condition; that the burning of this fuse was attended with unusual results, which would not have occurred if the fuse had been in proper condition; and that the most reasonable conclusion was that, if proper care had been exercised, there would have been no such flame.

Moreover, the court says that there was another feature in this case of some importance. This was an open car, and this fuse box was placed directly under a seat intended for passengers, so that if, for any reason, there should be a harmful flame resulting from the burning out of a fuse, it might be reasonably apprehended that it would reach and injure a passenger. While, therefore, the mere burning out of a fuse properly located and in proper condition does not of itself import negligence on the part of the defendant, still, if the fuse be so located as, by its burning out, to injure a passenger, such a location may be inconsistent with the degree of care which a common carrier owes to its passengers. It would

be something like arranging the safety valve of a locomotive engine so that the escaping steam might reach a passenger in his seat.

The conclusion is that, upon the whole, the plaintiff had a right to go to the jury on the question of the negligence of the defendant, and the court overrules exceptions to a judgment in favor of the plaintiff.

LIABILITY FOR KILLING COW WHICH MOTORMAN MIGHT HAVE SEEN ON TRACK 150 FEET AHEAD—POWER TO STOP CAR IN 150 FEET ON DOWN GRADE NOT TO BE ASSUMED.

Kotila vs. Houghton County Street Railway Co. (Mich.), 96 N. W. Rep. 437. Sep 15, 1903.

A motorman seeing an animal, like a cow, upon the track, the supreme court of Michigan holds, cannot assume that the animal will use diligence for its own protection. Nevertheless, the motorman cannot be held bound to anticipate danger to such an animal until it has reached, or at least approached, the path of the car. Therefore, in this case, to warrant the jury in finding a verdict for the plaintiff for the killing of his cow, notwithstanding his admitted contributory negligence in permitting the cow to be at large, the evidence should have warranted the inference that the motorman, after he discovered, or by the exercise of due care should have discovered, the cow in the position of danger, could, by the use of the appliances at hand, have either stopped the car, or so checked its speed as to prevent the injury which actually occurred. Moreover, the court says that it cannot agree with the statement that it is common knowledge that an electric car can be stopped within much less than 150 feet. Counsel asked too much when he asked the jury to assume, without any testimony whatever, that a car, going down grade at a great speed, could, by the use of ordinary appliances, be stopped in 150 feet. Clearly, this could not be assumed. Neither could it be assumed that in going that distance the speed of the car could be so checked that the cow would not have received injuries which, so far as damages were concerned, would not have been equivalent to its destruction.

INSUFFICIENT NOTICE AS TO STOPPING PLACES—CLEARNESS REQUIRED IN REGULATIONS INTENDED FOR THE PUBLIC—DUTY WHEN CAR STOPS WITHIN FIFTY FEET OF CORNER—ATTEMPTING TO ALIGHT AT UNUSUAL PLACES.

United Railways & Electric Co. of Baltimore City vs. Hertel (Md.), 55 Atl. Rep. 428. June 29, 1903.

A notice posted on cars read: "Warning. No one is permitted to ride on the platform, or to get off or on when the car is in motion. Persons are warned of the danger. Cars stop to take on and let off passengers at near sides of cross-streets. Those violating these orders do so at their own risk. No officer or agent of the company has authority to waive these regulations." The court of appeals of Maryland holds language of this warning did not justify the construction that such regulation notified passengers that cars stopped for them to alight at cross-streets only. It says that if the company intended to warn passengers that they were not permitted to get on and off at any other place than the near side of cross-streets, it could at least have inserted the word "only," or some similar term, in the warning. As the notice read, it might well be understood to mean that the cars would stop at the near side, and not at the far side of cross-streets. Those using cars represent all degrees of intelligence and experience in traveling, and a railway company should not be permitted to couch its regulations intended for the public in language of doubtful meaning, if it proposes to relieve itself of the results of its own negligence by claiming that a passenger has been injured through the violation of one of such regulations.

When a car stops so near the corner as—even the testimony of the company showed the one in question stopped at a point somewhere within 50 feet of the corner—the court holds that it is not exacting an unreasonable precaution on the part of the company's agents to require them to ascertain whether any of the passengers are alighting, as they might well believe the car had stopped for that purpose. They are frequently required to stop by reason of some obstruction on the tracks, and, if passengers undertake to get off at unusual places without notice to the conductor of their intention to do so, and are injured, they will ordinarily have no right to hold the railway company responsible, but when the car stops so near the regular stopping places as would probably cause the passengers to believe that they had reached the place for them to alight, it is asking very little of the company to require the conductor to warn the passengers, or see that none of them are in the act of alighting, before the car is again put in motion.

WHEN PRIVATE INDIVIDUAL CANNOT COMPEL BY MANDAMUS GIVING OF TRANSFERS.

People ex rel. Lehmaier vs. Interurban Street Railway Co. (N. Y. Sup.) 83 N. Y. Supp. 622. July 7, 1903.

Where a statute requiring the giving of transfers gives to each person injured by a violation of its provisions a right to recover a penalty of $50 for each refusal of the corporation to give a continuous passage, and provides for the enforcement of the obligation to give transfers by the railroad commissioners and the attorney general, the first appellate division of the supreme court of New York holds that a private individual has no right to compel a company by mandamus to issue transfers. It says that it is the people collectively who have granted the franchise or corporate existence that have the right to determine and to enforce the obligations imposed upon the corporation; and where provision is made in the statute creating the obligation for a proceeding by public officers to enforce it, who are vested with a discretion as to the time and method by which it shall be enforced, it would seem to follow that the application to enforce the provisions of the statute must be made in the manner provided in the statute, and that an individual who has no other interest in the enforcement of the statute except that of one of the people of the state at large has no right to apply in the court for a mandamus compelling the corporation to perform the duties imposed upon it.

MEASURE OF BENEFIT OF LOCAL IMPROVEMENTS TO REALTY HELD BY COMPANY UNDER LEASE.

Chicago Union Traction Co. vs. City of Chicago (Ill.), 68 N. E. Rep. 519. Oct. 26, 1903.

Where a street railway company owning city lots on a part of which was a power house leased said lots for 99 years to another street railway company "for street railway purposes only," and the latter subsequently leased them to other parties for ordinary business purposes, the supreme court of Illinois holds that if the paving and grading of an alley would increase the market value of the lots such increase in value would be the proper measure of the benefit of the improvement to the property, for the purposes of a special assessment therefor.

POWER OF STATE TO PROVIDE FOR TAXATION OF SPECIAL FRANCHISES—DEFINITION OF GENERAL AND SPECIAL FRANCHISES—TANGIBLE PROPERTY INSEPARABLE PART OF SPECIAL FRANCHISE.

People vs. State Board of Tax Commissioners (N. Y.), 67 N. E. Rep. 69. Apr. 28, 1903.

The court of appeals of New York holds that chapter 712 of the New York laws of 1899, which authorizes the assessment or valuation, for the purpose of general taxation, of all special franchises by a state board of tax commissioners appointed by the governor, does not violate that part of the state constitution which provides for home rule in certain political divisions of the state.

The general franchise of a corporation, the court says, is its right to live and do business by the exercise of the corporate powers granted by the state. The general franchise of a street railroad company, for instance, is the special privilege conferred by the state upon a certain number of persons, known as the "corporators," to become a street railroad corporation, and to construct and operate a street railroad upon certain conditions. Such a franchise, however, gives the corporation no right to do anything in the public highways without special authority from the state, or some municipal officer or body acting under its authority. When a right

of way over a public street is granted to such a corporation with leave to construct and operate a street railroad thereon the privilege is known as a "special franchise," or the right to do something in the public highway, which, except for the grant, would be a trespass.

The statute, which is an amendment of the general tax law, declares, in substance, that the right, authority, or permission to construct, maintain, or operate some structure, intended for public use, "in, under, above, on or through streets, highways or public places," such as railroads, gas pipes, water mains, poles and wires for electric, telephone, and telegraph lines, and the like, is a special franchise. For the purpose of taxation, such a franchise is made real estate, and is "deemed to include the value of the tangible property of a person, copartnership or corporation situated in, upon, under or above any street, highway, public place or public waters in connection with the special franchise and taxed as a part thereof." This, the court says, includes nothing but what is in the street, directly or indirectly, and excludes power houses, depots, and all structures without the lines of the street. The taxes thus imposed are for general purposes, and are collected in the same way and used for the same objects as other taxes upon the general assessment roll. Moreover, the court regards the tangible property as an inseparable part of the special franchises mentioned in the statute, constituting with them a new entity, which, as a going concern can neither be assessed nor sold to advantage except as one thing, single and entire. And it says that the function of assessing a special franchise does not, in its nature, belong to a county, city, town or village, for it has never been exercised by officers of such localities, but to the state, by which it is now exercised for the first time. It is not exclusively local in character, and home rule applies only to functions peculiar to localities.

Nor does the court consider that the taxation of a special franchise impairs the obligation of a contract, and thus violates the federal constitution. It says that while all attempts of municipalities to undermine or destroy franchises by changing the terms of the grant have been promptly repressed by the courts, there is no case which holds that a franchise, whether general or special, cannot be taxed the same as other private property. The condition upon which a franchise is granted is the purchase price of the grant, the payment of which in money, or by an agreement to bear some burden, brought the property into existence, which thereupon became taxable at the will of the legislature, the same as land granted or leased by the state.

COLLISION WITH FIRE DEPARTMENT HOSE WAGON—WHAT DRIVER OF FIRE VEHICLE MAY EXPECT ATTEMPTING TO CROSS AHEAD OF CAR—UNCONTROLLED SPEED OF TEAM—JUDGING OF SPEED OF APPROACHING CAR—DUTY OF LOOKING AND LISTENING FOR CAR—MAY SHOW ABILITY OF CAR TO MAKE GREAT SPEED.

Hanlon vs. Milwaukee Electric Railway & Light Co. (Wis.), 95 N. W. Rep., 100. May 29, 1903.

The omission to look and listen for an approaching car when the opportunity to do so exists, and the needless attempt to make the crossing ahead of the car with knowledge of its approach in such proximity and at such speed as to make the attempt dangerous, the supreme court of Wisconsin says must be held negligence as matter of law. But the court is of the opinion that it was not beyond reason for a jury to conclude that the plaintiff, a member of the city fire department driving a hose wagon, after having given warning of his approach by such clamor of his gong that it was heard by people shut up in houses while he was still a block or more away, and when he drove out from a cross street into plain sight of the motorman 90 feet away, might have believed reasonably that his presence was known, and might reasonably have expected that the usual and customary efforts to keep the car back from collision would be made. If that had been done, there was no pretense but the wagon would have passed in safety; hence, the court says, a decision to make the attempt would not have been unreasonable. In other words, the court holds that, although it might have been negligence in law for a traveler under ordinary conditions to have taken the chance of crossing ahead of a car in the proximity and at the speed of this one, still the circumstances surrounding the plaintiff so differed that reasonable minds might consider the same attempt by him within the bounds of due care; hence that the question was one properly for the jury.

Uncontrolled speed of the team, the court says, might or might not have been contributory negligence. It might or might not have contributed to the collision; for if, when the plaintiff reached the street on which the car was, and saw the car, it was consistent with ordinary care under all the circumstances for him to decide that it was safe to cross ahead of it, then the attempt so to do might not be negligence, although the event did not justify it; especially if, as the evidence tended to prove, the collision was due to conduct on the part of the motorman such as an ordinarily prudent person, driving a fire vehicle, would not have anticipated. In such case the antecedent rapidity of approach would have no casual connection with the collision.

An instruction was requested to the effect that one approaching a street railroad track, and "having a reasonable opportunity to judge of the speed of an approaching car, is bound to know such speed, and cannot assume that it is running at a speed consistent with ordinary care and proceed upon that assumption." Assuming that this instruction correctly stated an abstract rule of law applicable to ordinary circumstances, the court says it would be highly misleading in a case of this sort, where there were additional circumstances naturally affecting the driver's conduct; most prominent among them the custom of operators of cars to change their speed, either by slowing up or stopping, in order to give opportunity for the fire vehicle to pass. The man who has a right, in the exercise of ordinary prudence, to assume that such efforts will be made and be effective, is not necessarily negligent because he attempts to pass in front of a car, although it would be likely to collide with him if it continued at its known speed. The ordinary traveler has no right in the exercise of a reasonable prudence, to indulge such expectation; but the driver of a fire department vehicle has, if he has reason to believe that his presence is known to the motorman.

Moreover, the court holds this instruction erroneous in requiring of every man "having a reasonable opportunity to judge" that he judge correctly, and "know" the correct speed. This, it says, goes beyond any authority in this or other courts. He is obliged to know that which the ordinarily prudent and intelligent man would have known under the circumstances. Having reasonable opportunity to judge, he must reach the conclusion of the ordinary man, and not the infallible one. These suggestions, the court adds, are especially applicable to one who gets but a glance of a car or train approaching him nearly head on, for he is not at all well situated to observe accurately the speed. He must observe what is perceptible, but beyond this the law does not charge him with knowledge.

An instruction to the effect that one approaching a car track "must, in the exercise of ordinary care, look and listen for an approaching car, and continue so to look and listen up to the last moment that such acts would be of any virtue in preventing a collision with a car," the court says is a correct abstract rule in most of its language, but is faulty in lacking the qualification that one must look and listen if he have opportunity so to do. There is possibility, especially with one managing a team and vehicle, that his continued observation of the track in either direction may be at least morally impossible; that his attention may be not diverted, but absolutely forced away from watchfulness. For example, in this case it was just as essential to the plaintiff's due care that he should look westward for an approaching car as that he should look eastward. If this instruction required him, from the moment he was in position to see up or down the street, to keep his eyes fastened on this particular car, and to govern his conduct without informing himself as to the condition of things in the other direction, it of course contained its own refutation, for that would necessarily be negligence.

After several witnesses had described the speed of the car at varying rates up to 25 miles an hour, and the motorman himself had testified that he had his power lever thrown open to the eighth, or second highest, notch, the court holds that, in this situation, the ability of the car to make great speed was certainly a legitimate fact to be drawn out in testing the accuracy of the motorman as a witness, who had claimed that his speed was only seven or eight miles per hour, and that no error was committed in permitting him to be cross-examined as to whether the car in question was not a specially rapid one; he finally stating that, while not the most rapid, there were only two others which excelled it.

Financial.

The earnings from transportation of the Milwaukee Electric Railway and Light Co. for the last fiscal year amounted to $2,540,103.

The gross earnings of the Duluth (Minn.) Street Railway Co. for the year ending Nov. 30, 1903, amounted to $155,340. In 1901 the gross amounted to $117,974, and in 1902, $138,162.

The gross and net earnings of the Northern Ohio Traction & Light Co., of Akron, for the past four years are reported as follows: 1900—gross, $425,885; net, $164,508. 1901—gross, $617,010; net, $2[illegible],166. 1902—gross, $745,043; net, $334,251. 1903—gross, $830,000; net, $396,000.

The Sheboygan Light, Power & Railway Co's. annual statement shows the gross earnings in the railway department to have been $35,314. The receipts from light and power were $57,545.

The Milford & Uxbridge (Mass.) Street Railway Co. reported for the year ending Sept. 30, 1903, as follows: Operating expenses, $11,979; net earnings, $137,986; interest and other charges, $34,457; surplus, $3,528.

The annual report of the Fitchburg & Leominster (Mass.) Street Railway Co., for the year ending Sept. 30, 1903, shows operating expenses of $109,422, as against $121,272 in 1902; net earnings, $88,934, as compared with $64,174; dividends, $21,000 each year; surplus, $846, as against $6,289 the previous year. The operating expenses decreased 9.7 per cent, while the net earnings increased 38.5 per cent.

The Haverhill & Amesbury (Mass.) Street Railway Co's. operating expenses for the year ending Sept. 30, 1903, were $73,490, an increase of 1.9 per cent; net earnings, $35,900, a decrease of 12.7 per cent; deficit, $2,326, against a surplus of $220 the year before. No dividends were paid either year.

The Eastern Wisconsin Electric Railway & Light Co's. gross earnings for the year ending Dec. 1, 1903, amounted to $133,665, of which the Fond du Lac city lines earned $44,471; the Fond du Lac & Oskosh interurban line, $35,767, and the electric lighting department, $53,427.

The first report of the Kenosha Electric Railway Co., made to the city treasurer, shows that during the 10 months ending December 1st the company carried $375,000 passengers, the earnings from operation being $19,191, exclusive of $3,000 received from advertising. The company operates three cars.

The annual report of the Woronoco Street Railway Co., of Westfield, Mass., shows gross earnings amounting to $77,219; operating expenses, $51,558; number of passengers carried, 1,534,470.

The Seattle Electric Co. reported operating expenses for the year ending Oct. 31, 1903, as $1,492,522, an increase of 19.7 per cent; net earnings, $588,392, an increase of 4.7 per cent; net income, [illegible].

For the year ending Oct. 31, 1903, the operating expenses of the Terre Haute Electric Co. were $300,384; net earnings, $156,150; [illegible] the net earnings 17.6 per cent.

The Tampa (Fla.) Electric Co. reported for the year ending Oct. 31, 1903, as follows: Operating expenses, $165,144; net earnings, $130,680; net income, $106,363. Compared with the previous year the operating expenses increased 23.7 per cent and the net earnings increased 40.2 per cent.

For the year ending Oct. 31, 1903, the operating expenses of the Savannah (Ga.) Electric Co. amounted to $306,276, an increase of [illegible] per cent; net earnings, [illegible], an increase of [illegible] per cent; net income, [illegible].

The Houston (Tex.) Electric Co.'s operating expenses for the year ending Oct. 31, 1903, were $268,561; net earnings, $155,134; net income, $74,196. The operating expenses increased 35.7 per cent and the net earnings 4.5 per cent.

The Greenwich (Conn.) Tramway Co's. annual report shows operating expenses amounting to $28,151; net earnings, $18,267; surplus, $18,077; passengers, 928,384. Compared with the year ending June 30, 1902, the operating expenses increased 85.0 per cent and the net earnings increased 125 per cent.

The Middletown (Conn.) Street Railway Co. reported for the year ending June 30, 1903, as follows: Operating expenses, $31,683, an increase of 14 per cent; net earnings, $10,267, a decrease of 16.7 per cent; deficit, $156; passengers, 1,000,923.

The Fair Haven & Westville Railroad Co., which operates in New Haven, Conn., and vicinity, reported for the year ending June 30, 1903, as follows: Operating expenses, $642,962, an increase of 2.4 per cent; net earnings, $370,580, an increase of 5.1 per cent; surplus, $4,264; passengers, 25,804,187.

The Danbury & Bethel Street Railway Co., of Danbury, Conn., reported for the year ending June 30, 1903, operating expenses amounting to $61,072, an increase of 8 per cent; net earnings, $19,831, a decrease of 6.5 per cent; deficit, $3,383; passengers, 2,001,790.

The Torrington (Conn.) & Winchester Street Railway Co's. annual report for the year ending June 30, 1903, contains the following: Operating expenses, $30,341, an increase of 20.9 per cent; net earnings, $20,552, a decrease of 7.1 per cent; deficit, $14,099; passengers, 1,030,460.

The directors of the Cleveland Electric Railway Co. have voted to increase its bonded indebtedness $1,650,000, and negotiations are under way for the sale of the bonds to New York and Boston financiers. With this issue the bonded debt of the company will amount to about $8,000,000, or about one-third of its stock issue. The sale will enable the company to discharge nearly all its floating debt.

The several companies operating in York, Pa., and York County under the consolidation known as the York County Traction Co., show an excellent record for the last fiscal year. Dividends were declared by these companies as follows: York Street Railway Co., $43,350; York & Dallastown Electric Railway Co., $15,000; York & Dover Electric Railway Co., $11,050.

The gross earnings of the Janesville Traction Co., of Janesville, Wis., for the year ending Dec. 1, 1903, amounted to $13,554.

The gross earnings of the Waltham (Mass.) Street Railway Co. for the year ending Sept. 30, 1903, amounted to $3,603; operating expenses, $7,729; deficit, $8,020. This was the first year of the company's operation.

The Greenfield (Mass.) & Turner's Falls Street Railway Co. reported operating expenses for the year ending Sept. 30, 1903, of $35,336, against $31,110 in 1902, an increase of 13.6 per cent; net earnings, $27,450, against $20,506, an increase of 33.8 per cent; dividends, $6,137, against $4,620 the previous year; surplus, $13,085, against $7,701.

The operating expenses of the Worcester (Mass.) & Blackstone Valley Street Railway Co. for the year ending Sept. 30, 1903, amounted to $41,710, against $37,192 the year before, an increase of 12.1 per cent; net earnings, $26,200, against $18,617, an increase of 40.7 per cent; surplus, $6,975, against $10,056 the previous year. The company paid no dividends either year.

For the year ending Sept. 30, 1903, the Old Colony Street Railway Co., Brockton, Mass., reported operating expenses amounting to $1,[illegible]26,513, against $1,454,215 the previous year; net earnings, $876,310, against $830,122; dividends, $339,983, against $288,885; surplus, $5,316, against $60,070.

The Boston & Northern Street Railway Co., Boston, reported

as follows for the year ending Sept. 30, 1903: Operating expenses, $2,300,601, against $2,113,462; net earnings, $1,337,537, against $1,370,288; dividends, $483,000, against $367,380; surplus, $5,334 against $134,045.

The West End Street Railway Co., Boston, for the year ending Sept. 30, 1903, reported an increase of $1,171,470, against $1,155,450 in 1902; surplus, $554, against $763. The income comes from rental and dividends received from the Boston Elevated Railway Co. January 1st the latter company paid the semi-annual dividend rental of $2 per share on the West End company's preferred stock.

Mr. J. Morgan, president and general manager of the People's Rapid Transit Co., of Toledo, states that he has made the financial arrangement for the construction of the new road from Toledo to Cincinnati. A New York construction company will build the road. Mr. Morgan states that a $6,000,000 bond issue has been negotiated, and that the securities will be placed abroad. Five miles of track betwen Defiance and Napoleon have been graded.

The St. Louis Transit Co. reports gross earnings for November of $592,769, as compared with $553,577 in November, 1902. This is a gain of $113,379 over November, 1901. For the eleven months ending Nov. 30, 1903, the receipts were $6,681,731, as against $5,312,794 in 1902 and $5,888,237 in 1901.

The annual report of the Worcester & Southbridge (Mass.) Street Railway Co., as prepared by the receivers, showed gross earnings of $102,387; operating expenses, $53,102; net earnings, $549,285; fixed charges, $19,923; net income, $29,362. Dividends paid amounted to $15,000, leaving a surplus of $14.362.

The Interstate Consolidated Street Railway Co., of Pawtucket, R. I., which was absorbed by the Rhode Island Co., reported for the year ending Sept. 30, 1903, as follows: Operating expenses, $117,791, as against $147,704 the year before, a decrease of 20.2 per cent; net earnings, $34,820, against $38,118, a decrease of 8.6 per cent; surplus, $27,574, against $27,143 the previous year. No dividends have been paid by this company.

For the year ending Sept. 30, 1903, the Brockton & Plymouth (Mass.) Street Railway Co. reported operating expenses of $62,487, against $58,938 the previous year, an increase of .6 per cent; net earnings, $32,238, against $31,394 the previous year, an increase of 2.6 per cent; deficit, $3,156, against a surplus of $6,397. No dividends were paid in 1902 and 1903.

The Northampton (Mass.) Street Railway Co. reported for the year ending Sept. 30, 1903, as follows: Operating expenses, $100,413, against $97,523 in 1902, an increase of 2.9 per cent; net earnings, $50,618, against $47,322, an increase of 6.9 per cent; dividends, each year, $24,000; surplus, $3,346 against a deficit of $3,492 the previous year.

PROVIDENCE & FALL RIVER STREET RY.

The Providence & Fall River Street Railway Co., Swansea Center, Mass., which operates electric lines in Swansea, Rehoboth and Seekonk, Mass., reported for the year ending Sept. 30, 1903, as follows: Operating expenses, $31,487, angainst $29,609 the previous year; net earnings, $12,973, against $6,537 the year before; surplus, $392, against a deficit of $4,684 the previous year. The company paid no dividends either year. The operating expenses increased 6.3 per cent, while the net earnings increased 11.1 per cent.

BOSTON SUBURBAN ELECTRIC COMPANIES.

The seven subsidiary companies of the Boston Suburban Electric Companies, Newton, Mass., reported for the year ending Sept. 30, 1903, as follows: Newton Street Railway Co.—Operating expenses, $98,132, against $95,205 in 1902; net earnings, $37,172, against $39,095; surplus, $13,683, against $2,311. Wellesley & Boston Street Railway Co.—Operating expenses, $43,862, against $49,624; net earnings, $9,950, against $13,200; surplus, $1,163, against a deficit of $498. Newton & Boston Street Railway Co.—Operating expenses, $35,694, against $78,717; net earnings, $31,657, against $7,924; deficit, $56,891, against $27,473. Newtonville & Watertown Street Railway Co.—Operating expenses, (This company's tracks are used by the Newton & Boston company and it has no operating expenses.); net earnings, $8,845, against $7,919; surplus, $567, against $558. Natick & Cochituate Street Railway Co.—Operating expenses, $71,958, against $64,964; net earnings, $16,965, against $14,786; surplus, $108, against $437. Lexington & Boston Street Railway Co.—Operating expenses, $125,152, against $100,979; net earnings, $39,538, against $44,113; surplus, $11,783, against $5,714. Commonwealth Avenue Street Railway Co.—Operating expenses, $68,441, against $63,803; net earnings, $23,488, against $17,511; deficit, $1,601, against $8,340.

WOONSOCKET STREET RAILWAY CO.

The operating expenses of the Woonsocket (R. I.) Street Railway Co. for the year ending Sept. 30, 1903, amounted to $86,023, as compared with $77,048 the previous year; net earnings, $32,400, against $25,914 in 1902; surplus, $12,677, compared with $7,715. The company paid no dividends either year. The operating expenses increased 11.6 per cent and the net earnings increased 25 per cent. The company operates electric railway lines in Blackstone, Mass., and Woonsocket, Cumberland and North Smithfield, R. I.

YOUNGSTOWN-SHARON RY.

For the nine months ending Sept. 30, 1903, the Youngstown-Sharon Railway & Light Co., Youngstown, O., reported earnings from operations amounting to $383,220; operating expenses, including taxes, $226,313; net earnings, $156,907.

For October the gross earnings amounted to $42,254; operating expenses, $25,929; net earnings, $16,325.

HOLYOKE STREET RAILWAY CO.

For the year ending Sept. 30, 1903, the Holyoke (Mass.) Street Railway Co. reported as follows: Operating expenses, $244,088, compared with $223,328 in 1902; net earnings, $116,630, against $104,949 the previous year; dividends, $56,000, against the same amount the year before; surplus, $7,482, against $2,156 the previous year. The operating expenses increased 9.2 per cent and the net earnings increased 11.1 per cent.

WORCESTER CONSOLIDATED STREET RY.

The Worcester Consolidated Street Railway Co., Worcester, Mass., reported for the year ending Sept. 30, 1903, as follows: Operating expenses, $797,832, against $762,569 the preceding year; net earnings, $526,663, against $457,686 the previous year; dividends, $213,000, against $177,500 the previous year; surplus, $86, against $301 the previous year. The operating expenses increased 4.6 per cent and the net earnings increased 15 per cent.

PENNSYLVANIA STATE REPORT.

The returns to the Pennsylvania state bureau of railways for the fiscal year ended June 30, 1903, show that only 19 of the 100 operating street railway companies in the state paid dividends during the year, while 65 of the 109 street railways whose lines are operated by other companies paid dividends. The two largest corporations—the Pittsburg Railways Co. and the Philadelphia Rapid Transit Co., do not pay dividends to their stockholders, but the dividends earned by them are paid to the stockholders of the street railway lines leased and operated by them, a large majority of whose stock is held by these operating companies. Of the 100 operating companies 97 reported to the bureau gross earnings from operation, $33,009,564; income from other sources, $737,932, or a total income of $33,747,496, as against $29,001,741 reported the year before. The total number of employes reported, 19,955, as against 17,778 in 1902; total wages and salaries, $11,560,269, against $10,394,401 in 1902; total number of passengers carried during the year, 756,595,262, compared with 640,076,370 the previous year. The Philadelphia Rapid Transit Co. employed 9,240 persons and the Pittsburg Railways Co, 4,507. The total cost of road and equipment reported by the operating companies is $84,354,406; last year, $73,663,692; total assets this year, $126,082,230; last year, $116,204,481; total

amount of current liabilities, $16,130,806, as against $15,098,575 last year.

INTERNATIONAL TRACTION CO.

Following is the income account statement of the International Traction Co. system, Buffalo, N. Y., for November:

	1902	1903	Increase
Gross earnings	$292,878	$314,006	$21,128
Operating expenses	160,694	183,067	22,272
Net earnings	132,183	130,938	*1,244
Fixed charges (Int., taxes, etc.)	127,153	128,495	1,341
Net income	5,029	2,443	*2,585
Operating ratio	.557	.587	.030
Net income July 1st to date	$142,388	$212,516	$70,128

*Decrease.

BEAVER VALLEY TRACTION CO.

The Beaver Valley Traction Co., of Beaver Falls, Pa., reported earnings for 1903 as follows:

Earnings from operation	$227,409
Operating expenses	126,206
Net earnings	101,202
Fixed charges	70,414
Net income	307,88
Balance forward	49,802
Total surplus	80,590

The operating ratio for the year was .5550, as against .5440 in 1902 and .5982 in 1901.

GRAND RAPIDS RAILWAY CO.

The annual report of the Grand Rapids Railway Co. for the year ending Sept. 30, 1903, shows the following:

	1902	1903	Increase
Earnings from operation	$586,123	$700,341	$114,218
Operating expenses	291,151	350,722	59,571
Net earnings	294,972	349,619	54,647

The total assets are given as $6,684,616, including cost of road and equipment, $6,560,339. The net earnings for the year are sufficient to pay interest on the bonds, 5 per cent dividend on the preferred stock, and leave $137,119, or 6.8 per cent on the common stock.

CLEVELAND & SOUTHWESTERN.

The November earnings of the Cleveland (O.) & Southwestern Traction Co. compare with those of the Cleveland, Elyria & Western Railway Co. for the same period last year as follows:

	1902	1903	Increase
Earnings from operations	$27,924	$37,861	$9,937
Operating expenses	16,502	22,908	6,406
Net earnings	11,421	14,952	3,531
For 11 months:			
Earnings from operation	$276,135	$411,750	$135,615
Operating expenses	153,965	242,522	88,577
Net earnings	122,169	169,227	47,058

DETROIT UNITED RY.

The operating statistics of the Detroit United Ry. for November compare with 1902 as follows:

		Increase
Earnings from operation	$345,100	$17,370
Operating expenses	204,827	12,134
Net earnings	143,213	3,827
Fixed charges	84,007	2,808
Net income	59,206	929
From Jan. 1, 1903		
Earnings from operation	$4,033,417	$410,206
Operating expenses	2,350,345	330,012
Net earnings	1,682,461	80,204
Fixed charges	912,890	40,584
Net income	769,571	33,620

Earnings for the third week in December were $76,087, a gain of $1,046 over the corresponding week last year.

ELGIN, AURORA & SOUTHERN.

The Elgin, Aurora & Southern Traction Co., of Aurora, Ill., reports earnings for November and for five months ending November 30th, as follows:

	1902	1903	Increase
Earnings from operation	$33,464	$34,615	$1,151
Operating expenses	20,421	22,296	1,875
Net earnings	13,043	12,318	* 725
Fixed charges	9,049	9,172	123
Net income	3,993	3,146	* 847
For the five months:			
Earnings from operation	$33,464	$34,615	$1,151
Operating expenses	20,421	22,296	1,875
Net earnings	13,043	12,318	* 725
Fixed charges	45,247	45,862	615
Net income	39,810	43,928	4,118

*Decrease.

The directors voted January 2nd to pass the quarterly dividend on the common stock and buy equipment instead.

LAKE SHORE ELECTRIC RY.

Following is the financial statement of the Lake Shore Electric Railway Co., Cleveland, O., for November:

	1902	1903	Increase
Earnings from operation	$42,539	$46,817	$4,278
Operating expenses	30,981	33,731	2,750
Net earnings	11,558	13,086	1,528
Fixed charges	20,370	20,370	.....
Deficit	8,812	7,284	*1,528
Operating ratio	.7283	.7205	*.0078
For the 11 months.			
Earnings from operation	$427,088	$570,068	$142,980
Operating expenses	275,693	360,459	84,764
Net earnings	151,395	209,611	58,216
Fixed charges	220,374	220,374	....
Deficit	68,979	10,763	*58,216
Operating ratio	.6455	.6323	* .0132

*Decrease.

PHILADELPHIA CO.

The comparative statement of operating statistics of the Philadelphia Co., Pittsburg, and affiliated corporations for November follows:

	1902	1903	Increase
Earnings from operation	$1,164,647	$1,272,610	$107,963
Operating expenses	673,246	792,428	119,182
Net earnings	491,400	480,181	* 11,219
Fixed charges	311,373	336,585	25,212
Net income	180,377	145,133	* 35,244
Total for 11 months:			
Earnings from operation	$12,419,920	$13,884,508	$1,464,588
Operating expenses	7,098,306	8,129,318	1,031,012
Net earnings	5,321,614	5,755,190	433,576
Fixed charges	3,387,294	3,536,820	149,526
Net income	2,121,921	2,335,416	213,495

*Decrease.

CINCINNATI, NEWPORT & COVINGTON.

The comparative statement of the Cincinnati, Newport & Covington Light & Traction Co. for November follows:

	1902	1903	Increase
Gross receipts	$99,151	$104,151	$5,000
Operating expenses	38,629	42,860	4,231
Damages, taxes, etc.	14,563	16,742	2,179
Total expenses	53,192	59,602	6,410
Net earnings	45,958	44,548	*1,410
Fixed charges	21,223	20,979	* 244
Net profit	24,735	23,568	*1,167
Operating ratio	.3885	.4115	.0230

Same inc. damages, etc.	.5364	.5722	.0358
For the 11 months:			
Gross receipts	$1,003,407	$1,115,932	$112,525
Operating expenses	402,917	457,301	54,384
Damages, taxes, etc	153,577	184,173	30,596
Total expenses	556,494	641,474	84,980
Net earnings	446,912	474,458	27,546
Fixed charges	231,987	231,346	*641
Net profit	214,925	243,111	28,186
Operating ratio	.4015	.4097	.0082
Same inc. damages, etc	.5546	.5748	.0202

*Decrease.

TOLEDO RAILWAYS & LIGHT CO.

Following is the comparative statement of the Toledo Railways & Light Co. for November:

	1902	1903	Increase
Earnings from operation	$125,936	$140,718	$14,782
Operating expenses	55,817	75,210	19,483
Net earnings	70,119	65,507	*4,612
Fixed charges	38,739	40,811	2,072
Net income	31,380	24,696	*6,684
Operating ratio	.4432	.5345	.0913
For the 11 months:			
Earnings from operation	$1,319,483	$1,500,299	$180,816
Operating expenses	662,889	781,189	118,300
Net earnings	656,593	728,109	71,516
Fixed charges	420,280	448,907	28,627
Net income	236,313	279,201	42,888
Operating ratio	.5024	.5176	.0152

*Decrease.

TWIN CITY RAPID TRANSIT.

The Twin City Rapid City Transit Co., Minneapolis, reported for November as follows:

	1902	1903	Increase
Earnings from operation	$309,468	$335,256	$25,707
Operating expenses	147,167	160,056	12,889
Net earnings	162,300	175,208	12,908
Fixed charges	77,733	78,445	712
Surplus	84,567	96,762	12,195
For the 11 months:			
Earnings from operation	$2,280,879	$3,704,754	$413,875
Operating expenses	1,478,713	1,720,393	241,680
Net earnings	1,802,166	1,984,359	182,193
Fixed charges	843,699	862,520	18,821
Surplus	958,466	1,121,839	163,373

The gross earnings for the second week in December amounted to $76,892, against $68,586 for the corresponding week last year.

Express Business in Massachusetts.

The Boston Suburban Express & Parcel Co., recently organized, will consolidate 23 local express companies operating within 10 miles of the State House, and later proposes to absorb the local companies throughout the state and to transport express matter over such electric railways as have franchises permitting freight business. Nearly 20 of the electric railway companies have availed themselves of the legislative bill allowing them to carry freight, and it is believed that the revenue from this traffic would be appreciably increased by co-operation with the new express company.

Recently a man in Houston, Tex., obtained a settlement of $100 from the Houston Electric Co. for an injury which he claimed to have received, and as soon as the claim agent paid him he threw away the crutches upon which he had been hobbling around the city for several months. In the district court he was sentenced to the penitentiary for two years.

Chicago Elevated Traffic.

Traffic of the Lake Street Elevated Railroad Co. for December shows a daily average of 47,385 passengers, an increase of 1,134 over the corresponding month last year. Exclusive of transfers, the daily average traffic was 45,764, an increase of 1,251 over December, 1902. For the year the total passengers carried, including transfers, were 16,085,771, as compared with 15,849,411 in 1902, a gain of 1.49 per cent. On the main line the total passengers were 15,507,056, as compared with 15,005,083, a gain of 3.34 per cent.

The South Side Elevated Railroad Co. carried a daily average of 89,280 passengers in 1903, as against 78,566 in 1902, a gain of 13.65 per cent. The large gain was accounted for in part by the gains during the street car strike in November.

The daily average of passengers carried by the Northwestern Elevated Railroad Co. in 1903 was 68,315, as compared with 63,986 in 1902, a gain of 6.77 per cent.

The daily average of passengers carried in 1903 by the Metropolitan West Side Elevated Railroad Co. was 112,864, as compared with a daily average in 1902 of 105,877, an increase of 6.75 per cent.

Fine Semi-Convertible Cars for Chicago.

The car shown in the accompanying illustration is one of five lately delivered by the J. G. Brill Co. to the Chicago Union Traction Co. This lot is among the finest that the builders have ever turned out. The window sills are extra low so that when the windows are raised into the roof pockets the cars appear from the interior to be nearly as open as standard open cars. The seats at the corners are placed longitudinally with the car and are double length, giving ample room near the doors to prevent crowding. The platforms are extra wide being 6 ft. over end panels from vestibules. The interiors are handsomely finished in mahogany and beautifully inlaid. There is a single metal runway on the side of each window post, confirming the claim of the builders regarding the simplicity of the window system. The interiors of the vestibules are wainscoted in mahogany and above the windows the paneling is brought up to the head linings, an unusual feature which adds considerably to the fine appearance. In every detail no pains have been spared to finish the cars in the most complete and handsome manner. The seats are 36 in. in length and upholstered in spring cane with backs of the walk-over type. The seating capacity per car is 40. Not having window pockets in the sides, the ends of the seats are brought within the post lines leaving a roomy aisle 24 in. wide. The general dimensions are as follows:

Length over the end panels 28 ft. and over the vestibules 40 ft. Width over sills and panels 8 ft. 1½ in. and over posts at plate 8 ft. 4 in. Height from bottom of sills over roof 9 ft. From center to center of posts 2 ft. 8 in. Sweep of posts 1¾ in. The side sills of long leaf, yellow pine, are 4 x 7¾ in. plated on the inside by 12 x ⅜ in. steel. The end sills of white oak are 5¼ x 6⅞ in. The cars are equipped with Dumpit sand boxes, ratchet brake handles, angle iron bumpers, Dedenda gongs and other patented

SEMI-CONVERTIBLE CARS FOR CHICAGO.—J. G. BRILL CO.

specialties of the builder's make. The cars are mounted on 27-G trucks with 4-ft. wheel base, 33-in. wheels and 4½-in. axles. The weight of a car and trucks is 27,400 lb.

Accidents.

A Steubenville, Mingo & Ohio Valley Traction Co. car jumped the track at Brilliant, O., December 16th at a sharp curve on a steep grade and plunged into a gully, practically demolishing the car. The motorman was hurt, but not fatally. There were no passengers.

December 20th a Lake Shore Electric Railway Co. car collided at Detroit and Kentucky Sts., Cleveland, with a city car, resulting in injury to nine passengers in the city car, which was damaged.

A St. Louis Transit Co. car ran into an open switch December 27th and collided with a construction car. Four persons were injured, including the motorman and conductor of the passenger car.

In Kansas City December 22nd a Summit St. car was practically wrecked near the Metropolitan Street Railway Co's. power house by running onto a misplaced switch. Ten persons were injured, one seriously.

An outgoing interurban car of the Indiana Union Traction Co. collided with a city car at Anderson, Ind., December 25th. The ends of the cars were crushed and a motorman was injured.

A Reading Ry. engine ran into a Sunbury & Northumberland Electric Railway Co. car at Sunbury, Pa., December 29th and damaged the car beyond repair. The motorman was badly injured.

A car on the Knoxville and Mount Oliver line of the Pittsburg Railways Co. got beyond control while on Monastery hill January 2nd and after colliding with two wagons jumped the track and was wrecked. The conductor, motorman and four passengers were seriously hurt.

January 2nd a car on the Glen Oak line of the Peoria & Prospect Heights Railway Co. jumped the track at the entrance to Jackson St. hill, Peoria, Ill., rolled over and landed in the gutter on its side. Of the 34 passengers 15 were injured, but none fatally.

One motorman was killed and another motorman and a conductor were injured in a head-on collision between two Cleveland & Southern Traction Co. cars near Berea, O., December 30th.

The motorman of a 47th St. car of the Chicago City Railway Co. was killed January 5th in consequence of the car being struck by a train on the Pittsburg, Cincinnati, Chicago & St. Louis R. R. crossing. The car was demolished.

Four men were injured January 2nd in a collision between an Indiana St. car of the Chicago Union Traction Co. and a Chicago, Milwaukee & St. Paul freight train.

Three trainmen were killed January 7th by a collision of two trains on the Brooklyn elevated railroad. One passenger was seriously injured. A crowded passenger train ran into a train of empty cars, telescoping the rear empty car in which were the trainmen.

A La Crosse City Railway Co. car was wrecked January 6th by being run into by a section of a Chicago, Burlington & Northern Ry. train. The passengers escaped, but the motorman was severely injured.

January 7th a Center Ave. car of the Chicago City Railway Co. was struck by a Pittsburg, Cincinnati, Chicago & St. Louis R. R. car at the 59th St. crossing, Chicago, and 12 persons were injured. The car was wrecked.

A Metropolitan Street Railway Co. car in Kansas City jumped the track near at the approach of a trestle January 8th, and running over the ties onto the trestle toppled over and fell to the ground 10 ft. below, injuring five passengers.

A car on the Cotton St. line of the United Traction Co., at Reading, Pa., jumped the track at a curve January 6th and crashed into a house. The brick front of the lower part of the house for the whole width was wrecked. The motorman was injured.

January 11th a Graceland Ave. car of the Union Traction Co. was struck by a Chicago, Milwaukee & St. Paul R. R. train at the Graceland Ave. crossing in Chicago, and four passengers were injured.

A Wentworth Ave. and a 47th St. car of the Chicago City Railway Co. collided January 11th in Chicago and five persons were injured.

A Metropolitan Elevated Railroad Co. train and a South Side Elevated Railroad Co. train collided on the Union Loop, Chicago, January 11th, as a result, it was stated, of a defective air brake, and [illegible] persons were injured.

A Cleveland & Southwestern Traction Co. car was badly damaged [illegible] & Michigan.

Southern freight train about a mile east of the Puritas Springs junction. The passengers saved themselves by jumping into a snow bank.

New Publications.

DIRECTORY AND MAP OF AUTOMOBILE CHARGING STATIONS. Published by the Electrical Times, Ltd., 8 Bream's Buildings, Chancery Lane, E. C., London, Eng. 126 pages, flexible leather covers, 4½ x 7 in. Price, postpaid, 3s. 8d. This is a compilation of the leading stations in the United Kingdom, giving the town, the name and address, and the facilities afforded for recharging electric carriages and petrol cars, or for repairs. The towns are arranged alphabetically on alternate pages, the opposite pages being occupied by advertisements, of which there are a good many. A clear road map is attached, 21 x 27 in., reinforced with cloth back, showing the main roads suitable for automobiling, which are colored brown, and the different railways, which are indicated by black lines. Places where an electric supply is available are marked in different ways, according to the nature of the facilities afforded, and the meaning of these marks is shown at the side of the map. There is also an enlarged map of the London district. The book was compiled by Mr. Stanley J. Harding, of 46 Sidney Road, Beckenham, S. E., on behalf of the Electrical Times, it being Mr. Harding's idea wholly, and carried out by him without assistance. He obtained all the advertisements, compiled the directory and arranged the map. It is a book much needed by automobilists in England, and a large sale is predicted for it.

REPORT OF THE FIRST ANNUAL CONVENTION OF AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION. This is a carefully compiled report, containing 142 pages, which has been prepared by the secretary of the Association, Mr. Walter Mower, of the Detroit United Ry. It includes the minutes of the Association meetings which were held at the Grand Union Hotel, Saratoga Springs, N. Y., Sept. 1-3, 1903, together with the papers presented at the meetings and the discussions which followed their presentation, the papers being illustrated wherever practicable. Registration of the attendance at the convention is given, also, and there are half-tone likenesses of the officers of the Association. The report shows the following membership on Oct. 1, 1903: Active, 48; junior, 34; associate, 22; honorary, 5. Since the report went to press the following active members have been enrolled: John Boden, foreman carpenter department, Milwaukee Railway & Light Co.; F. F. Bodler, master mechanic United Railroads of San Francisco; W. C. Canfield, foreman armature and winding department Milwaukee Electric Railway & Light Co.; S. M. Coffin, master mechanic Mobile Light & Railway Co.; Cornelius W. DeForest, assistant chief engineer South Covington & Cincinnati Street Railway Co.; Henry C. Houston, assistant superintendent rolling stock Milwaukee Electric Railway & Light Co.; H. A. Johnson, chief engineer Camden & Suburban Railway Co.; J. W. Johnstone, master mechanic Sheboygan Light, Power & Railway Co.; John W. Kennedy, foreman motor department Milwaukee Electric Railway & Light Co.; Peter C. Kline, general superintendent Sheboygan Light, Power & Railway Co.; Frank C. Naatz, foreman paint department Milwaukee Electric Railway & Light Co.; W. A. Pearson, engineer Interurban Street Railway Co.; Charles W. Peterson, foreman machine department Milwaukee Electric Railway & Light Co.; A. E. Schroeder, foreman repair department Milwaukee Electric Railway & Light Co.; Frank G. Simmons, superintendent construction and maintenance of way Milwaukee Electric Railway & Light Co.; William J. Smith, master mechanic Duluth Superior Traction Co. The following associate members have been added: New Orleans Railways Co., San Juan Light & Transit Co. E. D. Sigler, Mobile Light & Railway Co., is a new junior member. This brings the total membership up to 126, including 64 active members.

GENERAL DATA ON THOMSON RECORDING WATT METERS. Published by the General Electric Co., Schenectady, N. Y. The handbook, which is No. 3,105 (August 1903) of General Electric Publications, contains 217 pages, including three pages devoted to the index. It is 4½ x 5¾ in. in size, flexible covers, and contains upward of 130 illustrations and diagrams. In addition to the data on Thomson recording wattmeters, there are sections giving information regarding Thomson single-phase induction, high torque induction and Thomson polyphase meters.

Personal.

MR. H. F. GENTRY has resigned as general passenger agent of the Pacific Electric Railway Co., and the office will be discontinued.

MR. B. H. RYDER, formerly connected with the American Steel & Wire Co., has become associated with the Chicago Insulated Wire Co., as sales agent.

MR. GEORGE E. CLAFLIN has resigned as superintendent of the Asheville (N. C.) Electric Co. and the Asheville Street Railroad Co., and has gone to Providence, R. I., to reside.

MR. S. W. WATKINS, president of the National Electric Co., of Milwaukee, January 15th returned from an extended European trip, looking after the foreign interests of his company.

MR. JOHN C. BRACKENRIDGE has resigned as chief engineer of the Brooklyn Rapid Transit Co., in consequence of his having been elected Commissioner of Public Works in Brooklyn.

Mr. H. A. SPARKS, chief engineer of the Sandusky Southwestern Railway Co., Wapakoneta, O., has been appointed to act as superintendent during the construction of the company's lines.

MR. P. P. CRAFTS, who has resigned as general superintendent of the Saginaw Valley Traction Co., to go to Mexico to enter the street railway business, was presented a watch fob December 20th by 30 of his old employes.

THE NATIONAL ELECTRIC CO., of Milwaukee, successor to the Christensen Engineering Co., has elected Mr. R. P. Tell secretary and treasurer of the company, and Mr. B. T. Becker has been appointed assistant general manager.

MR. T. F. MANVILLE, president of the H. W. Johns-Manville Co., 100 William St., New York, went West December 22nd and before returning to New York will visit the company's Milwaukee, Chicago, St. Louis and New Orleans branches.

MR. IRVING H. REYNOLDS, formerly with the Allis-Chalmers Co., and for many years identified with the design and construction of its engines, has accepted a position with the William Tod Co., of Youngstown, O., as consulting engineer.

MR. THOMAS GUNN, for five years storekeeper at the power house of the Lexington (Ky.) Railway Co., has been appointed purchasing agent of the company, the duties of purchasing agent and storekeeper having been combined, beginning January 1st.

MR. GEORGE S. SMITH has been promoted to division superintendent, High Park division, of the Old Colony Street Railway Co. Mr. Smith was formerly assistant superintendent, Lakeville division, which vacancy was filled by the appointment of Mr. John H. Hayes.

MR. CHARLES TOLMIE, who has been employed in the office of the London (Ont.) Street Railway Co. for several years, has been appointed cashier of the company to succeed Mr. James Currie, who on January 1st became secretary-treasurer of an Ohio traction company.

MR. P. I. WELLES has been appointed general manager of the Columbia (S. C.) Electric Street Railway Co., which has been reorganized. He will assume the duties of his new office on or before February 1st. He is at present superintendent of the Savannah division of the Southern Ry.

COL. H. I. WEED has been elected vice-president of the Winnebago Traction Co., Oshkosh, Wis., vice Mr. Emerson McMillan, resigned The president and general manager of the Winnebago Traction Co. is Mr. E. E. Downs; secretary, Mr. Walter B. Mahony; treasurer, Mr. S. M. Rothermel.

MR. R. L. ANDREWS has resigned as manager of the Eastern Ohio Traction Co., of Cleveland, and will remove to Youngstown, O., where he will superintend the construction work of the Youngstown & Southern Railway Co., of which he is vice-president and general manager, as well as being a director of the company.

MR. HARRY D'STEESE, of the New York branch of the Stuart-Howland Co., has been transferred to its headquarters in Boston, Mass., where he will assume the title and duties of assistant manager of the railway department. In addition he will continue covering his old territory in New York state and Pennsylvania.

MR. GEORGE LAIRD has been appointed superintendent of the Battle Creek division of the Michigan Traction Co., with headquarters at Battle Creek, Mich. For the past three years Mr. Laird has been general foreman of the Eighth Ave. division of the Metropolitan, now the Interurban, Street Railway Co., of New York City.

MR. A. B. SANDERS, who was for several years in the engineer's department of the American Telephone & Telegraph Co., New York City, and later was with the Electric Storage Battery Co., of Philadelphia, has become associated with John B. Watson, Drexel Building, Philadelphia, having charge of the electrical department.

MR. R. T. LAFFIN, who recently resigned as general manager of the Worcester Consolidated Street Railway Co., to accept a position with the street railway system at Manila, P. I., was on December 30th presented a diamond ring in behalf of the working staff of the Worcester company. Mr. Laffin will sail for Manila January 25th.

MR. H. F. WILGUS, who has been assistant chief engineer of the Brooklyn Rapid Transit Co. for the past four months, or since he became connected with the company, has been appointed engineer of way and structure, a substitute position for that of chief engineer, the latter position having been abolished upon the resignation of Mr. John C. Brackenridge.

MR. G. R. MITCHELL has resigned as general superintendent of the Jersey City Traction Co., and the Middlesex & Monmouth Electric Light, Heat & Power Co., and has accepted the position of general superintendent of the Olean, Rock City & Bradford Railroad Co., and the Bradford Electric Street Railway Co., with headquarters at No. 1 Main St., Bradford, Pa.

MR. REUBEN A. DENELL, who has been associated with Messrs. D. H. Burnham & Co., architects and constructing engineers, Chicago, since 1893, has signed a five-year contract with Messrs. J. G. White & Co., of London, Eng., as supervising architect. Mr. Denell left Chicago January 17th for New York City, where he will visit two weeks and then sail for London.

MR. CHARLES W. CROSBY, of Champaign, Ill., has been appointed assistant traffic manager of the McKinley syndicate interurban lines which center at Champaign, which city will be his headquarters. Mr. Crosby has been connected with the Wabash railroad in important capacities a number of years. The position to which he has been appointed was recently created.

MESSRS. E. P. ROBERTS AND I. H. SHERWOOD, who have, for seven years, conducted a consulting engineering business, under the firm name of E. P. Roberts & Co., Cleveland, O., dissolved their partnership on Dec. 31, 1903. Mr. Roberts will continue the business of the firm, while Mr. Sherwood will take a needed rest before making a decision as to future work.

MR. F. W. WANKLYN, vice-president and general manager of the Montreal Street Railway Co., and the Montreal Park & Island Ry., has resigned. It is understood that Mr. K. W. Blackwell will succeed Mr. Wanklyn as vice-president, and Mr. G. W. Ross, the company's secretary, will become managing director. Mr. Duncan McDonald will be the manager of the two systems and Mr. P. Dubee will be appointed secretary.

MR. FRANZ WELZ, who contributed an interesting article in the "Review" for December, 1903, on the proposed suspended railway for Hamburg, Germany, is at present connected with the electrical department of the St. Louis Purchase Exposition. He was for eight years with the Allgemeine Elektrizitats Gesellschaft, Berlin, engaged in designing and constructing electrical work in Germany, France and Belgium.

MR. W. S. MONTGOMERY, who for the past five years has been connected with the Conover Condenser Manufacturing Co., of Jersey City, as secretary and sales manager, on January 1st severed his connection with that company to assume the management of the Payne Engineering Co., of New York City, selling agent for the Payne Co., of Elmira, N. Y. On the same date the Payne Engineering Co removed to new offices in the Havemeyer Building, No. 26 Cortlandt St., N. Y.

MR. J. B. M'CLARY, who recently resigned as manager of the railway department of the Birmingham Railway, Light & Power Co., as announced in the "Review" for December, was presented a valuable token of esteem by the employes of that department upon the occasion of his official departure, December 31st. The gift, which was bestowed in the presence of several hundred employes, comprised a gold watch, chain and charm, the watch case being studded with diamonds, and the charm with diamonds and a large ruby.

MR. HERBERT W. SMITH and MR. GEORGE H. SWAZEY, both well known in the street railway field, have formed a partnership for the purpose of building street railways, power plants and electric lighting stations, and for furnishing street railway supplies. They will also represent prominent American and foreign manufacturers. Mr. Smith has been connected with the supply business a long time, the last four years as assistant manager of the railway department of the Stuart-Howland Co. Mr. Swazey has built and operated several street railways.

MR. N. S. BRADEN, formerly manager of the Westinghouse Electric & Manufacturing Co's. district office at Cleveland, has been appointed sales manager of the new Canadian Westinghouse Co., Ltd., and assumed the duties of that office January 1st. His headquarters are at Hamilton, Ont. Mr. Braden, who succeeds the late Mr. Thomas C. Frenyear, was born at Indianapolis and is 34 years old. In 1892, after leaving school, he entered the employ of the Jenny Electric Motor Co., of Indianapolis, and in 1899 entered the Cleveland district sales office of the Westinghouse company as a salesman.

MR. GEORGE W. PARSONS, who for a long term of years has so ably managed the business of the frog, switch and signal department of the Pennsylvania Steel Co., has retired from active service and will retain his connection with the company in an advisory capacity. Mr. C. W. Reinoehl, who has long been connected with the Pennsylvania Steel Co., succeeds Mr. Parsons as superintendent of the frog, switch and signal department, and Mr. W. C. Cuntz succeeds Mr. Reinoehl as sales agent in charge of the Steelton sales office. These appointments were all effective Jan. 1, 1904.

MR. DAVID J. EVANS has severed his connection with the Chicago office of the Lorain Steel Co. and has also resigned his position of secretary-treasurer of the North American Railway Construction Co. He has taken an office at 1564 Monadnock Building, Chicago, where he will handle railway supplies, iron and steel. Mr. Evans has been connected with the Chicago office of the Lorain Steel Co. and its predecessor, the Johnson Co., since early in 1893, having had charge of the business for the past three years, during the sojourn in Colorado of Mr. A. S. Littlefield, western sales agent.

MR. FRANK S. GIVEN has been appointed manager of the Erie Rapid Transit Street Railway Co., and the Lake Erie Traction Co., with headquarters at Erie, Pa. The two companies are separate organizations operating a continuous line from Erie to Westfield, N. Y. Mr. Given was for eleven years connected with the Lancaster County systems, which include the Conestoga Traction Co., the Lancaster Gas Light & Fuel Co., the Edison Electric Illuminating Co., of Scranton, and the Columbia Electric & Power Co., first as superintendent of the Columbia division and for the last seven years as general manager of the entire system. During his connection with these companies he was superintendent of construction and built over 53 miles of road. Within the past few years the entire system was changed from a direct to an alternating current system. Mr. Given is still connected with the Lancaster companies as a director and stockholder.

Obituary.

MR. GEORGE W. BLABON, president of the Janesville (Wis.) Street Railway Co., died at his home in Philadelphia January 13th. He was 71 years of age.

MR. DAVID R. POWELL, who died at St. Louis December 19th, of heart failure, was one of the organizers of the old Joplin (Mo.) Electric Railway & Motor Co., of which he was the first secretary and treasurer, and which was afterward absorbed by the interests which form the Southwest Missouri Electric Railway Co.

MR. CHARLES H. MAYER died at York, Pa., January 16th, after several weeks' sickness. For a number of years he was treasurer of the York Street Railway Co., and superintended the construction of the York & Dover and the York & Dallastown electric railway companies. Two years ago he embarked in private enterprises, and at the time of his death was treasurer of the York County Agricultural Society, secretary, treasurer and manager of the York & Maryland Line, and the York and Liverpool Turnpike companies, and a director in the York National Bank and the York Gas Co.

MR. ASA S. BUSHNELL, ex governor of Ohio, and president of the Springfield, Troy & Piqua Railway Co., died at Columbus January 15th of apoplexy with which he was stricken January 11th. He was born in Rome, N. Y., Sept. 16, 1834. In 1845 he moved with his family to Cincinnati, and in 1857 became a clerk in a dry goods store at Springfield, O. In a few years he became a manufacturer, being a member of the firm of Wardner, Bushnell & Glessner, of Springfield, makers of reapers and mowers. Mr. Bushnell was governor of Ohio for two terms, from 1895 to 1899, and was several years chairman of the Republican State Committee. He commanded a company in the civil war. He was a 33rd degree Mason.

MR. THOMAS CYPRIAN FRENYEAR, sales manager of the new Canadian Westinghouse Co., died at Fort William, Can., December 10th, of typhoid fever. He was born Mar. 16, 1865, in Middletown Spa, Vt., and when he was about 15 years old entered the employ of the Boston Electric Co., of which his uncle was manager. For several years he was employed by the Thomson-Houston Co. and the Brush Electric Co., as salesman, with headquarters at Buffalo, and from 1892 to 1895 he was superintendent of the Cayadutta Electric R. R. In the fall of 1895 he became associated with the sales office of the Westinghouse Electric & Manufacturing Co., where he remained until Nov. 1, 1903, when he went to Toronto to assume charge of the sales department of the new Canadian company.

MR. SAMUEL C. GRIER, of Pittsburg, president of the Youngstown Park & Falls Street Railway Co., of Youngstown, O., died January 3d at his home in Pittsburg, after an illness of one week. Mr. Grier was born in Allegheny, Pa., in 1851. He went to work as an errand boy at the age of 11 years and when 18 years old opened a coal office, which he conducted for 10 years. In 1879 he became assessor of warrants in Allegheny and afterward entered the county clerk's office. In 1887 he was elected delinquent tax collector, which position he held until 1901. Besides being president of the Youngstown Park & Falls Street Railway Co. he was president of the Pittsburg Vein Coal Co., the Colombia Plate Glass Co., and the Ohio Valley Water Co. He was also a director in the Second National Bank, of Allegheny, the Dollar Savings Fund & Trust Co. and the National Fireproofing Co.

MR. JOHN ALLAN MUIR, general manager of the Los Angeles Railway Co., died at Los Angeles January 8th. He was born at Truro, N. S., Sept. 25, 1850. He was educated in the public schools of his native town and in March, 1866, entered the employ of the Pictou Extension Nova Scotia R. R. as a telegraph operator. In November, 1870, he became night operator at Rocklin, Cal., for the Central Pacific R. R. In September, 1871, he was made agent of the road at Rocklin, and in 1875 became trainmaster. In July, 1881, he was appointed division trainmaster at Sacramento; May, 1882, he was promoted to assistant division superintendent of the Sacramento and Oregon divisions of the California Pacific & Northern R. R.; February, 1884, he was made assistant superintendent of the Southern Pacific Railroads of Arizona and New Mexico; April, 1886, he was transferred to a similar position on the Los Angeles division of the Southern Pacific Co., and in January, 1893, succeeded to the position of superintendent of that division. February, 1902, he resigned to accept the position with the Los Angeles Railway Co. Besides being general manager Mr. Muir was a director in the company, and also a director in the Gila Valley, Globe & Northern R. R., and had interests in a number of mining companies.

International Railway Employes' Dance.

The third annual ball of the International Railway Employes' Association, of Buffalo, was held January 5th and was attended by about 5,000 persons. Among the prominent guests were Mr. W. Caryl Ely, president of the International Railway Co.; Mr. T. E. Mitten, first vice president and general manager; Mr. Frank Clement, second vice-president; and Mr. R. F. Rankine, treasurer.

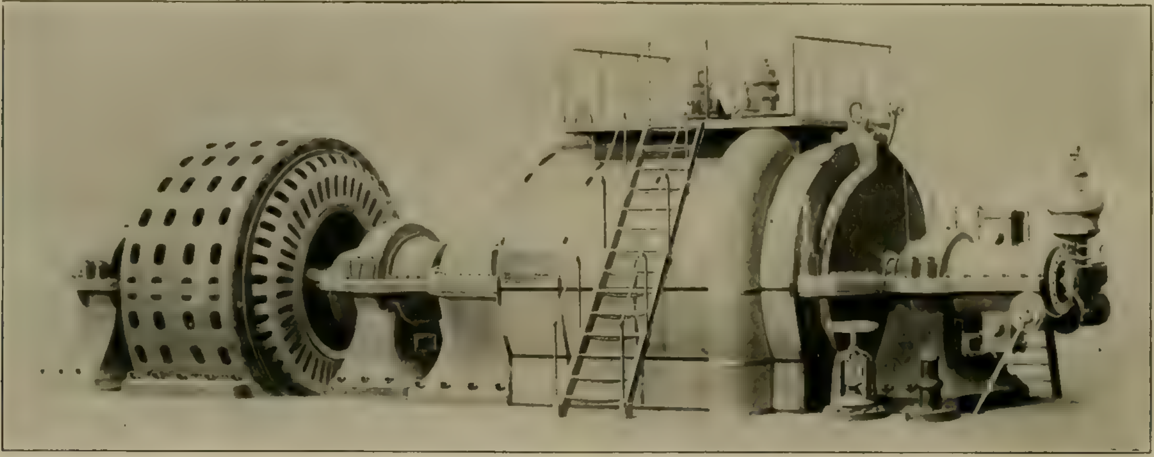
The committee of arrangements were Messrs. C. A. Coons (chairman), W. J. Sullivan and Joseph Huber.

High Power Westinghouse-Parsons Steam Turbines.

The application of the steam turbine for general power service is one of the most conspicuous features of American industrial development in the twentieth century. The Westinghouse-Parsons steam turbine was commercially introduced during the latter part of 1900, the sizes then built being of 600 h. p. nominal capacity direct connected to 400-kw. polyphase generators. The types of turbine units then built were illustrated in the "Review" for February, 1901. Subsequent development has been so rapid that within a period of four years turbines of 5,500 kw., or 7,500 h. p. nominal capacity, have been designed and are under construction. These machines will have a continuous overload capacity of 11,000 h. p. in one self-contained unit, and thus rank among the world's largest prime movers.

Recently, marine work has been contemplated by the builders and it is considered the near future may be productive of turbines of still greater power, although of slightly different arrangement, necessary to adapt the present type to marine usage.

The 5,000 kw. turbo-generating unit illustrated herewith is representative of the general type which will be constructed by the Westinghouse company for large powers. This type embodies the experience acquired in the construction and operation of a large number of machines. The principle of operation as well as the general relation and arrangement of rotating and stationary elements characteristic of former types have been employed. The largest machines therefore find their direct prototypes in the original design adopted, the horizontal single-cylinder turbine.



WESTINGHOUSE-PARSONS STEAM TURBINE UNIT

The most distinguishing features of the new type are the extreme compactness and low speed secured. These features have been practically prescribed by the necessity of minimizing the cost of power building construction for larger station capacities.

The space occupied by the 7,500-h. p. turbine is approximately 27 ft. 8 in. by 13 ft. 3 in., and the height to the top of the hand-railing is 12 ft. This is equivalent to .049 sq. ft. per electric horse-power capacity, or 20.2 h. p. per sq. ft. of floor area required.

For the complete unit a rectangular area of 47 ft. 4 in. in length and 13 ft. in width is required, which is equivalent to .084 sq. ft. per e. h. p. capacity, or 12 e. h. p. per sq. ft. of floor space.

A graphical comparison of floor space required for different types of prime movers is shown in the accompanying curves. In all cases a complete unit is taken as the basis of comparison.

In point of speed, the new type fulfills the demand for a unit operating at moderate speed. The 5,000-kw. units operate at 750 r. p. m., the 2,000-kw. unit at 1,200 to 1,560 r. p. m., and the 1,000-kw unit at 1,500 to 1,800 r. p. m., depending upon the frequency desired.

These speeds, although not comparable to engine speeds, do not impose much greater stresses upon the rotating parts, and in addition secure the great advantage of reduction in the bulk, weight and cost of the unit.

Construction.

The accompanying illustration of the 5,000-kw. unit shows the general arrangement of the main cylinder body, bearings and auxiliary parts. The unit rests upon a single bedplate cast in two sections which are secured by shrunk links. To the bedplate, which is heavily ribbed to secure rigidity, are bolted the pedestals, generator casing and turbine body, but the bedplate itself is not secured to the foundation by other means than the weight of the unit. Steam and exhaust connections are made beneath the floor level.

In the smaller machines of this type, the cylinder barrel and both journals are cast in a single casting, thus largely minimizing machine work. In the large machines, however, the barrel is cast in two sections united by links, the outboard section carrying the journal and worm casing, and the inboard section the journal and exhaust opening which extends through the bedplate. As in former types linear expansion and contraction of the turbine are provided for by a sliding foot. The inboard journal pedestal is bolted securely to the bedplate, but the outboard pedestal is free to slide between parallel machined ways. The main body of the casing is heavily lagged with non-conducting material, secured in place by sheet steel casings.

Leakage of air from the atmosphere into the exhaust spaces of the casing at the entrances of the shaft is prevented by frictionless packing glands. No oil is employed and in consequence the condensation from the turbines is pure distilled water.

In shaft construction great rigidity has been secured with minimum use of metal. A central steel quill carries the entire rotating parts, both blades and balanced pistons. Hollow forged steel ends are forced into the two ends of this quill, under hydraulic pressure, and are in addition secured by arrowhead links. High pressure steam is conveyed to all parts of this quill structure in such a manner as to eliminate stresses and consequent distortion due to highly superheated steam.

Power is transmitted to the generator shaft through a flexible coupling which is housed partly by the turbine and partly by the generator inboard journal. The coupling is split at the junction of the two shafts, so that by removing one bearing cap and the coupling bolts either section of the unit may be lifted out without disturbing the adjustment of the remaining section. In the smaller sizes the engagement surfaces of the coupling consist of the squared or hexagonal ends of the shafts, but in the larger machines a crow-foot sleeve is keyed to each shaft and the power is transmitted by an outside quill engaging the crow-feet. Thus great flexibility is secured, together with the greatest facility in dismantling.

The journals in the larger machines are of the solid self-aligning type, similar to that employed in generators and cross-compound engines. The departure from the familiar oil cushioned journal employed in the small machines is occasioned by the speed reduction secured. The journal shells are babbitt lined and are split horizontally, the two halves being united by bolts with shim adjustment. Oil from a central system is introduced at the center under slight pressure, thoroughly flushing all parts. Axial adjustment is provided by metal shims arranged in quarter-box fashion. The diameter of the shaft at the journal of a 5,000-kw. machine is 15 in., strikingly small in comparison to the 34 in. shafts required for a cross-compound reciprocating engine of corresponding capacity.

Longitudinal adjustment to preserve proper side clearance is secured by a thrust bearing located next to the out-board bearing. The bearing is not subjected to longitudinal thrusts from the action of the steam and is consequently of small size.

The two half shells are advanced in opposite directions by graduated set screws, so that the actual running clearances are measured in thousandths of an inch. Once set, these adjustments are permanent, and do not require frequent "taking up."

Steam enters the turbine successively through an automatic quick closing throttle, hand throttle, strainer and the main admission

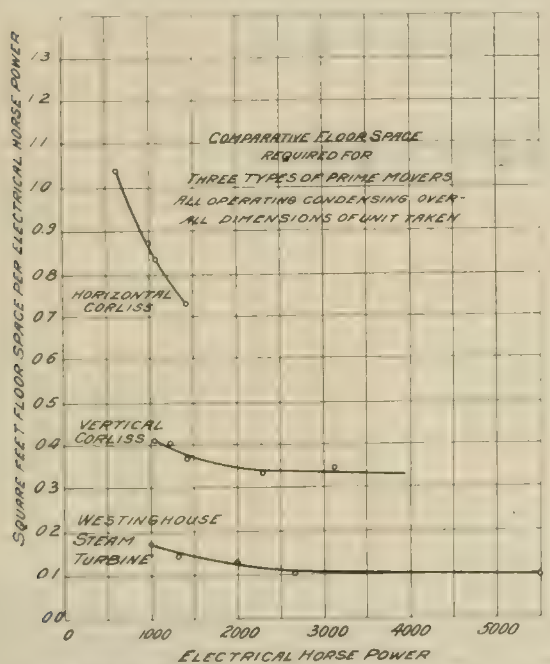


DIAGRAM OF COMPARATIVE FLOOR SPACE

valve. A circular steam port surrounding the entrance to the initial stage conveys this steam to all points so as to avoid stresses incident to more localized admission of highly superheated steam.

An important feature of the steam distribution system is the provision of a by-pass valve. This valve admits high pressure steam to the second stage of the turbine on overloads in order to increase its capacity up to 50 per cent in excess of full rated load. By properly proportioning the by-pass steam to the overload on the turbine maximum economy may at all times be secured together with reserve overload capacity. This results in a slight rise in the economy curve on heavy overloads, resembling in some respects the engine economy curve on loads exceeding that of maximum economy. The turbine, however, only suffers in economy at heavy overloads while the engine economy decreases progressively from 75 to 80 per cent of full load capacity.

The main admission valve consists of a double beat poppet valve operated by a small piston, this in turn being controlled by a small pilot valve directly actuated by the governor mechanism. The valve admits steam to the turbine in puffs, the duration of which are proportioned by the governor to the load upon the turbine. This intermittent method obviates the throttling of steam to accommodate loading and secure the highest economy by using at all loads steam at boiler pressure.

At the extreme outer end of the turbine shaft is mounted a worm driving a short horizontal cross shaft. This shaft drives at one end the oil pump and at the other end the governor through bevel gearing. An eccentric provides the reciprocating motion necessary for the valve mechanism.

The governor is of the fly-ball type with 90 degree bell crank ball levers mounted on knife edges and fitted with roller contacts. The governor sleeve and spring is mounted on ball bearings and adjustment of the spring tension may be made while the turbine is running, thus affording a most simple and convenient means for parallel alternating current generators and dividing the load proportionately between them.

At the extreme end of the outboard pedestal is mounted an auxiliary speed limit governor. It is likewise of the centrifugal type and may be set to release, at any predetermined speed, a small plunger valve which controls with high pressure steam the operation of the quick closing throttle before mentioned. This is normally held open by means of an overbalanced differential piston. At the moment the speed limit operates, the excess pressure is removed and the throttle closes. This device is employed purely for insuring absolute immunity from accident from excess speeds, due to the possible disablement of the governor mechanism.

Copious lubrication is supplied to all journals by means of a plunger pump driven from the worm shaft. The warm oil returning from the bearings passes through a copper coil cooler in the bedplate and thence to a reservoir from which the pump draws its supply. The cooled lubricant is circulated at slight pressure, sufficient to insure positive flow. At no point is oil under high pressure employed for preventing erosion of rubbing parts, bearing areas being sufficient for supporting the weight of the rotating parts.

Generators.

In general construction the 5,000-kw. turbo-generators conform to those now building for smaller machines. The field or revolving element is built from a solid cylinder of steel slotted for the reception of the bar windings, and provided with ventilating openings corresponding with openings in the laminations of the stationary element. The generators may be wound for high voltage if desired, in order to avoid the use of step-up transformers in a system of power transmission at voltages ranging up to 15,000.

The 5,000-kw. turbo-units here illustrated will be employed in heavy electric railway service, which is the most exacting encountered in central station operation. These machines will form the initial equipment of the Pennsylvania Railroad terminal property in New York City, operating with electric motors the heaviest trains through the tunnel approaches to Manhattan. Three units will similarly inaugurate the power service on the Philadelphia Rapid Transit subway system now under construction. Eight 5,000-kw. units will furnish power to the London subway system and three 3,500-kw. units to the surface system of the same city. These units will operate under 175 lb. steam pressure, high vacuum and 100 to 175 degrees of superheat.

Niles Car & Manufacturing Co.

The Niles Car & Manufacturing Co., of Niles, Ohio, which has been in operation about two years, has recently been reorganized, and ample additional capital provided. The company has also increased the plant capacity during the past year by the addition of a new machine and blacksmith shop. This company has turned out a number of interurban cars of high standard for such roads as the Aurora, Elgin & Chicago Ry.; Western Ohio Railway; Rockford, Beloit & Janesville R. R.; Stark Electric Ry.; Louisville, Anchorage & Pewee Valley Ry., and Trenton & New Brunswick Ry. It also made a record, recently, by delivering 25 double truck city cars to the Cleveland Electric Ry. within 28 days from receipt of order.

Mr A. W. Schall, who has been superintendent for the past year and a half and under whose supervision almost all of the cars mentioned have been built, has been retained in that capacity.

Mr James B. Ludlow, who has been secretary of the Ludlow Supply Co., of Cleveland, has resigned from that company and will be the general sales agent of the Niles Car & Manufacturing Co.

The new company starts with a large and thoroughly equipped plant, and as it has no old orders unfilled, is prepared to contract for a large number of cars for reasonably prompt delivery.

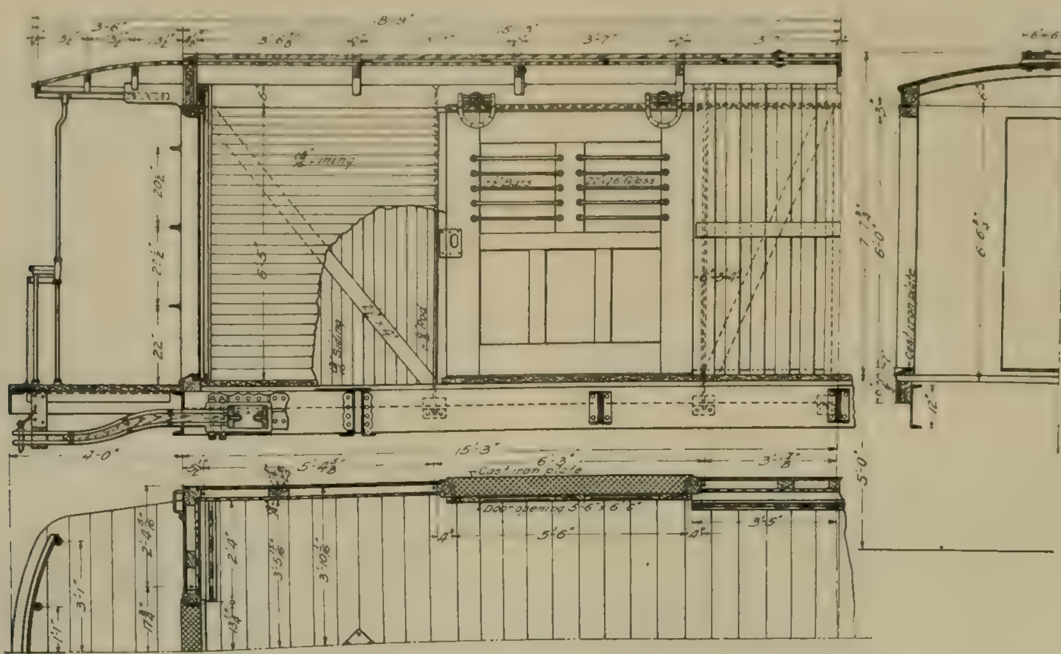
New Cars of the Middletown Car Works.

The accompanying illustrations show general views and details of construction of a number of express, box, ice and gondola cars recently built by the Middletown Car Works, Inc., of Middletown, Pa., for the Brooklyn Rapid Transit Co.

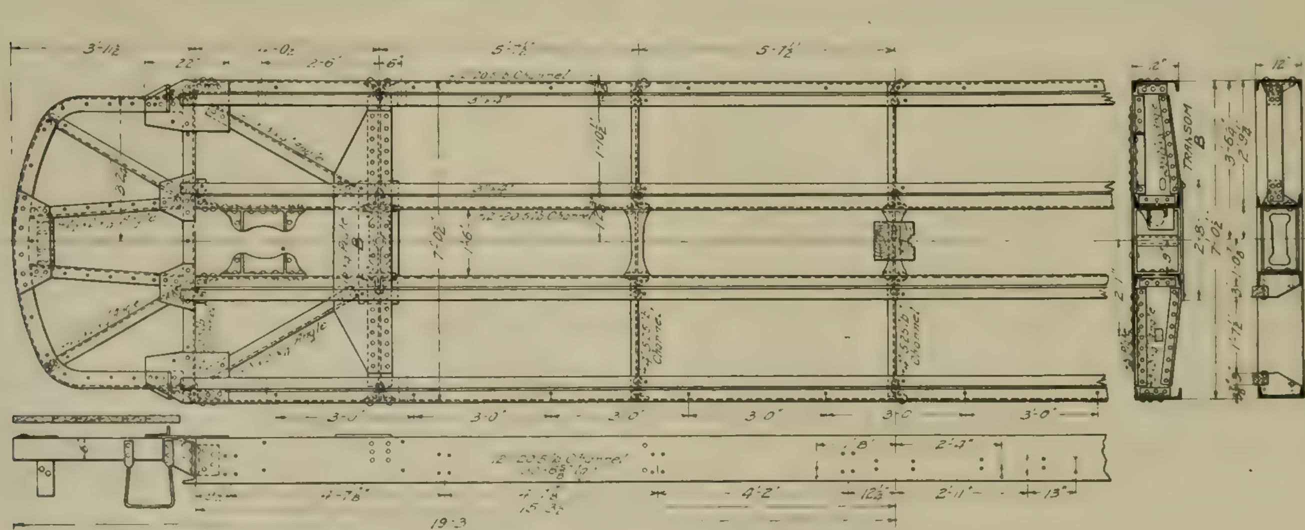
The most prominent feature of these cars is the steel underframing, a drawing of which is herewith shown. The method of constructing the platforms and attaching them to the car body has been patented by the company. All the frames are substantially alike and are quite simple as to detail. There are two side sills and two center sills, each consisting of 12-in. channels weighing 20.5 lb. per ft. These are framed into similar channel end sills by means of suitable connection angles. Extending beyond the end sills proper is a bent plate angle platform sill made of 6 x 4 x 3/8-in. angles, the 6-in. flanges standing vertically and forming the outside of the platform. These platform angles are stiffened by means of angle braces riveted to suitable connection plates. The body bolsters are of the built-up type and have top cover plates 15 x 1/4 in. in section, and bottom plates 10 x 5/8 in. in section, riveted to flange angles secured to 1/4-in. web plates. Between the center sills, which are spaced 18 in. apart, are malleable iron fillers at the bolsters and intermediate between these points. There are three series of floor beams consisting of 4-in. channels secured by means of deep connection angles to the side and center sills. These floor beams carry 3 x 4-in. yellow pine nailing strips, to which are secured between the end sills the flooring in the usual manner. The 1¾-in. floor boards at the platform are bolted directly to the underlying frame.

Above the underframes the cars are of the usual construction and measure 38 ft. 6 in. in length over platforms and 30 ft. 5 in. in length over bodies. On the box, ice and express cars the height over all from top of rail is approximately 10 ft. 10 in.; from the floor 7 ft. 7¾ in. The extreme width is 7 ft. 9⅝ in. Box cars have interior sheathing of southern pine extending to a height of 4 ft. and are provided with one sliding door at the center of each side, with a 6-ft. opening. Thirteen of these box cars were included in the recent order; also eight ice cars of the same general dimensions, the latter, however, being lined inside at the roof and to the full height at the sides and ends. These ice cars have double floors, the bottom course being 1½-in. yellow pine and the top course ⅞-in. maple. All flooring, sheathing, lining and roofing, is tongued and grooved.

The express cars were built to approximately the same general



HALF PLAN AND ELEVATIONS OF MIDDLETOWN EXPRESS CAR.



FLOOR FRAMING OF MIDDLETOWN CARS.

dimensions as the box and ice cars, and are provided with two sliding doors at each side and one at each end. These cars were painted blue and suitably lettered for American Express Co. service.

Three different sizes of gondola cars were built, twelve with 18-in

MIDDLETOWN EXPRESS CAR FOR BROOKLYN RAPID TRANSIT CO.

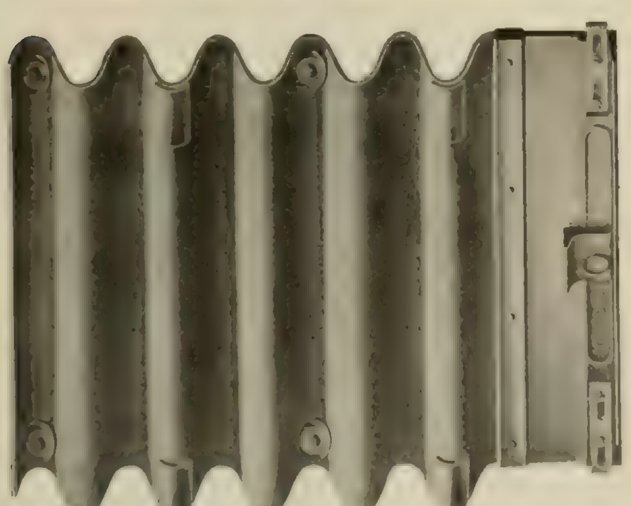
sides, six with 30-in. sides and six with 38-in. sides and peak floors. All of these gondolas were arranged with side doors hinged at the sills and secured by suitable latches at the top.

All the gondolas were supplied with 10 x 10-in. southern pine trolley masts at the center of the cars. On the 18-in. and 30-in. gondolas these trolley masts also serve to support the center latches for the doors.

Rolling Steel Shutters and Fire Proof Doors.

The accompanying illustrations convey a good idea of the double-edged corrugated rolling steel shutters or doors made by the James G. Wilson Manufacturing Co., of 3, 5 and 7 West 29th St., New York City. These are particularly suitable for closing car house fronts, express and freight houses and sheds, and in all cases where protection from fire and thieves is desired.

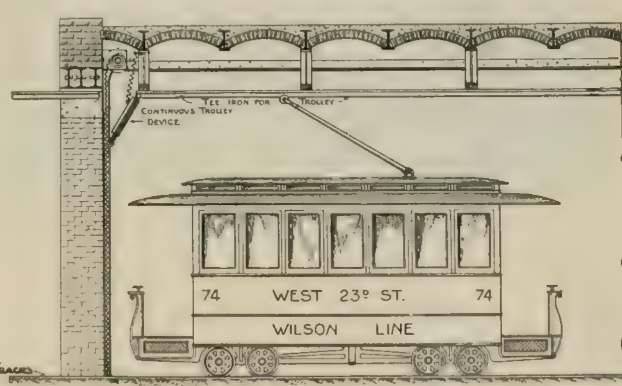
The shutters are made of open hearth, cold rolled sheet steel



WILSON ROLLING STEEL SHUTTER

corrugated and riveted together, forming a firm, unbroken surface [illegible] heat and fire resisting [illegible]. Being of the same thickness throughout it is urged that [illegible] heat is uniform [illegible] buckling tendency and enabling the shutter to hang loosely in the iron grooves and remain in place without twisting or warping when [illegible] pointed out by the [illegible] is not actually fire-proof in the strict sense of the word. A sheet of steel, under a severe test, will become red-hot and ignite any combustible material in contact with the heated surface, although separated from the actual flames. But it is emphatically claimed for the Wilson steel shutters that they will prove a perfect barrier against flames without warping or twisting out of shape, and if there is a clear space behind the shutters of 2 or 3 ft., and no combustible material in contact with them, they can be depended upon to preserve the contents of the building against a fierce fire. The company makes an inter-looping or inter-locking slat style of door but that style, even if made of heavier gage steel cannot be considered as durable as the other because of the peculiar grinding action between slats and the impossibility of the painters reaching the inner surface of the slats where they interlock. The company has installed a complete plant for galvanizing its shutters of any style by the commercially new cold electro process.

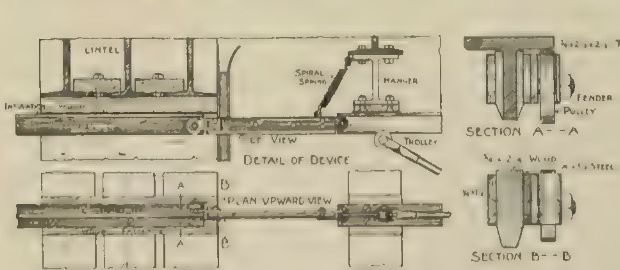
The manipulation of the Wilson shutters is cared for in several ways. The "self-coiling" principle is recommended as the best plan as it enables the shutters to be opened and closed like an ordinary spring roller shade, from either side. The "endless chain" arrangement with single or compound gear and spring counterbalance, is a good plan for large and especially for very high openings. Screw gearing is another method that is sometimes used



APPLICATION OF ROLLING DOORS TO CAR BARNS.

and is more particularly useful where a number of shutters, one above another, are to be operated at one time and by one set of gear.

Any of the rolling shutters or doors can be fitted with a device



DETAILS OF CONTINUOUS TROLLEY LINE DEVICE

that will ensure their closing when the temperature in the vicinity reaches a pre-determined degree of heat.

Attention is particularly called to the heavy metal shields on the edges of these shutters, designed to protect them from wearing out by friction in the iron grooves.

One of the drawings explains the particular application of the Wilson system of fire-proof shutters to car house protection. As will be noticed, this involves the use of a special bridge or connector for preserving the continuity of the trolley wire at the entrance to the car house, and providing an unbroken passage for the trolley wheel when the door is in the raised position.

The business carried on by this company was established in 1870, and the various styles of shutters, doors, blinds, etc., made by it are protected by over 25 U. S. letters patent.

Interesting Cars for Topeka, Kan.

The car shown in the accompanying engraving is one of 12 recently completed by the American Car Co. of St. Louis for the Topeka Railway Co., Topeka, Kan. The entire property of the company has lately been re-constructed and new equipment added and these new cars are a valuable addition to the lines. Several unusual and interesting features will be noticed in the engraving. The back platform is of the "Detroit" type with entrance at one side only and closed, except when the car is at a full stop, by high gates. The other side of the platform is permanently closed with a high gate of wire netting. The platform at the forward end of the car is flush with the car floor and entrance to the enclosed vestibule is only permitted to the motorman, a step iron being provided for him of the usual baggage-car type. The seating capacity of each car is 28. The seats are of the walk-over type. They are 32 in. in length and the aisles are 25 in. wide. The interiors are finished in quartered oak with ceilings of birch. A single sliding door at the rear end is at the side near the entrance. This arrangement is known as the Brownell Patents Co's. semi-accelerator type of door and facilitates the movement of passengers in and out. Length of cars over end-panels 20 ft. 8 in. and over crown pieces 30 ft. 8 in. From panel over crown-piece at the front end 4 ft. and at the rear end 6 ft. Width over sills, including sill plates, 7 ft. 10 in. Width over posts at belt 8 ft. 2 in. Sweep of posts 2½ in. From center to center of posts 2 ft. 8 in. The side sills are 4 x 6¾ in. with 8 x ⅝ in. sill plates extending from the vestibule corner post to the rear corner post on either side. The corner posts are 3¾ in. thick and the side posts 2¼ in. Height of platform step 17 in. from rail head and from step to platform 14 in. The cars are equipped with American Car Co. sand boxes and Brill angle iron bumpers, Dedenda gongs, ratchet brake handles and radial draw bars and are mounted upon Brill 21-E trucks having 6 ft. wheel base, 33 in. wheels and equipped with 25-h. p. motors.

NEW CAR FOR TOPEKA, KAN. (AMERICAN CAR CO.)

Changes in Offices of the National Electric Co.

The general sales office of the Christensen air brake department of the National Electric Co. has been transferred from No. 135 Broadway, New York, to the works at Milwaukee, and will hereafter be under the direct charge of Mr. F. C. Randall, who has been elected vice-president and general manager of the company. The company will retain a sales office at No. 135 Broadway, New York, which will take care of New York City and all of New England and Canada. This office will be in charge of Mr. J. T. Cunningham, who has been the New England representative of the company for the past two years. Mr. J. D. Maguire has been appointed special sales representative of the air brake department, and will make his headquarters at the New York office, also. Mr. J. H. Denton, who formerly made his headquarters at the general sales office at New York, has been appointed chief of the inspection department at the Milwaukee works, in addition to his position as chief engineer of sales department for Christensen air brakes. Mr. Denton in future will be located in the Milwaukee office.

The Thomas High-Tension Insulator.

We present herewith an illustration of one of the high-tension insulators made by the R. Thomas & Sons Co., of East Liverpool, O., and especially adapted for high-voltage power transmission. These insulators are made by what is known as the "glaze-filling" process which has been patented by the maker, who has given the subject of insulation of this character very careful study. During the past five years the company has conducted such tests as warrant it in affirming that insulators constructed under this process are sure to be thoroughly vitrified, and being made in separate parts of a uniform thickness, each part being thoroughly glazed and extra layers of glaze being used in firing the parts together, an insulator is produced which is considered practically non-puncturable.

The insulator here shown is made in two sizes, designated as No. 12 "C-T" and No. 14 "C-T", and is either white or chocolate color, as preferred. The only difference is in the size, No. 12 'C-T" being 2¼ in. smaller in diameter than No. 14 "C-T", which is 14¼ in. across. The smaller insulator weighs 20 lb. and the larger, 24 lb. The height of each is 13⅝ in. The test voltage is the same in each--120,000 volts. The line-working voltage recommended for these insulators is up to 60,000 and 70,000 volts, respectively, which is believed to be a very conservative recommendation. The R. Thomas & Sons' sales offices are at 39-41 Cortlandt St., New York City.

R. THOMAS & SONS HIGH TENSION INSULATOR

Nurnberg Gas Engines.

The Allis-Chalmers Co. announces that it has acquired the exclusive rights for the United States, Canada and Mexico for the manufacture and sale of Nurnberg gas engines for all power purposes. These engines have been developed and thoroughly tested in large units and it is claimed that their performance will meet the most exacting demands of power generation with absolute reliability. They will operate with either natural, producer, coke oven, blast furnace or illuminating gas; and they are built in sizes of from 130 to 6,000 h. p. capacity. They are of the four-cycle, double-acting type. The Allis-Chalmers Co. is now prepared to install complete gas power plants.

The Lindsley Brothers Co., of Chicago, dealer in Michigan and Idaho poles, posts and ties, reports that 1903 was a most prosperous year. Several very large orders were received for Michigan and western cedar poles and railway ties, one order for western poles alone requiring over 200 cars to transport them. The company is operating several camps to produce stock to care for 1904 orders, and not only reports a heavy inquiry already, but has received several large orders for future delivery.

Cars for Rockford & Freeport Ry.

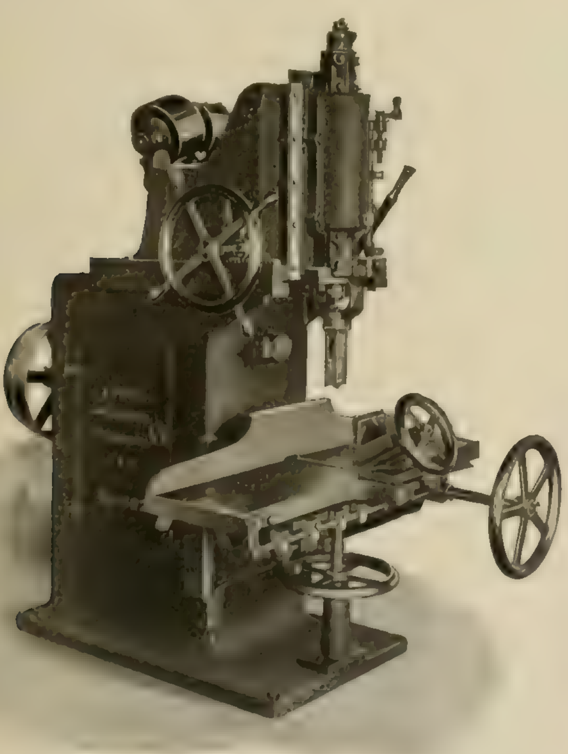
An exterior view of one of the semi-convertible interurban cars which the St. Louis Car Co. recently built for the Rockford & Freeport (Ill.) Electric Railway Co. is shown herewith. Each of these handsome cars has two compartments, passenger and smoker, with toilet room. There is a hot water heater in the passenger compartment next to the partition. The interior finish is of veneered mahogany, the roof being of steam coach pattern. The seats are the St. Louis Car Co's. reversible type, and the main compartment is fitted with parcel racks.

ROCKFORD & FREEPORT RY. CAR (ST. LOUIS CAR CO.)

The length of the car body is 34 ft. Each car has double vestibule doors and outside window guards. The St. Louis Car Co's. vertical wheel brake and sand boxes are used, and each car is provided with a four-motor equipment and mounted on the St. Louis Car Co's. 23 B. trucks for high-speed interurban service.

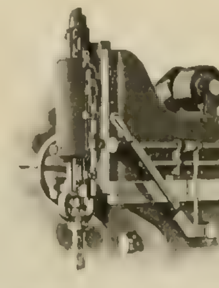
New Automatic Vertical Hollow-Chisel Mortiser.

The engravings shown herewith represent a new automatic vertical hollow chisel mortiser which is the outcome of careful study into the requirements of car builders and wood workers who have large quantities of framing to finish. It is built for fast and economical work and an inspection of the engravings gives the impression of the same sort of care in designing and constructing the machine as is given to the highest grade of machine tools.



VERTICAL HOLLOW CHISEL MORTISER

It is essential that convenience to the operator be considered in designing a machine of this class, as the rapidity with which it may be operated is governed by the location of the controlling parts and if these can be adjusted or handled from one point, much time can be saved. On this machine all the operating and controlling devices are placed within easy reach and they do not require even a step in their manipulation. This is exceedingly important and greatly adds to the capacity of the machine.



DEVICE FOR CHANGING DEPTH OF MORTISE

Among the characteristic features in construction the following are particularly noticeable and worthy of careful attention:

The layout stops for laying out mortises contribute to quick and accurate work. For taking up the end thrust of the spindle and supporting it, an improved composition step-bearing, running in a bath of oil, is provided. The machine has a new device for instantly changing the depth of the mortise, without disturbing the table. The tension of the spindle belt is kept uniform by an automatic tightener. The tool frame has a transverse movement with adjustable stops for regulating its travel; when located in position it is locked by a novel clamping device. In this respect the machine presents a new feature for a medium-sized mortiser and one which is sure to be appreciated. The table has both vertical and longitudinal movements. The timber clamp is very strong and is adjustable as well as detachable from the table. Improved friction feed with two speeds is provided with quick return. To prevent air cushioning of the belt, a patent pneumatic spindle pulley is employed. The chisel ram has a vertical travel of 9½ in.

The chisel carriage moves horizontally 18 in. and will drop to mortise stock 17 in. high with a 6½ in. chisel.

Timber up to 12 in. may be clamped and chisels up to 1½ in. can be used on hard wood.

The floor space occupied is 5½ ft. x 5½ ft.

This machine is one of the most recent productions of the S. A. Woods Machine Co., of South Boston, Mass., which makes a specialty of high grade wood working machinery.

Peckham Manufacturing Co.

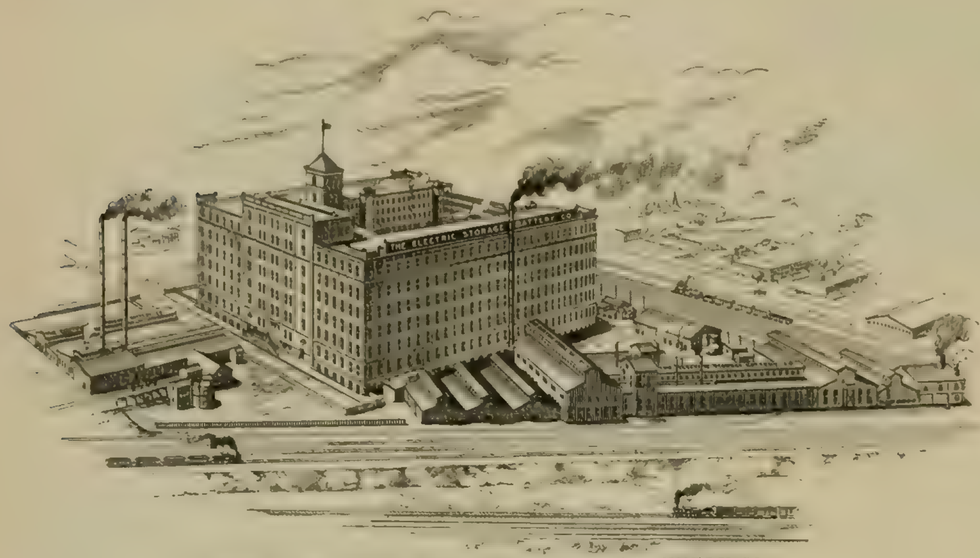
At a late meeting of the board of directors of the Peckham Manufacturing Co., E. Burton Hart, jr., Bird S. Coler, and Henry G. Lewis were elected to the board in place of J. J. Riley, Virgil B. Van Wagonen and W. H. Wilkinson, resigned.

The board now consists of the following: E. Peckham, president; Hon. Bird S. Coler, ex-comptroller of the City of New York, member of the New York Stock Exchange; E. Burton Hart, jr., president of the Portsmouth, Kittery & York Street Railway Co., director of the Consolidated National Bank; J. R. Beetem, vice-president and general manager, formerly general manager of the Union Traction Co. of Philadelphia and vice-president of the New York & Queens County Railway Co.; Henry G. Lewis, treasurer, assistant cashier of the Consolidated National Bank; Hon. C. H. Duell, ex-commissioner of patents, member of the firm of Duell, Megrath & Warfield; Geo. H. Bowers, secretary and assistant treasurer

The total number of passengers handled by the Nashville Railway & Light Co. during 1903, including transfers and passes, was 19,418,303.

New Quarters for Electric Storage Battery Co.

The Electric Storage Battery Co., of Philadelphia, manufacturer of the "Chloride" and "Exide" accumulator, has recently completed arrangements with the trustees of the estate of W. G. Warden, by which the company acquires the entire property situated on Allegheny Ave., between 18th and 20th Sts. The main building on Allegheny Ave. is a seven-story and basement brick structure, having two wings, and containing over 280,000 sq. ft. of floor space.

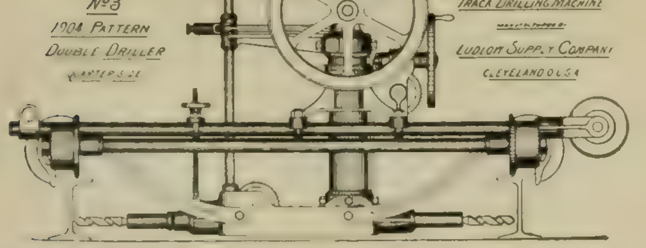


NEW PLANT OF THE ELECTRIC STORAGE BATTERY CO.

Aside from this building there are sixteen other structures utilized for the different processes of manufacture by the battery company. The property covers over three acres of ground, and has a frontage on Allegheny Ave. of nearly 600 ft., and is bounded by the Philadelphia & Reading Railway and a branch of the Pennsylvania Railroad, thus giving unusual facilities for the handling of freight and express.

A Novel Double-Drilling Machine.

The Ludlow Supply Co., of Cleveland, maker of the "Cleveland" track drilling machines, announces that it is about to place on the market a machine that will drill either rail without it being necessary to turn the machine around, as heretofore. The accompanying illustration fully exhibits the details of the new device. In the construction of this machine malleable iron is used almost entirely,



making it stronger and lighter. The feeding, lowering and raising mechanism has been changed from a screw to a worm and gear, which facilitates operation. The drill point can be raised or lowered 11 in., making it possible to drill from a 60-lb. T rail to a 10-in. girder. Holes for tie rods can be drilled absolutely true without measurements, it is stated.

The new machine combines all of the company's latest improvements, including automatic feed and roll-off attachments. Ball bearings are used in the spindle to lessen the friction and enhance the ease of operation.

Pipe Wrench Attachments for the B. & S. Drop Forged Adjustable Wrenches.

The pipe wrench attachment shown in the illustration is for the B. & S. 6 and 8-in. adjustable wrenches and consists of a serrated tool steel jaw, with a tempered spring attachment which serves to

PIPE WRENCH ATTACHMENT.

hold the jaw in place. This pipe wrench attachment is easily removed and can be used for either right or left hand threads by simply reversing its position on the wrench, or, if preferred, changing the working position of the wrench.

This important addition in the equipment of those popular wrenches makes it possible to instantly convert them into pipe wrenches, a feature the trade will be quick to perceive. When so converted they can be used on pipe up to and including ¾ in. in diameter.

These wrenches and attachments are manufactured by the Billings & Spencer Co., Hartford, Conn.

Street Railway Detective Agency.

Our readers will be pleased to know that the well-known detective agency of Drummond & Co. has recently established a department for the purpose of investigating and systematically inspecting street railways.

A. L. DRUMMOND.

The agency is prepared to undertake the investigation of all classes of crime committed against persons or property, to obtain

evidence in both criminal and civil cases, serve legal papers, investigate frauds, infringements, counterfeiting, the character and habits of employes and all general high grade systematic detective work as pertaining to street railways and their operation.

This agency is in the personal charge of Mr. A. L. Drummond, for twenty years with the secret service department of the United States treasury and for three years its chief. His references include many of the leading railway officials, government officials, bankers and business men of the country and abroad. His personal testimonials are of the highest, including the capturing and convicting of the famous gang of counterfeiters who for years baffled the Southern Pacific Railway with their clever counterfeiting of railway tickets, passes, etc.

The agency is fully prepared to furnish high grade men for railway companies, who will thoroughly ferret out the labor situation, dissatisfaction, graft, etc., among employes. These furnished employes are not roughs, sluggers and mischief makers, but are trained men in their line of work, as well as first-class railway operators, and will furnish daily a full written report of the situation on the road where they are employed.

Strikes of the Month.

January 1st the employes of the Bloomington & Normal Railway Electric & Heating Co., of Bloomington, Ill., struck for increased wages. The old men who had been receiving 17 cents an hour demanded 19 cents, while the new men, who have been working six months, or longer, asked for an advance from 15 cents to 16 cents an hour. New Year's day no cars were run, but on January 2nd the company placed four cars in operation, having hired 20 nonunion men. January 3rd a mob wrecked the cars and assaulted the nonunion motormen and conductors and policemen as well. They tore up sections of the track and greased the rails, so that, although the company tried to run cars on 11 lines, it did not succeed fully. January 4th the police force was augmented and cars were run under heavy guard. Two rioters were arrested. January 5th members of the State Board of Arbitration arrived to seek a settlement. Five more arrests were made January 5th. January 6th the Citizens' Alliance announced that it would tender $10,000 to aid the company. The mayor issued a proclamation. January 7th cars were run on schedule, although there was disorder. The arbitration board reported that the company would not make concessions. January 8th the electrical workers and light trimmers struck in sympathy, but their places were filled. January 9th and 10th 14 aldermen served as policemen and preserved order. Saloons were ordered closed. January 11th all the gambling houses were closed. January 12th the union appealed to the Business Men's Association January 13th the railway officials notified the Business Men's Association that, as an act of courtesy, the president of the company, Mr. A. E. DeMange, would meet the Business Men's Association and the city council, but their efforts to settle the strike would be useless, as the company's position was irrevocable. The company is satisfied with its present force, as well as the patronage, and the fact that the old employes left voluntarily prevents the company from considering their claims for recognition.

January 8th a strike of the employes of the Auburn & Syracuse (N. Y.) Railroad Co. was ordered because the company had discharged three union men for cause. It was not effective, however, as only six employes went out.

Former employes of the San Antonio Traction Co., or their sympathizers, have caused the company a great deal of annoyance since it was announced that the strike, mentioned in the "Review" for November, was over, so far as the company was concerned. Several attempts have been made to get the company to take back all the strikers, but the president flatly refused to have anything to do with unions. The disgruntled ones then resorted to dynamite and dynamited two cars. Leaders of the unions were arrested and December 27th the grand jury found indictments against three of them on 27 counts for dynamiting cars and assaulting, to murder, the passenger. The men were required to furnish bonds in $2,000 each for their further appearance.

The Metropolitan Street Railway Co., Kansas City, collected more than 270,000 fares Christmas day, it being the heaviest traffic with two exceptions in the company's history.

Advertising Literature.

THE AMERICAN STEEL & WIRE CO. has issued in pamphlet form, 24 pages, 6½ x 7¾ in., a list of products of the company, which include electrical wires and cables and rail bonds.

THE SAMPSON CORDAGE WORKS, Boston, Mass., issues an unique desk calendar, 4 x 5 in., with a support at the back. Above the calendar pad, which is 1½ x 3 in., is attached a sample of the well-known Sampson "spot" cord.

THE STUART-HOWLAND CO., of Boston, has issued a fine calendar, the chief feature of which, aside from the calendar proper, is a half-tone illustration, about 7 in. square, showing the company's substantial and altogether attractive office building.

THE WESTERN WHEELED SCRAPER CO., of Aurora, Ill., has issued a four-page folder, 5 x 9 in., illustrating and describing its "ten-yard bottom dump double truck car," adapted for ballasting purposes on electric roads, or for filling in, hauling cinders, coal, gravel, crushed stone, etc.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING CO. has issued Circular No. 1,032 (superseding edition of September, 1902), on "The Westinghouse No. 56 Railway Motor". Also Circular No. 1,056 (superseding edition of April, 1903), "Electric Motor-Vehicle Equipments."

THE UNDER-FEED STOKER CO. OF AMERICA, Chicago, in the Publicity Magazine for December, emphasizes the fact that the Jones under-feed system of mechanical stoking is the only method of boiler firing in which the supply of fuel and air is automatically proportioned and controlled by the demand for steam.

THE NATIONAL ELECTRIC CO., of Milwaukee, successor to the Christensen Engineering Co., is sending out an exceptionally artistic calendar, the upper portion of which frames in oval a handsome picture in colors. The calendar card is black, 13 x 17 in., and is lettered in silver bronze. The pad is black, 3¾ x 7 in., and is lettered in white.

THE PHILIP CAREY MANUFACTURING CO., of Lockland, O., sole manufacturer and patentee of "magnesia" flexible cement roofing and 85-per-cent "magnesia" pipe coverings, has issued an attractive 1904 calendar printed in silver bronze on black "magnesia" paper, the whole being 14 x 22 in. in size, and the calendar part 5 x 10 in. Surmounting the calendar pad is a picture, in colors, showing a beautiful woman in artistic pose.

JOHN A. ROEBLING'S SONS CO., of Trenton, N. J., manufacturer of wire rope and wire, has issued a handsome calendar for 1904, of which the card is 10 x 14 in. in size and the calendar pad 4 x 8 in. The upper portion is adorned with a half-tone view of the "America" cup defender, "Reliance", taken from a copyright photograph by James Burton, of New York. The wire rope and rigging for the "Reliance" were furnished by the John A. Roebling's Sons Co.

THE INGERSOLL-SERGEANT DRILL CO'S. pneumatic tool department has just issued a calendar of novel and artistic design. It pictures a workman operating one of the company's Haeseler pneumatic hammers on a sky-scraper, while the "axial" valve, a very important feature of the Haeseler-Ingersoll hammer, appears in a novel way. It is an excellent calendar for the office. The Ingersoll-Sergeant Drill Co's. general offices are at 26 Cortlandt St., New York.

THE AMERICAN BRAKE SHOE & FOUNDRY CO., of Mahwah, N. J., has just issued Catalog No. 2, setting forth its line of tools made by the "Tropenas" converter process which is in successful operation at the company's Chicago Heights plant The catalog contains eight pages, 3½ x 6 in., and is illustrated. The leading features described are engineers' wrenches, "S" car wrenches, track wrenches, coal picks, car repairers' hammers and machinists' hammers.

THE REPUBLIC RUBBER CO., of Youngstown, O., has issued an ornate poster entitled "A Talk On Packing", and treating of the "Searchlight" packing which is so favorably known. The poster, when open, is 18 x 26 in. in size, closed, it is about 7 x 13 in., and on the back are reserved lines for the name and address of the person to whom it is to be sent, and space to affix a postage stamp. The poster is on white paper, printed in red, blue and black. It is adorned with artistic borders, illuminated capital and old English title, being got up in the form of an official proclamation, or "greeting to the engineers of America". The type is very large and the

reading matter terse and emphatic. When unfolding the circular a surprise awaits the reader at every turn, due to the variety of designs and assembling of trade mark, title and colors.

THE STEWART HARSTHORN CO., of East Newark, N. J. in the Christmas and New Year numbers of Hartshorn's Roller assembled some exceptionally attractive illustrations and enjoyable reading matter, of which the advertising features are by no means least commendable. The Roller serves as an excellent medium to set forth the Hartshorn specialties and is eagerly awaited each month by those fortunate enough to be on the mailing list. It costs nothing—only to send for it.

THE MICA INSULATOR CO., of New York and Chicago, issues a 14-page booklet, 3¾ x 6¼ in., treating of insulating cloths and papers made by it and which are claimed to be the only linseed oil cloths on the market. Samples of these cloths, which are known as "Empire" linseed oil cloths, accompany the booklet. The company also issues a folder, 3½ x 5¼ in., describing a new process of "Empire" oiled cloths in the form of a tape under the registered name of "Linotape". A "Linotape" price list is also given.

THE JOSEPH DIXON CRUCIBLE CO., of Jersey City, publisher of Graphite, which is issued in the interest of Dixon's graphite productions, in the January number of this readable paper launched into color printing with excellent result. On the last page of the paper is a view showing a silica graphite pail, with red label, "looking as natural as life," and on an inside page is an illustration showing a pyramid of red-labeled cans such as contain Dixon's No. 635 graphite, Dixon's graphitoleo and Dixon's graphite compound.

THE MAYER & ENGLUND CO., of Philadelphia, in the Christmas number of the Keystone Traveler, advertises in attractive fashion its "Protected" rail bonds, controller contact fingers, the Barrett trip jack, trolley ears, the Knutson trolley retriever, International fare register, the Philadelphia fender, automatic vestibule shades, track scrapers, snow brooms, sleet cutters, safety treads, the Automotoneer and the "Keystone" pit light, the last-named being a new portable incandescent lamp for working around motors in the pit. This lamp has a special weather-proof socket.

THE RAILWAY APPLIANCES CO., Old Colony Building, Chicago, and 107 Liberty St., New York, has issued a novel calendar to advertise its "R. A.", or "Ajax" vestibule diaphragm for railway cars. In the center of the calendar card is a view of this diaphragm in the aperture of which is shown in decollete costume a pretty young woman in the apparent act of alighting from a car. The novel feature is that the waist of the young woman's gown is a "color barometer", being made of cloth which has been chemically treated so that it changes color with the weather. At one side of the picture is a diminutive calendar pad, 1⅓ x 1½ in. in size. The card, which is 6¼ x 8¾ in., is artistically colored.

THE BULLOCK ELECTRIC MANUFACTURING CO., of Cincinnati, issues a very valuable calendar consisting of a set of 12 cards, 3½ x 6 in. in size, each card containing a likeness of a prominent electrician, the entire set including portraits of Sir Oliver J. Lodge, Thomas A. Edison, William Spottiswoode, Andre E. Blondel, Charles Proteus Steinmetz, Sir William Siemens, Alexander Graham Bell, Dr. Michael Idvorski Pupin, Frank J. Sprague, Joseph Henry, Sir William Crookes and Nikola Tesla. The cards are very handsomely decorated with different designs in vari-colored inks, the whole forming an ideal exposition of the art of color printing. On the back of each card is a biographical sketch of the subject whose portrait appears on the front.

THE GENERAL ELECTRIC CO. has issued the following publications: Bulletin No. 4,348, "Automatic Circuit Breakers, Carbon Break, Type C". Bulletin No. 4,349, "Belt-Driven Form L Continuous Current Generators for Lighting and Power". Bulletin No. 4,350, "Generators for Electroplating, Electrotyping and Other Electrolytic Work". Bulletin No. 4,351, "Type T A Regulators for Alternating Current Generators". Series No. 9,118 (supersedes No. 9,108), "General Electric Railroad". Series No. 9,126, "Thomson Recording Wattmeters". Series No. 9,127, "Fifteen Years' Experience in Transformer Manufacture". Supply Catalog No. 7,584 (supersedes No. 7,533), "Marine Supplies". Flyer No. 2,119, "Flush Pocket Wall Receptacle". Flyer No. 2,120, "Edison Socket Rings". Flyer No. 2,121, "G. E. Porcelain Receptacles". Flyer No. 2,122 (supersedes No. 2,086), "Punched Clip Spring Switches with Edison Fuse Plugs". Flyer No. 2,123 (supersedes No. 2,102), "G. E. Porce-

lain Knobs and Cleats". Flyer No. 2,124 (supersedes No. 2,108), "Attaching Plugs". Price List No. 5,113 (supersedes No. 5,093), "Edison Miniature Incandescent Lamps". Price List No. 5,114 (supersedes No. 5,093), "Edison Minature Incandescent Lamps". Price List No. 5,117, "Principal Repair Parts for Form 8, D. C Multiple Enclosed Arc Lamps". Price List No. 5,118 (supersedes No. 5,097), "Thomson Recording Wattmeters".

J. R. M'CARDELL & CO., of Trenton, N. J., patentees and sole manufacturers of the improved Trenton trolley wagon, issue a 24-page descriptive pamphlet, 5¼ x 8 in. in size, illustrating these widely-known wagons, which are built in two sizes and of which it is stated that more were sold last year than all other kinds combined. The pamphlet refers to a long list of domestic and foreign users of the Trenton wagon, and there are also published many testimonials from leading roads to show that the claims made by the manufacturers are substantiated in every particular. Some of these claims are the following: It is the lightest practical tower wagon ever constructed; it is the quickest in operation, and can be changed to any position in one-quarter of the time required by any other wagon; it is the strongest, steadiest and best balanced and most durable; it is the only tower wagon that can be successfully operated by one man; it is not affected in its operation by climate or weather; all overhead work can be readily effected from the extended platform without stopping cars; it is built by hand of the best materials and is sold under a positive guarantee; it is the cheapest tower wagon on the market.

SKILLED FIREMEN.

Remarkable Feat of Engine Firing on The New York Limited.

The Pennsylvania Lines are frequently referred to as the training school for skilled railroad employes. Attention to details is one of the reasons for the characteristic which has distinguished the Pennsylvania as the standard railway system of America. Probably on no other system is a greater effort put forth by employes and officers alike in an endeavor to keep passenger trains on schedule time. The preparation of equipment and motive power; the make-up of trains and their handling is given close attention. As a result Pennsylvania employes become experts in the different lines of work assigned to them.

The high degree to which men in the Pennsylvania service are trained was demonstrated recently in the firing of engines used on the New York Limited, running between St. Louis and New York. The men on the engines are perhaps directly responsible for trains making time and keeping their schedules. The work of supplying requisite steam devolves on the fireman and is of considerable importance. The performance of skillful engine firing on the New York Limited consisted of maintaining a uniform pressure of steam from Indianapolis to Columbus, a distance of 181 miles, on the two engines used, one from Indianapolis to Richmond, and one from Richmond to Columbus.

The New York Limited left Indianapolis at 6:50 p. m., on time, hauled by a Class D-13A engine No. 8305, with Engineer Martin and Fireman Clark. The train was a heavy laden one of nine cars, making a total weight of 425 tons. The weather conditions were very unfavorable, the rails being wet by a drizzling rain; yet Fireman Clark succeeded in having a uniform pressure of steam maintained all the way from Indianapolis to Richmond, which place was reached on time. At Richmond another engine, Class D-16B, No. 6614, with Engineer Gibney and Fireman Hoag, took the train and hauled it to Columbus on time, running under a uniform pressure of steam the entire distance, Fireman Hoag being so skilled in his duties as to keep the pressure at a certain point all the way.

Notwithstanding the heavy grades, the unfavorable weather conditions, and the fact that the engines were not of the heavy Class E 2 Atlantic type which the Pennsylvania system is introducing, there was only the slightest variation in the steam gages the entire distance from Indianapolis to Columbus. So well was the work of the firemen done that the exact variation in steam pressure was less than three pounds. The performance of expert engine firing is one of the many similar feats by which the men on the engines of the Pennsylvania lines have made that railway system famous.

Trade Notes.

THE BROWN CORLISS ENGINE CO., of Corliss, Wis., advises us that it has received an order from the Passaic Steel Co., of Paterson, N. J., for one 24 and 44 x 36-in. tandem rolling mill engine; also an order from the Lorain Steel Co.

OSGOOD BRADLEY & SONS, of Worcester, Mass., have just placed their order with the S. A. Woods Machine Co., of Boston, for several new wood working machines. It is expected this equipment will be shipped and installed during January.

THE AJAX METAL CO., of Philadelphia, announces that it has purchased the business, plant, good will and fixtures of the former Bates Metal Co., of Birmingham, Ala., and will continue the metal business in all its branches under the name of the Ajax Metal Co. of the South, Birmingham, Ala.

THE RAILWAY JOURNAL LUBRICATING CO., of Chicago, reports that after an extended trial of its lubricator and dust guard the Chicago City Railway Co. has placed an order for a full equipment of these lubricators for its Wentworth St. and Halsted St. lines and the same are being installed.

THE VILTER MANUFACTURING CO., of Milwaukee, has been awarded a contract to build 250-ton refrigerating machinery to be used for ice making and cold storage purposes on the grounds of the Louisiana Purchase Exposition at St. Louis. This company also makes corliss engines for street railway use and is in position to make good deliveries.

THE DETROIT TROLLEY & MANUFACTURING CO., of Detroit, Mich., advises us that it begins the new year most auspiciously. It is doing an excellent business with the street railway companies, a number of which have adopted its favorably known

FULL OF GOOD THINGS.

The January number of the Four-Track News starts the new year with an especially interesting table of contents, including "Among Golden Pagodas," by the well-known writer, Kirk Munroe; "A Famous Autograph," by Marie Josephine Morgan; "Marblehead," described by M. Imlay Taylor; "A Western Paradise (Catalina)," by Frank M. Byron; "Santo Domingo," Frederick A. Ober; "Where Extremes Meet," and the race track and the sanctuary are neighbors, G. M. Clapham; "Montezuma's Well and Castle," Emma Paddock Telford; "The School City," and what it has accomplished, Wilson L. Gill; "Where Soldiers Are Made," a graphic picture of West Point, Frank H. Taylor; "Stealing a Railroad Train," the story of the Andrews raid, H. M. Albaugh; "The Trianon," Sophie Earl; "George Groghan, Hero," Lucy Elliot Keeler; "Kentucky's Natural Bridge," Henry Cleveland Wood; "A Light-House and a Honeymoon," Harriet Quimby, and "The Serpent Mound," by Mary L. Kane. In addition there are numerous poems, bits of humor, and "Little Histories," while the departments will be found interesting and varied. Every article is profusely illustrated and, taken collectively, the initial number of the volume six of this popular magazine ranks among the best that have been issued.

The Four-Track News is 50 cents a year, or 5 cents a copy, and can be had of George H. Daniels, publisher, 7 East 42d St., New York.

STREET RAILWAY REVIEW

Vol. XIV | FEBRUARY 20, 1904 | No. 2

Electric Tramways of Sofia.

Operated by Means of a High Tension Water Power Station with Low Tension Steam Power Station for Reserve.

With the increase of business and commercial transactions has also increased the necessity of transporting oneself economically, easily, quickly. Electric tramways are recognized everywhere as furnishing the best facilities for urban transportation, and throughout Europe where installed have proved to be most popular even in those cities having well paved streets.

Sofia, though the capital of Bulgaria and a flourishing town of 60,000 inhabitants, with a modern quarter entirely constructed in the taste of occidental Europe, and with broad boulevards and large buildings making an agreeable impression on strangers, has not yet paved streets. In many places the foot ways leave much to be desired and communication in rainy weather is most difficult. There are, indeed, everywhere stands of hackney coaches drawn by small horses which convey the business man quickly from one point to another, but these coaches are costly if one has to avail oneself frequently of their service.

The town of Sofia has now a network of 25 km of trolley line. The number of cars operated is 35, of which 25 are motor cars and 10 are trail cars. The cars are equipped with motors using current at 500 to 550 volts.

The concession for lighting the town has been granted to the Societe des Grands Travaux a Marseille and that for electric traction to the Trust Franco Belge, of Brussels. The first named engages to furnish to the second the necessary energy at a determined price; the second named company engages to organize its central station in such a way that in case of need the town may likewise be lighted directly from it.

The electric installation is interesting, because it solves economically a problem which may present itself in many other localities. The station was designed and directed by M. Polaz, professor at the University of Lausanne.

CITY TERMINUS OF THE SOFIA TRAMWAYS

The tramway network is now supplied sometimes from the central station, with low tension generators, situated in Sofia, and sometimes from the high tension central water power station on the Isker and located about 25 km from the town.

The high tension central station was constructed by the Societe Oerlikon, of Oerlikon, Switzerland; the low tension installation was made by the Societe Electricite et Hydraulique, of Charleroi, Belgium. When current from the Isker station is employed, the central station in Sofia serves as a sub-station. During seasons of dryness and frost the low tension central station, by operating its dynamos by steam power, furnishes the current necessary for the tramways. When, however, the network is fed by the high tension central station, the central station of Sofia may operate its steam engines for

the production of continuous or alternative currents to be utilized for the lighting or for other applications of the town.

The water power station on the Isker is 2,000 h. p., though water for 3,000 h. p. is available. The average delivery is from 5 to 6 cubic meters per second. The intake canal is 1,100 m. (3,600 ft.) long, 2 m. wide and 2.5 m. deep, built of masonry and vaulted.

The conduit under pressure has a length of 110 m. (360 ft.), with inside diameter of 1,400 mm. (55 in.). The pipes are of steel, from 5 to 8 mm. thick, riveted.

SHOWING LOCATION OF THE HIGH TENSION STATION.

VIEW OF LINE IN SOFIA.

The station building is 30 m. long and 12.5 m. wide (about 98 x 40 ft.). It is designed for six 425-kw. units, four of which are installed. An annex (4.8 x 9.9 m. in area) is exclusively occupied by the switchboard and the distribution apparatus.

The turbines are constructed for a fall of from 52 to 55 m. with a flow of from 960 to 910 litres of water per second with an efficiency of 75 per cent when developing 500 h. p. at 400 r. p. m.

The turbines were built in the shops of Piccard, Pictet & Co., Geneva, and are of the centrifugal type with horizontal staff. The adjusting may be made by hand or by means of a servo-motor actuated by the shaft of the turbine. A centrifugal governor serves as relay so that the number of revolutions always remains the same.

The generators, each of 425 kw. capacity, are connected to their respective turbines by flexible insulated couplings. At 400 r. p. m. the machines deliver current at 8,000 volts, the periodicity being 53 1-3. The field has 16 poles of laminated iron wound with 110 turns of copper wire 7 mm. in diameter. The armature coils have 65 turns each of copper wire 3.4 mm. in diameter, insulated by micanite tubes.

Exciting current at 50 volts is furnished by a bipolar 9-kw. machine.

The current is collected at the generators by aluminum bars supported by porcelain insulators and thence conveyed to the switchboard in underground conduits. The conductors from the exciter are carried in the same conduits.

The switchboard is in two stories. The upper section is of panels of white marble supported on cast iron frames, one panel carrying the instruments for one machine. At the left of the switchboard are the feeder panels and at the right the synchronizing lamps, voltmeters, etc.

The lower section of the switchboard carries the machine circuit breakers, rheostats, machine switches and transformer switches. This portion is separated from the generator room by a perforated sheet iron partition. The upper section of the board is reached by two iron stairways.

The lightning arresters are mounted on the upper feeder panels connecting to the wire.

From this station there are two transmission circuits, each comprising three 8-mm. wires. One circuit serves for lighting and the other for the tramways.

For the lighting service of the suburbs the high tension current

is stepped down from 7,200 to 156 volts in 400-kw. transformers. In the center of the city is a 270-kw. transformer station where the pressure is reduced from 7,200 to 3,400 volts; and from this station current is distributed to five transformer sub-stations where the pressure is further reduced to 156 volts for distribution to the lighting system.

The railway high-tension transmission line terminates at the power station in Sofia, which is located on the Boulevard Marie Louise. At this station the generator room has an area of 416 sq. m. (4,450 sq. ft.) and the boiler room an area of 232 sq. m. (2,475 sq. ft.).

The boiler equipment comprises two Babcock & Wilcox water-tube boilers working under 150 lb. pressure. The stack for this installation is 40 m. (130 ft.) high and 1.5 m. (5 ft.) internal diameter.

High tension current (7,000 volts) drives directly two 400-h. p. synchronous motors operating at 265 r. p. m., each motor being direct connected by means of a flexible coupling to a continuous current 550-volt, 8-pole generator rated at 270 kw. When high-tension current is not available for driving these railway generators, the couplings connecting the motors are thrown out and the generators are driven (through similar couplings) by means of two 400-h. p. Sclessin steam engines, shown at the left in the interior view of the station.

The two generators are operated in connection with a storage battery, which is also used for starting the generators. A 50-h. p. motor generator set is also available for this purpose.

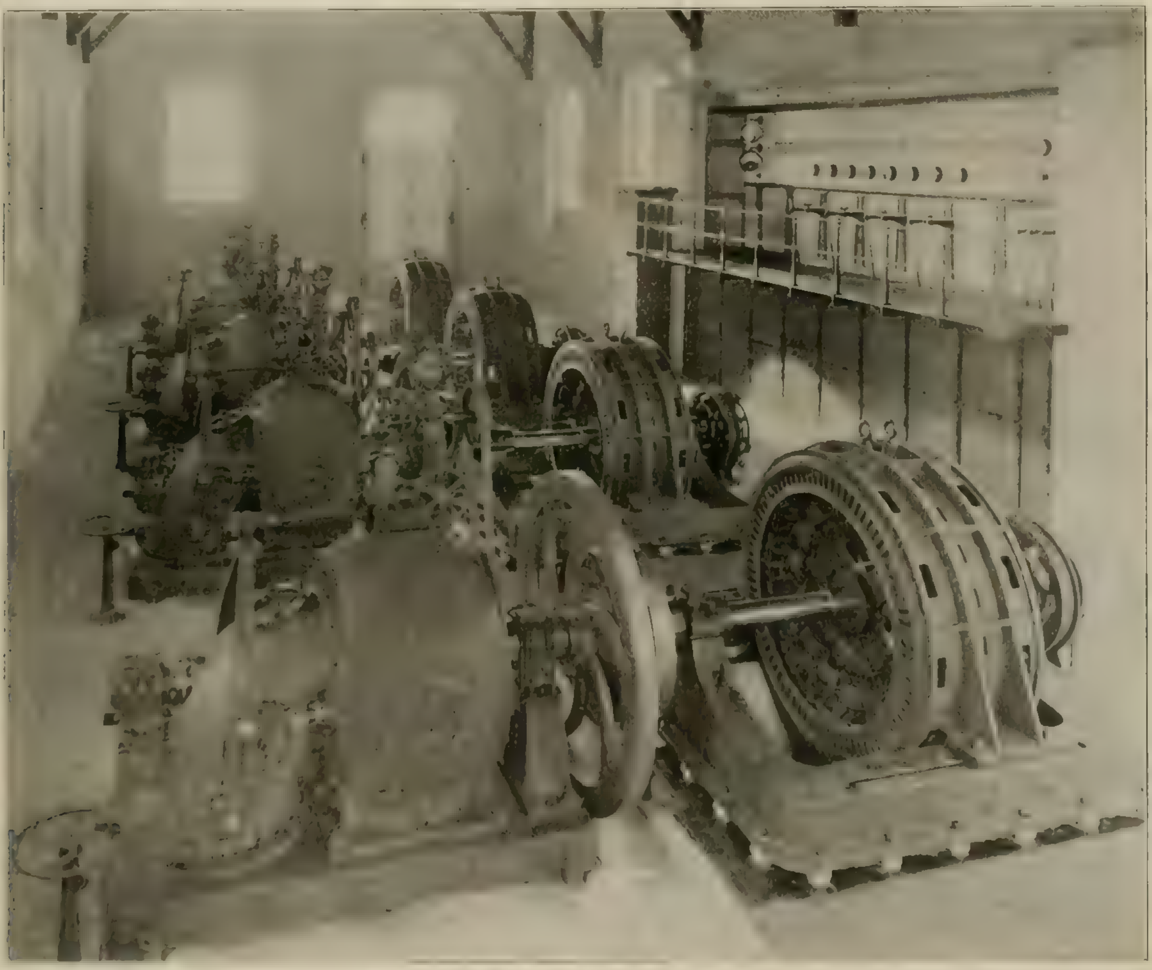
If desired the motors may be steam driven and supply current for the lighting system. In the operation of the plant no difficulty has been experienced by reason of sudden changes of load on the tramway, these being largely taken care of by the storage battery.

All the machines are supported on porcelain insulators, but are connected to ground in case of thunder storms.

The station switchboard has 9 panels, three of which are for a third generator not yet installed.

TRANSFER TABLE AT LOW TENSION STATION.

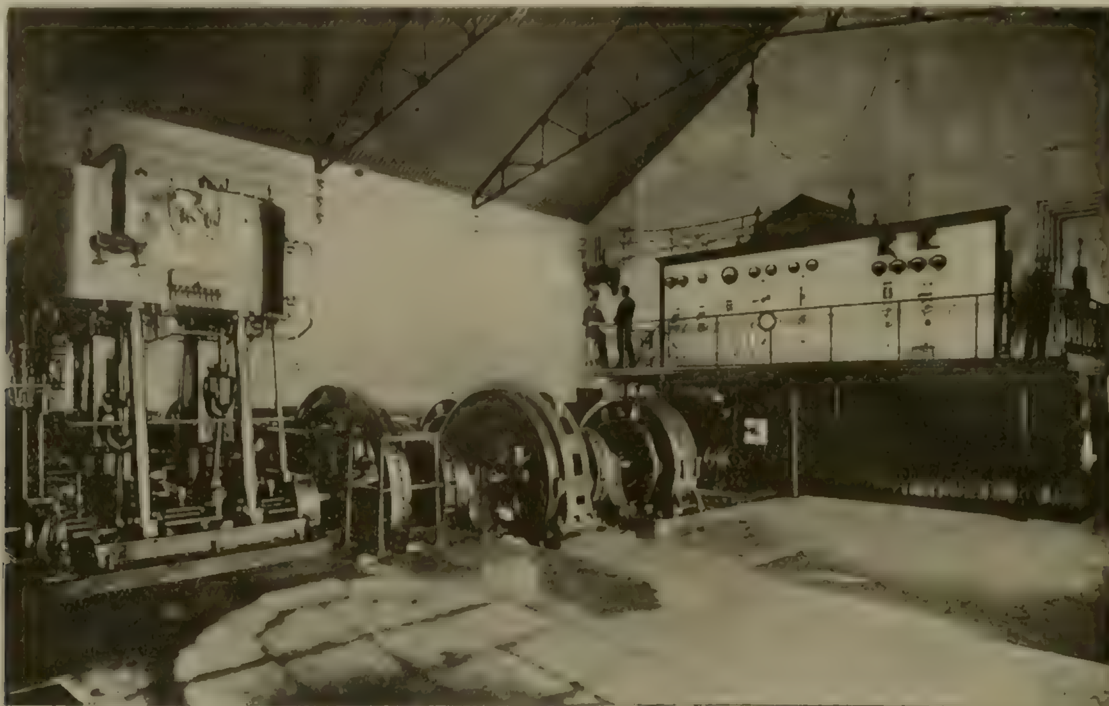
The working regulations of the tramways limit the speed of cars to 8 km. (5 miles) per hour in narrow streets and the more densely populated section, to 12 km. (7.5 miles) in other quarters of the town, and to 28 km. (17.5 miles) per hour on the suburban line to Knjajewo. At crossings and switches the speed limit is 5 km. Cars stop only at designated points.



INTERIOR OF HIGH TENSION STATION.

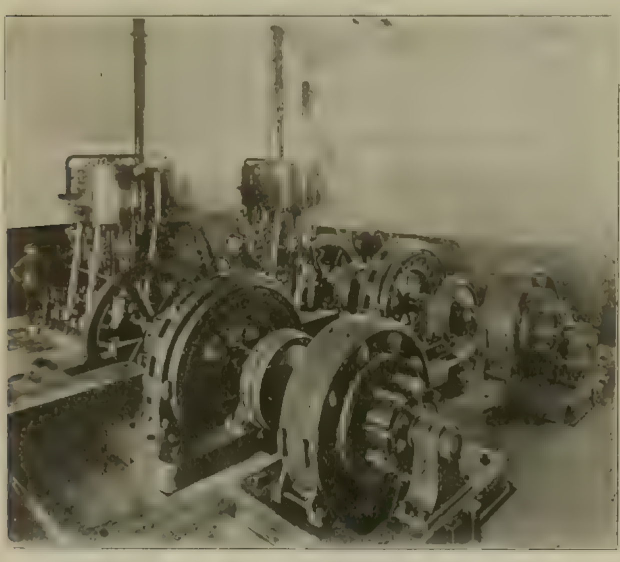
The fares within the urban district are 10 and 15 centimes (2 and 3 cents). The headway of cars varies from 7½ to 10 minutes.

The motor cars accommodate first and second class passengers and provide for 16 seats inside and 10 standing places on each platform. Each car is equipped with two 30-h. p. motors and series-parallel control. An automatic circuit breaker and a cut-out switch are installed on each car. For lighting five incandescent lamps are used, three inside and one on each platform.



SWITCHBOARD IN LOW TENSION STATION.

The tramways' system comprises two lines which cross the town diagonally, intersecting in the Place des Bains, three branch lines within the town limits and a line to the village of Kniojewo, 8 km. distant. The company gives a 15-minute service to this village and the line has been a paying one from the start, as there is considerable excursion business; the attractions at the village are the baths and the scenery.



ENGINE ROOM AND LOW TENSION STATION.

The road is laid with rails weighing 35 kg. per meter (70 lb. per yd.). Within the town the trolley wires are suspended from span wires fastened to rosettes on the buildings in narrow streets, and from brackets on posts in the wider streets, the same posts serving for street lights.

The car house which is near the power plant is designed to accommodate 40 cars. At the same site are the shops and store-room. One of the illustrations shows the transfer table.

New Rates of Fare on Interurban Line.

Beginning February 1st the Indiana Union Traction Co. put into effect a revised schedule of rates of fare on its interurban lines between Indianapolis and Muncie, Anderson and Marion and Alexandria and Elwood, including intermediate points, as follows: Single trip fares on the basis of 1½ cents per mile. Minimum cash fare 10 cents. Round trip fares on the basis of 10 per cent reduction from single trip fares. Two-hundred-and-fifty-mile mileage books good on all lines of the company will be sold for $3.25. One-thousand-mile mileage books good on all lines of the company will be sold for $12.50. Mileage books will be sold only by company cashiers at passenger waiting rooms. An additional seat fare will be charged on limited cars.

The 1,000-mile books are 2 13-16 x 5⅛ in. in size, the strip being 2 5-16 in. wide with the body printed in green ink. The 250-mile books are 2½ x 4¼ in. in size, the mileage strip being 2⅛ in. wide with the body printed in yellow ink. The cross lines and numbers on both tickets are in black. The books are of the standard form in extensive use on steam roads.

New Lines and Extensions Opened.

The new Broadway extension of the City Railway Co., of Dayton, O., was opened to traffic January 23rd. This line reaches a section hitherto without facilities.

The Scioto Valley Traction Co. has completed its new line between Columbus and Circleville, O., and now has two lines completed, the other being between Columbus and Lancaster, O. It will open its entire system April 1st. The third-rail system is used. Right of way has been secured to Chillicothe, O. A large power house has just been completed at Reeses, north of Circleville.

The Delta Light & Car Co., of Greenville, Miss., opened its new line in Greenville February 3rd. This makes the second street car company in operation in Greenville.

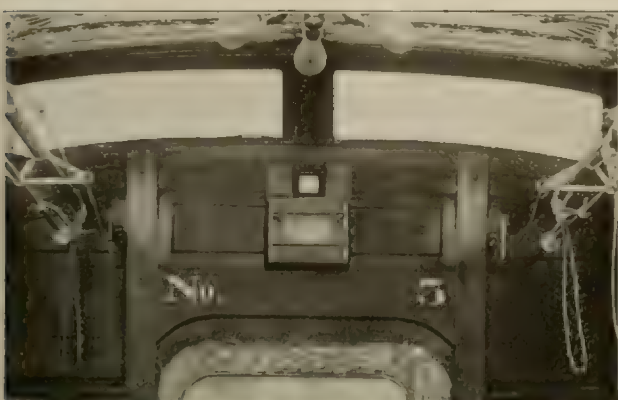
Car Meters for Electric Railways.

BY L. B. PEMBERTON, E. E.

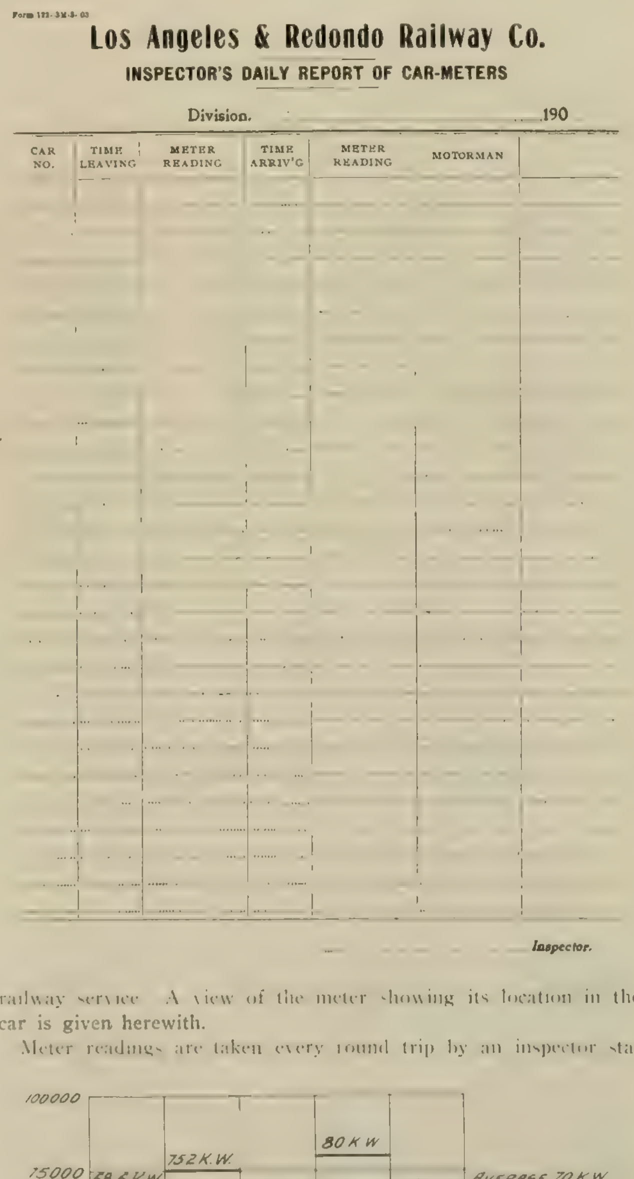
The advent of electric power for railway work at once proved such a convenience and economy over other methods of propulsion that its adoption for city and suburban travel soon became general. Under its worst conditions it is gladly welcomed as being far in advance of the cable or the noisy steam locomotive. In keeping with the improved types and consequent increased efficiency of electrical machinery there is a noticeable effort of late towards economy in its use and it is the purpose of this article to show the importance of such economy as evidenced by a proper check on the efficiency of the motorman.

Since the days of the mule car it has been the custom to provide the conductor with a fare register or to display it in some other conspicuous place to safeguard the company's receipts, while the motorman has been allowed unchecked to use what power he needed and waste as much more as he pleased. Thus, while the conductor was carefully gleaning nickels on the inside of the car the motorman on the front end might be counteracting his efforts by carelessly increasing the fuel bills at the power station. The standard of a good motorman has usually been his ability to get over the road and to refrain from maiming the general public or from running into the moving obstacles that happen to cross his path. His rank and rate of wages has been fixed by his years of service instead of being fixed by the intelligent and economical use of the power and the apparatus at his command. Nevertheless, it is well known that these gray hairs and long years of service, while they may lend dignity to an employe, often leave him in a well-worn rut from which it is almost impossible to extricate him. In other words, years of routine work are apt to develop into the careless feeding of the controller and a lack of that continual study required to make a run on scheduled time with the minimum amount of power.

In view of these facts, the management of the Los Angeles & Redondo Ry. upon electrically equipping this road, decided to install a permanent meter in each car. These meters are of the well-known Thomson recording type and designed especially for street railway service. A view of the meter showing its location in the car is given herewith.



SHOWING LOCATION OF METER IN CARS



Form 173-3M-8-03

Los Angeles & Redondo Railway Co.

INSPECTOR'S DAILY REPORT OF CAR-METERS

Division. 190

CAR NO.	TIME LEAVING	METER READING	TIME ARRIV'G	METER READING	MOTORMAN	

................................Inspector.

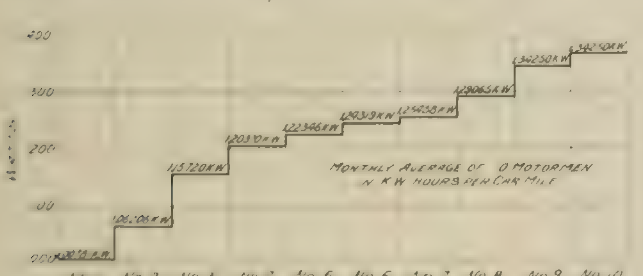


DIAGRAM NO. 1

Meter readings are taken every round trip by an inspector stationed at the end of the line and these readings are reported on a blank similar to the one used for fare registers. From the inspector's slips two reports are made monthly to the management.

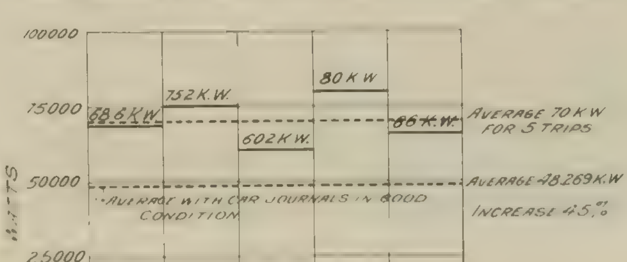


DIAGRAM NO. 2

one of these showing the number of car-miles made by each car during the month, the total kilowatt-hours used by each car and the average kilowatt-hours per car-mile; the other report showing the relative rank of each motorman, the total number of car-miles made by him during the month and his average kilowatt-hours per car-mile. The latter report is posted in the form of a bulletin in a conspicuous place and the attention of trainmen is called to it. The rivalry caused through each of the men trying to stand at

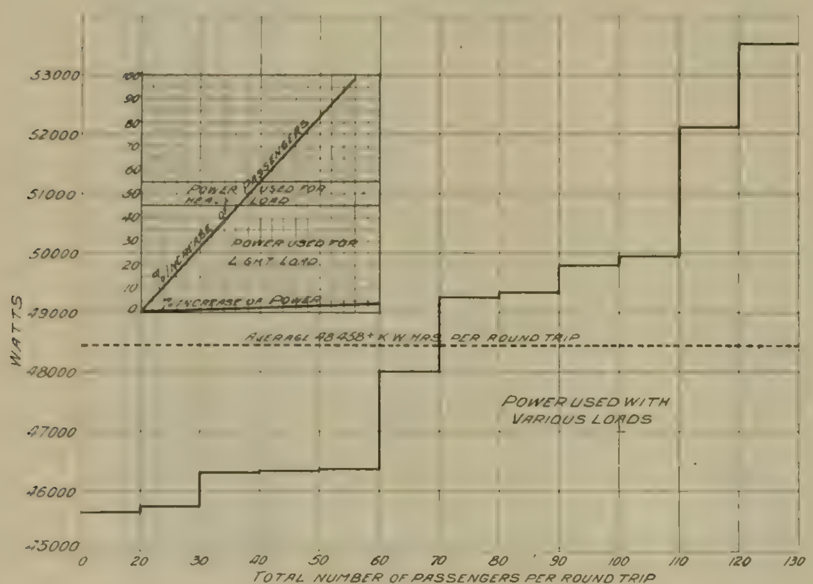


DIAGRAM NO. 3.

the head of the list has a very beneficial effect, and no effort is spared on the part of each man to accomplish this, especially if some reward or honorarium is offered as an incentive. Diagram No. 1 shows the monthly averages of 10 motormen. The difference in this case between the highest and the lowest being .33907 + kw. h. per car-mile, which is a difference of 33 1-3 per cent. As each of these motormen averaged over 4,500 car-miles per month motorman No. 10 used 1,526 kw. h. more than motorman No. 1, which, at 2½ cents per kw. h. would amount to $38.15, or nearly one-half of his month's wages. This difference would undoubtedly have been greater had there been no check on the motormen, or in other words, actual conditions on cars without meters would show a much higher percentage than the one given.

STANDARD CAR BUILT BY LOS ANGELES & REDONDO RAILWAY CO.

Besides being a check on the motormen the car meters have proved invaluable as a means of keeping both the electrical and mechanical parts of the car in first-class condition, as the meter readings will readily disclose any defect. It is not an uncommon thing to see a car running trip after trip with hot squeaking boxes and so long as the wheels continue to revolve no particular attention is paid to it except, perhaps, to inject a little more black oil or stir up the packing. Diagram No. 2 shows the effect of hot journals and new and improperly fitted bearings. A number of cars in this condition would certainly have a decided effect on the station output.

Another interesting point which individual car meters will help to determine is the best and most economical weight for electric cars. The tendency of car builders has been to add enormously to the weight, especially of interurban cars, until it is not uncommon to find equipments weighing from 30 to 35 tons. This is undoubtedly good practice from the car builders' standpoint, but whether it is the best scheme for the operator is a question that would seem to deserve some consideration. Some idea of the relation between live weight and dead load may be had from diagram No. 3, which is the result of a test covering 30 days and aggregating over 1,000 trips. The readings were segregated into twelve classes, the lowest division being where 20 or fewer passengers were carried per round trip and increasing by tens to 130 passengers per round trip.

The results show that only 17 per cent more power was used to haul 130 passengers than was required for 20, or fewer passengers, per round trip of 40 miles. An average of 45.659 + kw. h. per round trip of 40 miles was used for the lightest load, while the heaviest load required only 53.520 + kw. h.—an increase of 7.861 + kw. h. This would indicate that over 85 per cent of the actual power used during the heaviest traffic was necessary to overcome the dead weight of the car and while the number of passengers increased over 600 per cent per round trip the power consumption increased only 17 per cent. This ratio would, of course, not hold good in city traffic on account of the increased number of stops incident to increased traffic, and would be applicable only to interurban work. The type of car used in these tests is shown in one of the accompanying illustrations. The car is of the type built by the Los Angeles & Redondo Railway Co. in its shops at Redondo, Cal. These are equipped with two No. 38-B Westinghouse motors, K-11 controllers, and are mounted on No. 37 McGuire trucks. Their average weight is 34,550 lb. each.

New Third Rail Contact Shoe.

A patent has just been issued for a new form of third rail contact shoe, which the inventors believe will overcome one of the greatest obstacles in the operation of third-rail systems—that of securing good electrical contact in icy weather when the rail is covered with snow and sleet. It is, in effect, a combination winter and summer shoe, with interchangeable parts. Acting on the theory that ice that collects on the third rail forms on the flat, top surface of the rail, and not on the corners, the new shoe, as applied in winter, has been made with an inverted U-shaped base designed to fit over the rail, the divergent sides of the base making tangential contact with the rounded corners of the rail head. For use on clear rails the shoe is provided with a removable contact block which is inserted between the divergent sides of the base and makes contact with the flat surface of the rail just like the ordinary shoe.

An additional advantage claimed for the new shoe lies in the fact that the contact parts are removable and may be easily slipped out and new pieces inserted whenever they become worn.

The Aurora, Elgin & Chicago Railway Co. has tried the new shoe and the inventors have a letter from the president of the road which states that a car equipped with the new device maintained schedules during snowy and sleety weather, while cars which were not so equipped gave the company much trouble. The letter stated that the company would equip all its cars with it. The inventors of the new shoe are Messrs. George W. Brady and Lawrence R. Jones, of Wheaton, Ill.

Everett-Snohomish Interurban Line.

On Dec. 1, 1903, the Everett Railway & Electric Co., of Everett, Wash., started the operation of a new interurban electric road between Everett and Snohomish, Wash., a distance of nine miles.

The novel features (which we commented upon editorially in our issue for November last) about this road are that the electric cars replace steam trains, and the cars are operated over the track formerly used by the Northern Pacific Railway for its local trains, as a branch of its trans-continental system.

The fact that the results of this branch of the Northern Pacific were not entirely satisfactory to the officers of that road, and the activity of the Electric company in its project for an interurban electric road to parallel this track, started negotiations between President [illegible] of the Everett Railway & Electric Co., and President Mellen of the Northern Pacific, with the result that the Electric company has negotiated a lease of the track from the Northern Pacific for a term of years, undertaking to make connections with all Northern Pacific trains at Snohomish, and handle all its passenger, regular baggage and express business between Everett and Snohomish. Transcontinental passengers, baggage and express over the Northern Pacific are handled by the Electric company between Everett and Snohomish, using Electric company [illegible] on all through tickets.

An interurban waiting station has been built at the Everett end of the line, and large platforms have been put in at different stopping places between the two cities, there being six stops along the line, serving principally farming and fishing districts with a population of about two hundred people at each stop.

The cars to be used on this line consist of two passenger cars and one combination passenger and baggage car; one car was built at the shops of the Everett Railway & Electric Co., the other two being bought of the American Car Co. of St. Louis. The dimensions of these cars are as follows: Combination car, 43 ft. 8 in. over all; width 8 ft. 4 in.; passenger cars, 43 ft. over all; width 8 ft. 4 in.

The passenger compartment of combination car seats 40 people, baggage room 9 ft. long. Passenger cars seat 48 people. The cars have cross seats, and windows with double sash, the upper sash being stationary and the lower sash dropping down.

The cars are heated with the Consolidated Car Heater Co's. eight-heater equipments and are mounted on Brill No. 27-E-1 trucks with 5-in. axle; 33-in. spoke wheels, made by St. Louis Car Co. are used. Westinghouse No. 68 motors, four to a car, inside hung; Westinghouse K-6 controllers, and Westinghouse air brakes are used on all three cars.

TRESTLE OVER NORTHERN PACIFIC TRACKS AND JUNCTION OF THE STEAM AND ELECTRIC LINES

The operation will be under telegraphic train orders from the chief dispatcher of the Northern Pacific at Seattle, the card system being used on this block on account of the frequency of the service, and the Northern Pacific still operating its freight trains on this line.

The overhead trolley system is used, consisting of No. 0000 Fig. 8 trolley wire supported every 110 ft. by flexible brackets on side pole construction. The Ohio Brass Co's. material is used exclusively for the trolley construction. The poles are of cedar, 12 in. at the top, ranging from 38 ft. to 45 ft. long according to cut or fill, and are set 8 ft. in the ground and placed 6 ft. 4 in. from the rail.

The trolley wire is 23 ft. from the top of the rail, on account of danger to brakemen on steam freight trains if lower construction was used. On account of the distance of the poles from track, a 10-ft. bracket is used.

A 350,000 c. m. feeder cable is used to within a mile of the end of the line, taps being made every 1,000 ft., while another 350,000 c. m. cable is used to a point three miles from the power house, at the point of heaviest grade.

Two draw bridges are crossed by this road, necessitating a pivot pole in the center of the draw span carrying the trolley, feeder, and return current cables up over this pole high enough to allow the passage of vessels up the river. Taps are made off of these cables at the pivot pole to the trolley and track on the bridge.

STRAIGHT TRACK AND POLE CONSTRUCTION.

DOUBLE DECK TRESTLE 70 FT. HIGH

TYPICAL CURVE AND OVERHEAD WORK

The entire construction of this road had to be done while the Northern Pacific was operating an average of ten steam trains a day over it, making the work extremely difficult and hazardous.

On account of the danger involved and the novel construction, the work was done under the personal supervision of the company's general superintendent, Mr. R. P. Stevens.

The track was bonded with Ohio Brass Co's. flexible No. 0000 bonds, with compressed terminals, which were expanded into ⅞-in. holes in the rails. This bond is 12 in. long and placed under the angle bars. No. 0000 cross bonds of the same type are used every 1,000 ft.

DRAWBRIDGE WITH PIVOT POLE FOR OVERHEAD LINES

Power for the operation of this road will be furnished from the Everett power house of the Everett Railway & Electric Co., about ten miles from the further end of the line, and one mile from the Everett terminal. A complete description of this power house was given in the "Street Railway Review" of May 20, 1903.

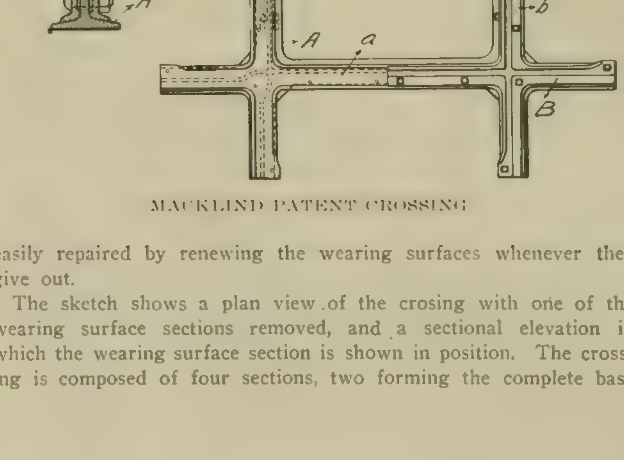
The fare from Everett to Snohomish one way is 25 cents, round trip tickets being sold for 40 cents, including transfer from or to any part of the city. Tickets are sold at stations at each end of the line and on the cars, cash fare receipts being given by the conductors. Five cents is charged between any two stations.

The results of the operation of this road will undoubtedly be eagerly watched, owing to the use of the track by the Northern Pacific freight trains and the resultant effect on the rail bonds; also because of the boat and Great Northern rail competition.

The officers of the Everett company are: President, J. T. McChesney; secretary, E. C. Mony; general superintendent, R. P. Stevens.

Patent Street Railway Crossing.

The accompanying illustration shows a railroad crossing which has been invented by Mr. William R. Macklind, vice-president of the W. D. Boyce Engineering Co., of St. Louis, and for which the inventor has been granted a patent. This crossing was designed for the purpose of obviating the jarring of the car, and the noise of the ordinary crossing, and also to procure a crossing that can be easily repaired by renewing the wearing surfaces whenever they give out.



MACKLIND PATENT CROSSING

The sketch shows a plan view of the crosing with one of the wearing surface sections removed, and a sectional elevation in which the wearing surface section is shown in position. The crossing is composed of four sections, two forming the complete base

and two forming the corresponding wearing surface. A A represent the base sections and B B the renewable wearing surface sections, the members of the respective sections being interchangeable. Each base section comprises a main rail section, a a, with longitudinal and angular extensions. The upper surfaces of the heads of the base are provided with grooves in which the wearing surfaces, B, are secured.

Each wearing surface has sections, b b, corresponding with the respective base sections, and the parts are so assembled that the joints between the base sections are diametrically opposed to the wearing surface joints. By this arrangement of grooves and joints the entire crossing is securely locked together by its own parts and held against spreading or twisting. The wearing surfaces are fastened to the base by means of headed bolts, b4, the wearing plates being clamped in such manner that the passage of cars does not tend to jar the bolts loose, and the bolt heads, being placed in the portions of the wearing surface which are not engaged by the car wheels, are saved from wear.

The crossing is grooved its entire length, but between the crossing rails and for a distance at each side the tread is of less height than the wheel flange, whereby at a suitable point before reaching the interesecting tracks the wheel flanges are gradually lowered until they ride upon the bottom of the grooves, and the wheel treads move entirely across the crosing above and out of contact with the treads of the wearing surfaces. When the wheels reach the opposite side of the crossing they gradually ride upon the upwardly-inclined treads of the wearing surfaces and thus carry the wheel flanges out of contact with the groove bottoms.

During the passage of the wheel across the crossings it is guided by the groove so that jarring or jolting due to sudden vertical inequalities at the track intersections, or to lateral displacements of the wheels, are declared to be impossible.

International Electrical Congress of St. Louis.

It is announced that according to present indications the International Electrical Congress to be in session at St. Louis, Mo., Sept 12-17, 1904, will be one of the most successful ever held, with respect to the membership and the value of the transactions. About 3,500 invitations have been issued by circular to persons or associations in North America, and from these 875 post card acceptances of membership have been received. About 350 similar invitations have been recently sent to other countries. It is intended to issue about 5,000 invitations in America in all and about 6,000 in foreign countries. Collection of fees has commenced, and upon receipt of a fee the member will be forwarded a certificate of membership, which will entitle him to attend all general and sectional meetings, and to receive a copy of the Transactions of the Congress, which will form one, and perhaps two large octavo volumes. The membership certificate is 8½ x 11 in. in size and printed on heavy paper of excellent quality.

Recently 280 special invitations were issued to prominent electricians and electrical engineers requesting papers for the Congress. Of these 146 were sent to foreign authors and 134 to American authors. There has hardly been time to receive replies from all those sent abroad, but 21 acceptances have been received to date, and 46 from North America. It is hoped that the Congress will convene with a full program, and that at least one-half of the papers will be from foreign countries. Although the papers for the Congress are specially solicited, all papers voluntarily submitted will be received, and if the plans will permit, will be allotted places in the official program.

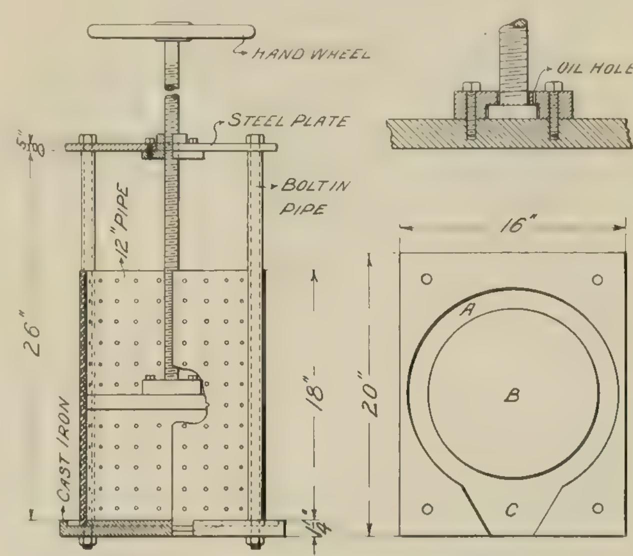
Petitions from the committee on organization and the president of the American Institute of Eectrical Engineers were filed with the Departments of State and Commerce and Labor, and with the National Bureau of Standards, urging that the foreign governments be invited to appoint delegates to the Congress in accordance with the lists allotted at the Paris and the Chicago congresses. Including the United States, these lists comprise 56 official delegates. These petitions have been granted and the State Department has instructed the diplomatic officers abroad to extend the invitations. Arrangements are being made with a view to perfecting plans of cooperation between the Congress and electrical societies in various parts of the world. Invitations have been extended to the members of the Congress to visit places of electrical interest on the journey to and from St. Louis.

The committee of organization of the Congress comprises the following: President, Elihu Thomson; general secretary, A. E. Kennelly; treasurer, W. D. Weaver; vice-president and chairman of executive committee, Bion J. Arnold; vice-presidents, C. F. Scott, Dr. S. W. Stratton, Prof. H. S. Carhart, Prof. W. E. Goldsborough. The list of section officers was published in the "Review" for November, 1903.

All communications should be addressed to the general secretary, Dr. A. E. Kennelly, Harvard University, Cambridge, Mass.

Simple Design for a Waste Press.

A simple form of waste press which can be readily made from material generally at hand in a machine shop is shown in the accompanying sketches. Only a few dimensions are given as the sizes will necessarily be varied to suit different conditions. A piece of wrought iron pipe 10 x 12 in. in diameter and about 18 or 20 in. in length is faced squarely at each end and drilled full of small holes of about ¼ in. in diameter spaced about 1 in. apart. A cast iron plate 1¼ in. thick is faced on top and a ring about 3 in. wide is cut out as shown at A so that the pipe will fit down over



DETAILS OF WASTE PRESS.

the projecting part D which holds the pipe central on the plate. The front of the plate is chipped out as indicated at C, the bottom surface sloping downward towards the edge so that the oil will run off the plate.

A piece of ½ in. or ⅝ in. steel plate is used for the top of the press and this is cut about the same size as the cast iron plate at the bottom. The two plates are held apart by four 1½ in. pipes used as distance pieces, through which run bolts holding the plates firmly in place. The steel plate is drilled to receive a cast iron bushing, which is threaded to receive the screw and is held in place by bolts or cap screws. The piston is made of 1-in. or 1¼-in. cast iron, and secured to this is another cast iron piece which is turned out to receive the head of the screw. The latter is upset and turned down to fit. The screw should be of 1¾ in. steel, or larger, and on its upper end it carries a hand wheel by which the press is operated. For securing the final pressure the leverage may be increased by putting a bar between the spokes of the hand wheel. The press may be conveniently mounted on iron brackets fastened to the wall.

Although cheap and simple in construction this press will be found to give good satisfaction and besides saving the waste will reclaim a considerable quantity of oil. The economy which may be effected by such a device is too generally understood to need further mention.

The Muncie, Hartford & Fort Wayne Ry. has installed a pouch mail service on its line, the first in that section.

New Power House of the Rhode Island Company.

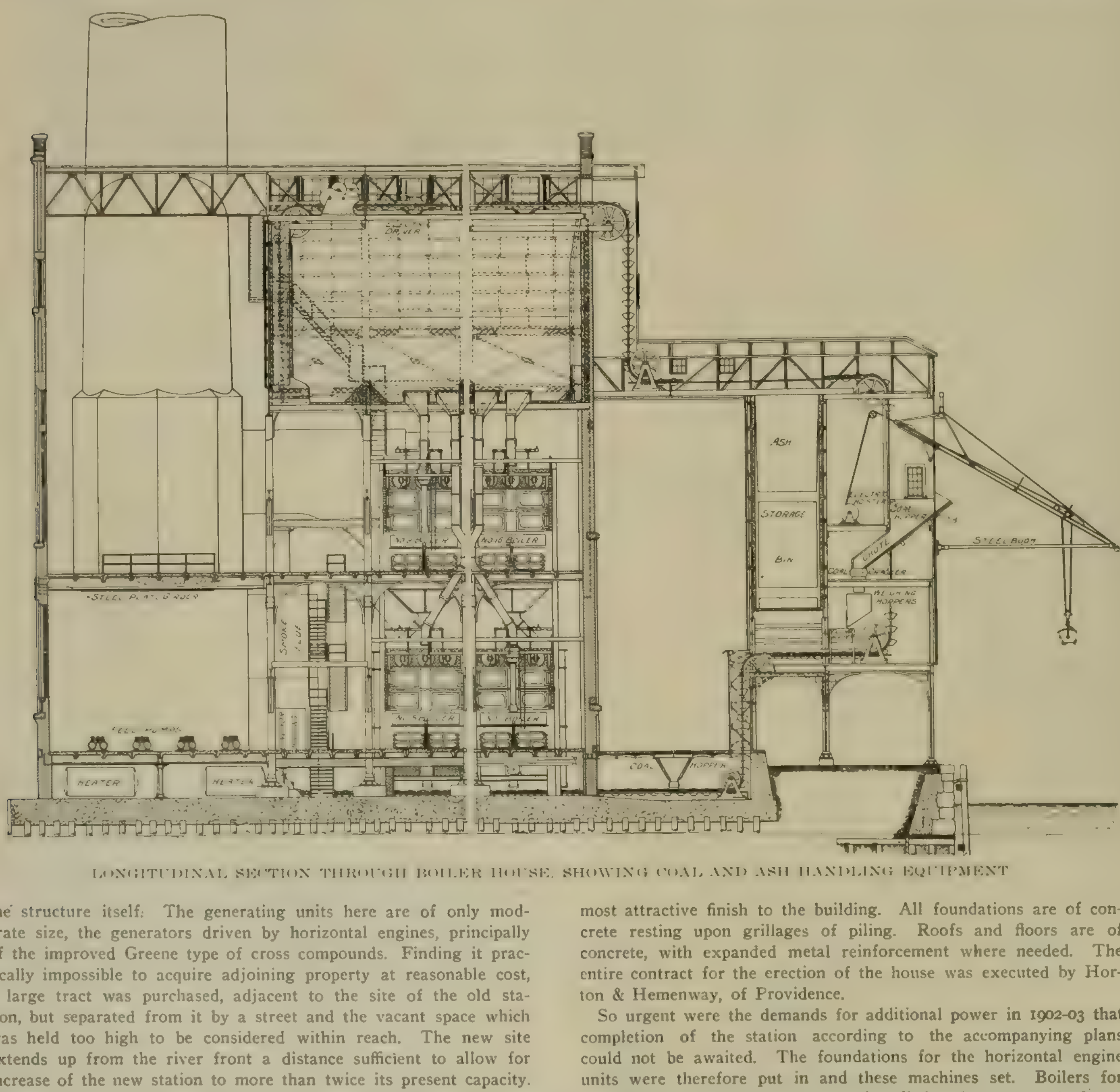
The Recently Completed Generating Station at Providence—Distribution System and Sub-station Equipment.

One of the penalties of prosperity and growth in almost any industry is the resultant necessity for increase of plant to meet the greater demands of the enlarged business. Like many another traction system, that of the Rhode Island Co., controlling and operating nearly the whole electric railway mileage within the limits of that small state, has been forced to greatly augment and partially modify its power generating and distributing system.

The old Eddy St. power house long since reached the limits of growth within the ground space available, and of equipment within the structure itself. The generating units here are of only moderate size, the generators driven by horizontal engines, principally of the improved Greene type of cross compounds. Finding it practically impossible to acquire adjoining property at reasonable cost, a large tract was purchased, adjacent to the site of the old station, but separated from it by a street and the vacant space which was held too high to be considered within reach. The new site extends up from the river front a distance sufficient to allow for increase of the new station to more than twice its present capacity. At the river end of this property has been erected the new Manchester St. power house, whose present appearance, construction and equipment are quite fully illustrated by the several engravings.

The main structure is 200 ft. long and 144 ft. wide. A longitudinal dividing wall separates the boiler from the engine room, giving the former an interior breadth of about 60 ft. and the latter a width of about 76 ft.; the inside length is 197½ ft. in both cases. The building is of brick, concrete and steel, fire proof to the smallest detail. Wired glass is generally used in the windows, and all sash, as also the doors and interior trim, are sheathed with copper. This copper sheathing is painted in some parts of the station; in more conspicuous portions it is planished and gives a most attractive finish to the building. All foundations are of concrete resting upon grillages of piling. Roofs and floors are of concrete, with expanded metal reinforcement where needed. The entire contract for the erection of the house was executed by Horton & Hemenway, of Providence.

So urgent were the demands for additional power in 1902-03 that completion of the station according to the accompanying plans could not be awaited. The foundations for the horizontal engine units were therefore put in and these machines set. Boilers for supplying the requisite steam were installed and a temporary frame house built to shelter the whole. The erection of the permanent structure was then proceeded with and has now been completed.

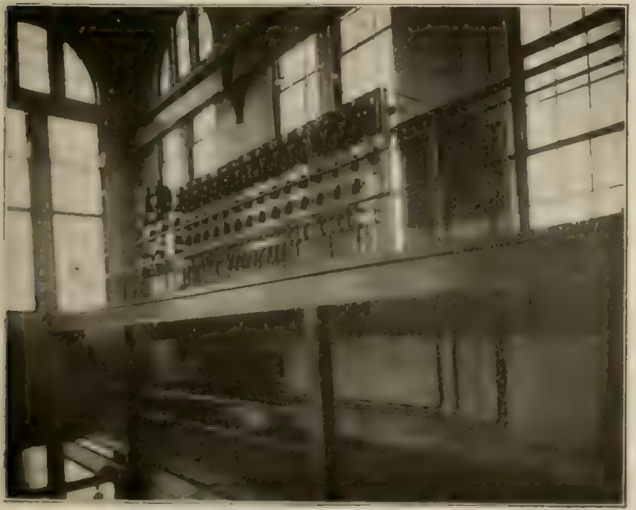


LONGITUDINAL SECTION THROUGH BOILER HOUSE, SHOWING COAL AND ASH HANDLING EQUIPMENT

What may possibly be nearly, if not quite, record time for work of this character, especially in consideration of the difficulties attendant upon such conditions as here existed, was made by the contractors in completing the building. In the early fall months of the year just past the work was only fairly started.

The original plans as approved by the former management of the company contemplated the use of horizontal engine units only, and three of these were installed. With changes of control came alterations of plans, the revised decision calling for vertical engines. This decision was, however, affected largely also by the desire to economize ground space and to use larger units without increase of floor area. The adoption of the vertical type for future installations involved also the necessity for double decking the boiler plant, and dictated the general arrangement of the station equipment as shown in the drawings. Of the three horizontal engines originally placed, two drive alternating current generators, while the third drives a direct current machine. The alternator units will remain; these are to constitute the complete alternating current generating equipment within the present structure. The third horizontal unit, a direct current machine, will eventually be removed to the other power house and replaced by a vertical unit, as contemplated by the plans. One vertical unit is already erected, this being the middle one of the three indicated on the plan. The second unit will occupy the space reserved for it at the end of the room The third unit will not be placed at once; it will, however, be similar to the other two, and all three will generate direct current.

The engine room interior is nicely finished, is well lighted and presents an appearance of considerable attractiveness. The brick walls are enameled in green for a dado height of about seven feet, above which they are finished in light cream enamel. The windows are in two separate rows, the upper ones having vertically sliding sash mechanically operated in groups by handwheels at convenient height above the floor and connected with the windows by bevel gears and light shafting. Artificial illumination is by enclosed arc lamps suspended from ornamental brackets attached to the crane runway columns, which are spaced 17½ ft. on centers at each side of the room. The runway extends full length of the room, and carries a 25-ton three-motor electric traveling crane. At one corner of the room, adjacent to the first horizontal generating unit is a winding stairway leading to the second floor level of the boiler



DIRECT CURRENT SECTION OF SWITCHBOARD

room. From this level a wall ladder affords access to and from the crane operator's cage.

Against the boiler room wall is a large clock, and below this a gong which is struck every 20 minutes by electrical connection with the clock mechanism. The sounding of the gong is a signal to the oilers to make the rounds of the machinery, attending to the hand lubricated parts. This is a novel feature whose value is considerable, not alone as a reminder to prevent excuse for negligence, but also as an aid to economy and efficiency by inducing regularity in the work of lubrication and the use of the lubricants.

The horizontal engines are cross compounds, with cylinder diameters of 32 and 64 in., and a stroke of 54 in. They were built by The Filer & Stowell Co., of Milwaukee, Wis., for whom Mr. T. W. Phillips is eastern representative, with headquarters at Providence. These engines are of the maker's recently developed type

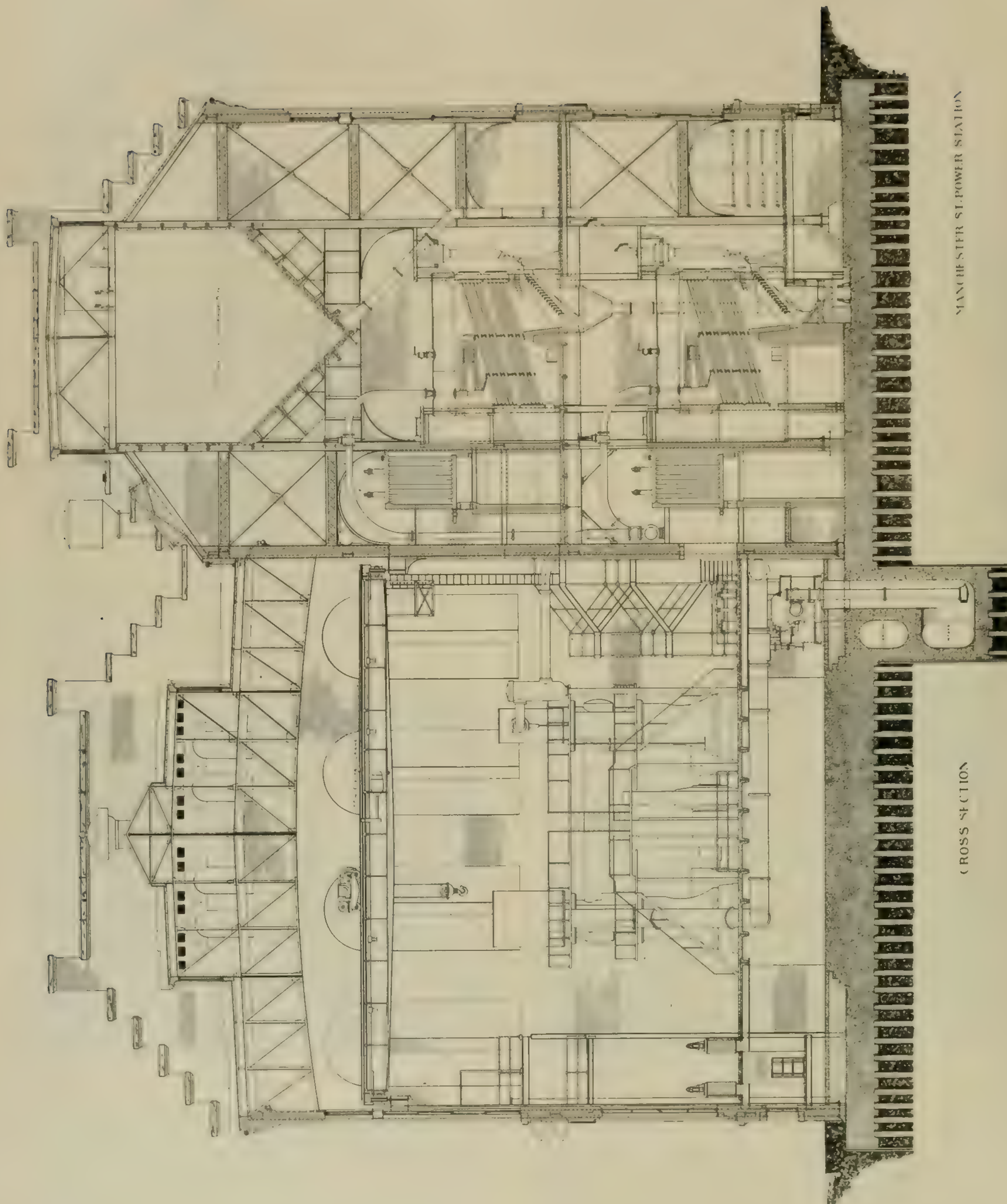
EXTERIOR VIEW OF MANCHESTER STREET STATION.

wherein no wrist plates are used for operating the valves. Double eccentrics are provided for both cylinders, and the valves are actuated directly by the eccentric rods; the admission valves by one rod, the exhaust valves by the other. The alternating current generators are of the General Electric revolving field, fly-wheel type

ALTERNATING CURRENT SWITCHBOARD AND GALLERIES.

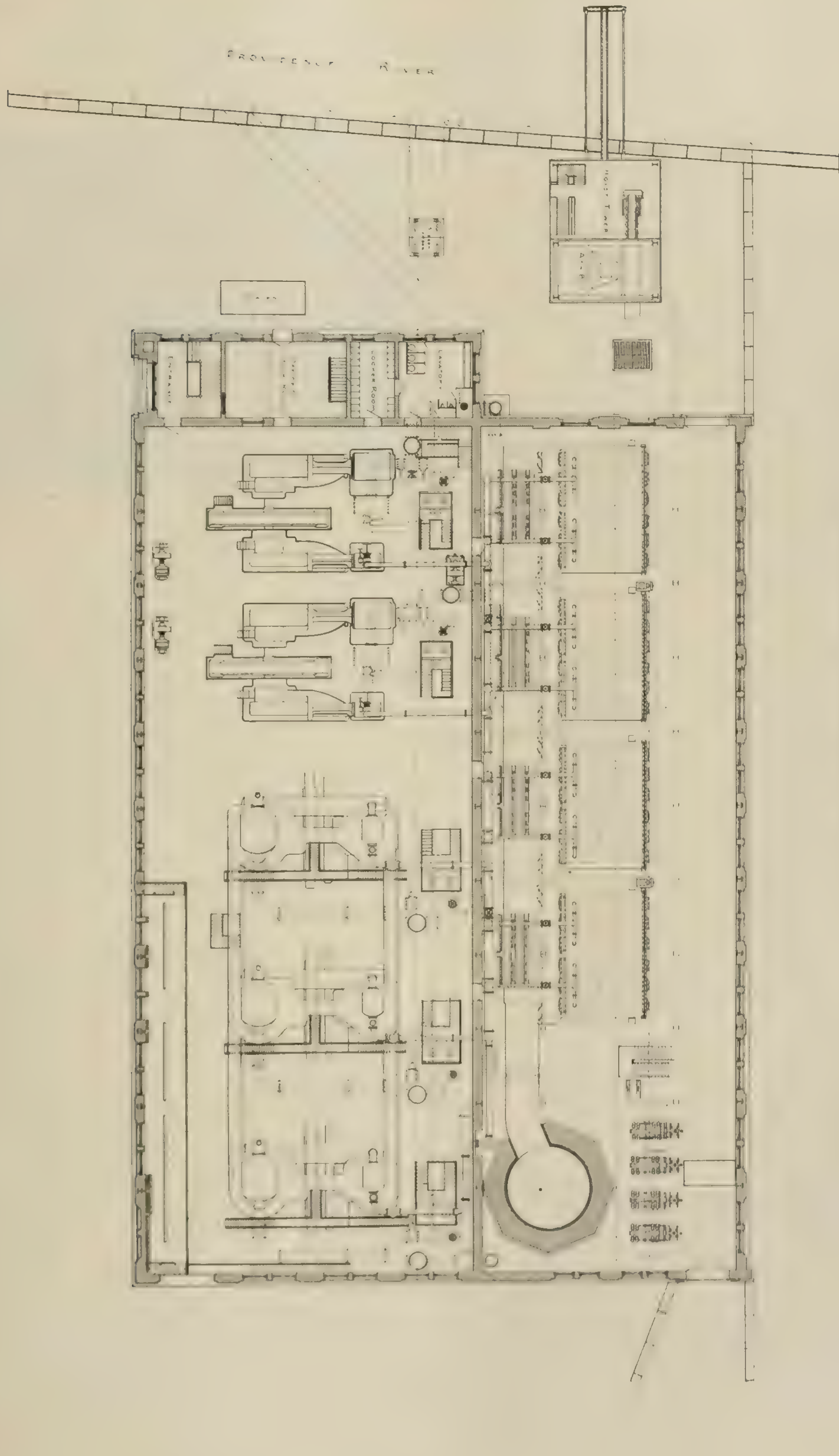
of 1,500 kw. rated capacity, rotated at 94 r. p. m. and generating at 11,000 volts, 25 cycles, three phase. The third horizontal engine drives at 90 r. p. m. a G. E. direct current machine of 1,600 kw. capacity, 600 volts. A separate fly-wheel is mounted upon the engine shaft.

The vertical engine is a Westinghouse Machine Co. cross compound, 42 and 86 x 60 in. in cylinder dimensions, and running at 75 r. p. m. The generator is a 2,500-kw. G. E. machine operating at 600 volts, direct current. As shown in the illustration, it is planned that when the other similar units are installed their footway galleries shall be connected at each level, so that communication



MANCHESTER ST. POWER STATION

CROSS SECTION



PLAN OF MANCHESTER ST POWER STATION

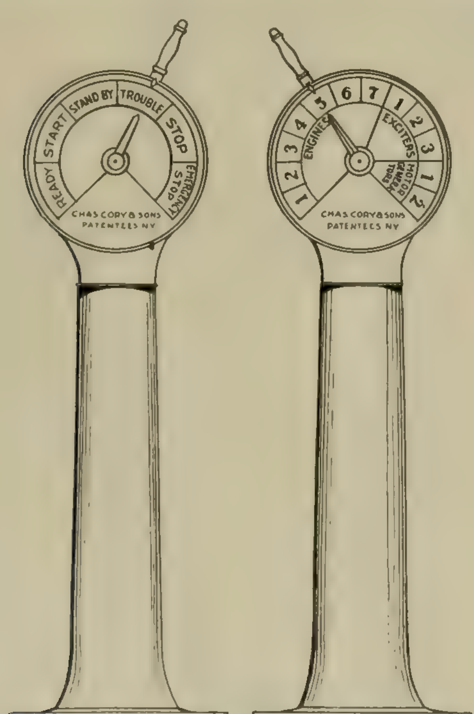
from one engine to the others may be had without necessity for decending to the floor.

The electrical auxiliaries include two motor driven exciters, which, like the other electrical apparatus, were furnished by the General Electric Co. Each has a 75-h. p. induction motor, driving at 750 r. p. m. a multipolar exciter generator giving direct current at 125 volts. There is also a marine engine exciter set, consisting of a G. E. vertical marine type engine, 11 x 8 in. in cylinder size, driving a 30-kw. exciter generator at 305 r. p. m. This engine driven exciter is placed adjacent to the boiler room wall, for convenience in making steam connections. For the motor driven exciters there are placed in the basement six 25-kw. G. E. type H. transformers for reducing the generated voltage of 11,000 down to 460 for the induction motors.

The switchboard is in two independent sections for the alternating and direct currents, and is placed in a high gallery along the outer wall.

The illustrations show the sections as seen from the upper gallery of the vertical engine, close to the low-pressure cylinder. All necessary instruments are mounted upon each section, the arrangement being entirely simple and quite complete. Placed upon the floor in front of each direct current generator is a single switchboard panel carrying positive and equalizer switches. The negative switches are at the main switchboard in the gallery. Supported above the engine room floor below the switchboard galleries, are nine G. E. electrically operated oil-break switches for the 11,000-volt alternating current. Space is provided for three more if wanted in the future. All cables and wires leading to and from the switchboard gallery pass through tile ducts extending up from the basement within the building wall. Thus the electrical connections are removed from sight and protected from injury, adding greatly to the interior appearance of this portion of the room. A winding iron stairway affords access to the two switchboard galleries from the engine room floor.

Signal communication between the switchboard attendant and



CORY SHIP TELEGRAPH SYSTEM AS APPLIED TO SWITCHBOARD—ENGINE ROOM SIGNALING.

the engineer in charge upon the floor below is provided for by installation of a Cory ship telegraph system, furnished by Chas. Cory & Son, 278 Division St., New York. This system includes two instruments at each level, one of each pair indicating the several engine units by number and the other showing the order to be executed. Manipulations desired or made may be transmitted either to or from either station at the switchboards or on the engine room floor, a gong sounding to attract attention whenever a change in the setting of the apparatus is made. The installation in the present case is an adaptation of the regular ship telegraph to the needs of the power house by alteration of the dials. Connections between the stations are mechanical, by means of rods and chains. One of the accompanying illustrations shows a pair of the signalling instruments as installed in this station. The diameter of the dial on each

INTERIOR OF SUB-STATION AT RIVERVIEW.

is 15½ in. and the instruments are finished in brass and composition.

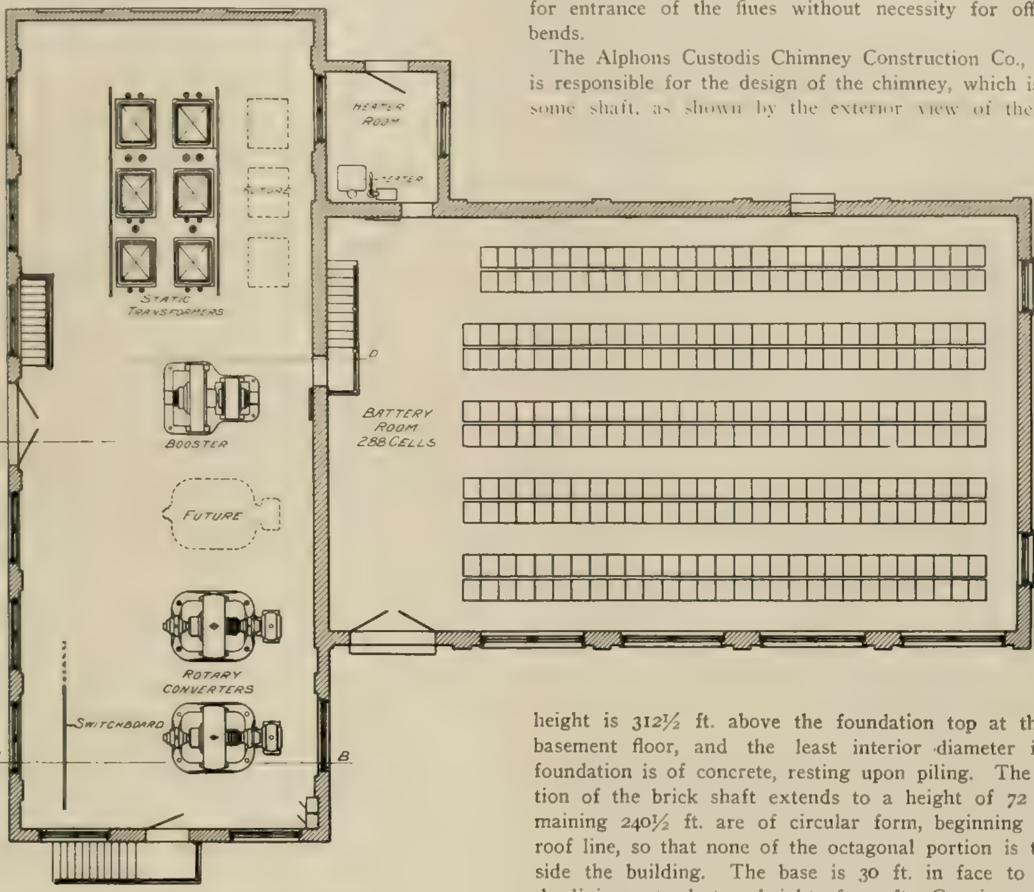
The exhaust steam from each main engine unit is piped either to the atmosphere or to a Blake Admiralty type condensing set. There are two atmospheric exhaust pipes, one out of doors at one end of the boiler house, the other inside at the other end near the chimney. Gate valves of the Chapman make are used in the exhaust piping, as also elsewhere throughout the plant. Each condensing set consists of a jet condenser in connection with a twin vertical steam air pump. For each horizontal generating unit the pumps are 16 x 40 x 24 in. in size; for the vertical units they are 16 x 48 x 24 in. The setting of the condensing apparatus is best seen from the sectional view, where are shown in section the intake and overflow conduits leading from and to the Providence River and extending full length beneath the engine room. All oily drippings from the engines and auxiliaries are caught and drained by gravity to an isolated oil room in the basement below the office and stock room at the river end of the engine house. Here the oil is filtered and then elevated by a Mason steam oil pump to a wall tank overhead at the boiler room side of the engine room. From the tank leads a piping system by which the oil cups for all main bearing surfaces are filled. The whole system of piping for the drips and oil feed is of brass.

The steam generating equipment consists of 515-h. p. Babcock & Wilcox water-tube boilers set in batteries of two each. Eight of these boilers, or four batteries, are provided for on each floor; the full complement is installed and in use on the first floor, but only two boilers, or one battery, are thus far in on the second level. Each boiler is of 515 h. p. rated capacity and is designed for 160 lb. per sq. in. working pressure. It is at this pressure that steam is generated and used throughout the station. The boiler tubes are 4 in. in diameter and 18 ft. long. There are three drums per boiler, these made of open hearth steel of 56,000 lb. per sq. in. tensile strength, 7/16 in. thick. The drums are 20 ft. 4 in. in length. Superheating coils are fitted to some of the boilers and are provided for in all; it is expected that they will be used on all boilers later on.

Along the boiler room side of the dividing wall and at about the level of the boiler drums extends full length of the boiler room a steam header main, to which leads the supply pipe from each boiler and from which lead the steam pipes to the several engine units. This main may be divided into three sections by closing two gate valves; thus any one of the three sections may be isolated when desirable, or operated independently of the others. All high pressure piping is of steel with steel flanges welded on. All

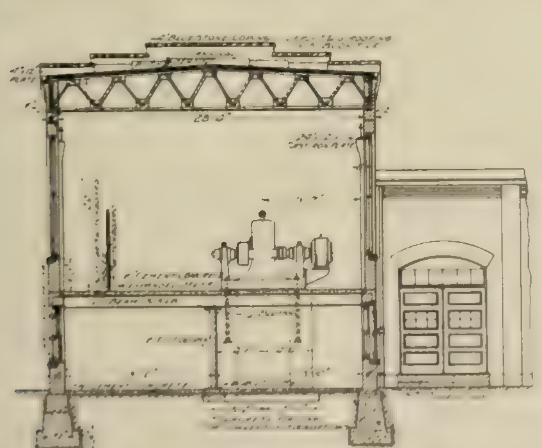
turns, so far as possible, are made at long radius and generally with bent piping. All fittings are of open hearth cast steel.

Behind each battery of boilers on both banks is placed a Green economizer. The method of setting the economizers in connection with the flues to the chimney is such that the gases from the two boilers of a battery may be forced either through or past the economizer in order to reach the main flue, the control being by means of a system of dampers. For passage through the economizer the gases leaving the boilers enter the economizer chamber, traversing the latter and reaching the by-pass flue beneath by deflection downward at the right-hand end. When it is desirable to cut out the economizer, the gases may be allowed to enter directly the downtake to the flue. By closing the dampers at the entrance of the economizer chamber and the deflecting damper at the right, the economizer chamber may be entered from the cleaning-out door, leading from the passageway behind the economizer setting. For the battery nearest the chimney on each floor no downtake to the by-pass flue is required, as the dampers at the right-hand open directly into the steel flue leading to the chimney. The hexagonal base of the chimney is set with two of its long diameters parallel to the building walls, thus presenting a flat face for entrance of the flues without necessity for offsets or sharp bends.

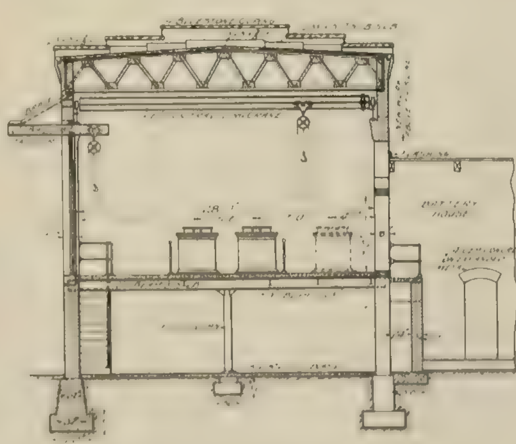


PLAN OF SUB-STATION AT RIVERVIEW.

The Alphons Custodis Chimney Construction Co., of New York, is responsible for the design of the chimney, which is a very handsome shaft, as shown by the exterior view of the station. The height is 312½ ft. above the foundation top at the level of the basement floor, and the least interior diameter is 16 ft. The foundation is of concrete, resting upon piling. The octagonal portion of the brick shaft extends to a height of 72 ft and the remaining 240½ ft. are of circular form, beginning just below the roof line, so that none of the octagonal portion is to be seen outside the building. The base is 30 ft. in face to face diameter; the lining extends to a height of 100 ft. Openings are provided for entrance of flues from additional boilers which may at some time be placed in an extension of the plant. The present flues require openings 8 ft. wide and 17 ft. high to the top of the semicircular upper portion. The under side of the flues at the first floor enter at a height of 21½ ft. The walls of the chimney start with a minimum base thickness of 52 in., and at the start of the circular portion the thickness is 30 in. The usual cleaning-out door opens into the basement. The top of the shaft is finished with a cap ring of ornamental design. This cap ring is made of cast iron in channel section, ½ in. thick. The upper slope of the ornamental swell below the cap is covered with special terra cotta plates, 1 in. thick and with overlapped joints. Suitably placed in and below the swelled portion are embedded three reinforcing bands of 5/16 x



SECTION OF SUB-STATION ON A B



SECTION OF SUB-STATION ON C D

3-in. iron. Ladder rungs are placed on the outside, their ends firmly secured into the brick work. The total weight of the chimney upon its foundation is estimated at 2,080 tons.

The boilers are fed by four 14 x 18 x 15 in. Worthington duplex pumps, outside center packed plunger type. A double system of steam piping is provided for these pumps, so that they may be supplied with steam from either of the two end sections into which the main header may be divided. All clean drips and condensation water from various parts of the station are returned to the boilers by an installation of the Holly system. In the basement, beneath the feed pumps, are placed two heaters to which are piped all oily drips and condensation, and from them these are allowed to run to waste after having passed through the internal tube system and yielded all their available heat to the cold feed water surrounding the tubes. These heaters thus save the heat which would otherwise escape, and without the necessity for attempting to separate the oil and use the water again in order to save the heat in it. The volume of water about the tubes is so large, and the velocity of the drips through the tubes is so low, that the conditions are favorable for reduction of the drips temperature very closely to that of the entering feed water.

Coal and ashes are handled with very slight labor cost. A 3,000-ton storage bin of concrete and steel occupies the greater portion of the space above the second bank of boilers. This bin extends the full length of the four batteries of boilers and has spouts leading from it to the front of every boiler in both decks. These fixed spouts terminate at cut-off valves or gates above each boiler front, whence coal is dropped through chutes to the hoppers of the Roney stokers by means of trolley spouts, one for the two boilers of each battery. A continuous pivoted bucket conveyor passes above the coal bin, descends to the basement near the feed pumps and returns underneath the first floor boilers to the river end of the station, where it rises by the path indicated in the engraving. Coal brought in wagons may be checked in weight by the platform scales at the office and then be dumped into the hopper just outside the boiler house and directly over the conveyor. Thus coal delivered by wagon may be elevated and deposited in the storage bin. The usual method of receiving fuel will be by barge towed to the river front and unloaded by trip buckets raised by an electric hoister and dumped into a hopper, whence a chute leads to a crusher and weighing hopper below. From the weighing hopper to the filling hopper and thence to the conveyor and the storage bin finishes the process of receiving the fuel.

From capacious hoppers into which the stokers deposit the ashes, spouts lead directly to the basement and terminate in cut-off gates directly over the conveyor. Whenever the conveyor is not handling coal, ashes may be received from these spouts, either continuously or periodically and carried to the large concrete and steel ash storage bin in the coal tower at the wharf. Thence they may be disposed of as convenient, wagons being set underneath the hopper and filled directly from it.

The bucket conveyor and entire coal and ash handling machinery is actuated by an electrically operated driver above the coal storage bin at the chimney end. The turn at the basement level is made around a take-up curve, arranged to slide horizontally so as to keep the whole circuit properly taut in compensation for wear and expansion. Where the conveyor descends through both floors, sheet steel guard housings 7½ ft. high are placed around the floor openings.

Attention should be called to the locker and lavatory accommodations supplied for the comfort and convenience of the station operatives. The engineers, electricians and office attendants have free access to the rooms adjoining the office and opening off the engine room. In the basement below are similar rooms for the boiler room employes and laborers. The shower bath in the lavatory is noteworthy as an unusual feature.

Sub-Stations.

Five sub-stations are required for the distributing. These are at Westcott, southwest from Providence, at Riverview to the south, at Barrington to the southeast and at Pawtucket and Attleboro at different distances off to the northeast. In connection with the sub-stations at Pawtucket, Riverview and Westcott, storage batteries are installed. The Riverview station is typical of all three in which storage batteries are used, and it is of this station and its equipment that drawings and views are shown. The sub-station buildings are all constructed of brick, concrete, and steel, with roofs of concrete and expanded metal, supported by steel trusses. The machine rooms are supplied with 6½-ton hand traveling cranes, fitted with chain hoist trolleys. Extending outward from the main door of the machine room is in each case an outrigger of 10-in. I-beam for use in hoisting machinery and other heavy loads by means of a chain hoist trolley.

Rotary converters and static transformers used at all sub-stations are similar in both size and type. All were furnished by the Westinghouse Electric & Manufacturing Co., Pittsburg, Pa. The rotary converters are of 400-kw. capacity and the static transformers are rated at 150 kw. For each rotary converter at any station there are three of these transformers. Attleboro has one converter and three transformers, at Pawtucket there are three converters and nine transformers, at Barrington two and six respectively, at Riverview also two and six and at Westcott three and nine. Provision is made at Riverview, as shown in the plan of that station, for future installation of a third converter and a corresponding set of three transformers. The current generated at the main power station at 11,000 volts, three-phase, is transformed and converted to direct current at 600 volts for delivery to the feeder lines.

The storage battery rooms at the three stations, where such equipment is used, are quite independent from the machine rooms. The 288 cells in each station are placed in five double rows of 29 cells for each row with the exception of two. The battery room floor is of wood arranged in skeleton construction with footways between the rows extending the full length of the room. The batteries, which were furnished by the Electric Storage Battery Co., of Philadlphia, Pa., are charged through G. E. boosters, one of which is placed in the machine room of each storage battery sub-station. The sub-station equipments in all cases include also the necessary switchboards for both alternating and direct current apparatus. "Stick" circuit breakers are used in all sub-stations. The main foundations extending upward from the basement floors are of the box form, leaving the central portions open for free access to the terminals of the cable connections.

In connection with each station there is provided a heater room, as shown in the engraving, in which is installed the boiler of a steam heating system for warming the whole structure.

Street Railway Guide to New Orleans.

The New Orleans Railways Co. issues gratis a condensed folder, entitled "Tourists' Guide to New Orleans—What to See and How to See It," giving points of interest in and about the city, together with railroad stations and places of amusement. The folder is printed in red, black and green and contains, besides a map which shows the car lines, parks, transfer points, steam railroads and depots, a description of the New Orleans Railways Co's. cars and routes, a schedule of "owl cars," half-tone views of public buildings, parks and other attractions, as well as a brief sketch of same, the location of the principal buildings, monuments and cemeteries, and a chapter devoted to "rides which every tourist should take." When fully opened the folder is 14 x 21 in. in size; folded for the pocket, it is 3½ x 7 in. It is distributed by the railway company and may also be procured at the leading hotels and restaurants. It is readably compiled and attractively illustrated.

The New Orleans Railways Co. and its subsidiary companies operate over 187.4 miles of track and have a total of 666 cars now in use, of which 591 are closed cars, 51 open cars, 17 work cars and 7 sprinkling cars. The trackage and cars are divided among the various companies as follows: New Orleans City Railroad Co.—Miles of track, 115; closed cars, 369; open cars, 39; work cars, 7; sprinkling cars, 4. New Orleans & Carrollton Railroad, Light & Power Co.—Miles of track, 35.5; closed cars, 122; open cars, 12; work cars, 7; sprinkling cars, 1. St. Charles Street Railroad Co.—Miles of track, 17; closed cars, 72; work cars, 3; sprinkling cars, 1. Orleans Railroad Co.—Miles of track, 11.2; closed cars, 28; sprinkling cars, 1. New Orleans & Pontchartrain Railway Co.—Miles of track, 8.7; cars, 5.

The New Orleans Railways Co. issues a flyer, 3½ x 6 in., containing condensed facts concerning New Orleans' industrial, geographical, climatical, municipal and financial features and facilities.

Accidents.

January 20th a car on the Swissvale and Rankin branch of the Pittsburg Railways Co. jumped the track, owing to slippery rails, and went over a 25 ft. embankment, injuring 28 persons, but none fatally.

January 20th a car on the Union Ave. division of the St. Louis & Suburban Railway Co. jumped the track while going at a high rate of speed and the motorman was thrown over the front gate and in front of the wheels. He was killed.

January 21st a freight car on the Anderson-Marion division of the Indiana Union Traction Co. collided with an extra car and the trainmaster, who was acting as motorman on the extra car, was fatally injured. The motorman of the freight car and another employe were injured, also.

January 23rd nine persons were injured, one seriously, in a collision between two Chicago City Railway Co. cars at 16th and Clark Sts., Chicago.

January 24th a Scranton Railway Co. car jumped the track near Carbondale, Pa., and went over a steep embankment, injuring 14 persons.

January 26th a Rockford & Interurban Railway Co. car was struck by a Chicago & Northwestern Ry. engine in Rockford, Ill. The car was wrecked, but no one was injured.

January 27th two St. Louis Transit Co. cars collided at Broadway and Meramec St., St. Louis, and 30 persons were injured, two fatally. It was foggy.

January 28th a Union Railway Co. car in the Bronx, New York City, ran into a six-horse truck while going down a steep hill and two cars which followed crashed into the first car and each other. Four persons were seriously hurt and the cars were badly damaged.

January 30th there was a rear-end collision between two Twin City Rapid Transit Co. cars in St. Paul, Minn., resulting in injury to four persons. The cars were partially telescoped.

January 31st a Lake Shore Electric Railway Co. limited car struck a local car of the same line east of Norwalk, O., and six persons were injured, none fatally.

January 31st a theater special car and a Camden & Trenton Railway Co. regular car collided at Burlington, N. J., during a dense fog. Five persons were seriously injured. There were 115 passengers on the special.

February 3rd a conductor was fatally injured in a collision between a passenger car and a construction car on the Philadelphia & West Chester Traction Co's. line near Manoa, Pa.

February 5th a Knoxville Traction Co. car jumped the track on the Lonsdale line three miles west of Knoxville, Tenn., and four persons were injured.

February 7th a Public Service Corporation car jumped the track in Plainfield, N. J., and struck a tree. The motorman was killed and three passengers were injured.

February 8th there was a rear-end collision between two Fifth Ave. trains on the Brooklyn Rapid Transit Co's. elevated system, and six persons were injured.

February 7th a Chicago & Northwestern Ry. freight train struck an East Omaha Street Railway Co. car at Omaha, Neb., and two persons were injured, but not fatally.

January 26th a Cottage Grove Ave. cable grip car of the Chicago City Railway Co. "ran away" on Wabash Ave., Chicago, and could not be stopped until the company shut off the power at the power house. Five persons were injured and two wagons wrecked en route. The gripman remained at his post, although the grip car was practically demolished. For some reason the grip mechanism refused to respond when the gripman tried to stop the car at Randolph St. and before turning into Wabash Ave.

February 8th a Detroit United Ry. city car and a Northwestern car collided in Detroit, Mich., and six persons were injured, one seriously.

February [illegible] two persons were killed and nearly 75 injured, 25 seriously, in an accident at Frostburg, Md. A Cumberland & Westernport Electric Railway Co. car ran away on a grade, jumped the track and struck a telegraph pole.

February [illegible] an Eastern Ohio Traction Co. car ran away on a steep grade, jumped the track and overturned, injuring 16 persons.

Chicago Union Traction Co.

It has been decided that the arguments upon the validity of the 99-year franchise act shall be heard before Judge Grosscup at Chicago during the first part of March.

February 17th Judge Grosscup received the resignations of Messrs. Govin and Eckels as receivers for the North and West Chicago Street Railroad companies, and appointed in their places Messrs. John C. Fetzer and Henry A. Blair. Mr. Fetzer was also appointed an additional receiver for the Union Traction Co., so that the two boards of receivers as they now stand are as follows: Union Traction Co.—John C. Fetzer, R. R. Govin, James H. Eckels, Marshall E. Sampsell. North and West Chicago Street Railroad companies—John C. Fetzer, Henry A. Blair, Marshall E. Sampsell. It is understood that the duties of Mr. Fetzer so far as the Union Traction Co. is concerned will be that of a "managing receiver." He is to give his whole time to the work and his special duty will be to look after the physical condition of the system.

Following the change in receiverships, the Chicago Passenger Railway Co., an underlying company of the Union Traction Co., which has no claim under the 99-year act, applied to the city council for a renewal of its franchises upon practically the same terms as it is suggested will be acceptable to the Chicago City Railway Co., except that it proposed that the city may purchase the road at the end of 15 years. No compensation is offered, other than the old agreement of $50 per car per year license fee. Mayor Harrison is quoted as stating that the application has little chance of being considered, as the city would feel that it is simply a plan to help the Union Traction Co. by giving it a renewal of that part of its system which it does not claim is under the protection of the 99-year act.

During the past month the Blue Island and Lincoln Ave. lines have been electrically equipped and new cars put into operation. Seventeen new cars were also put on the North State St. line.

The receivers borrowed $50,000 to pay the February interest on the underlying bonds of the Chicago Consolidated Traction Co.

Elevated Traffic in Chicago.

Traffic on the elevated lines in Chicago during January suffered from the closing of the theaters and the lessening of business activity, as the following daily averages for the month will show: South Side Elevated Railroad Co., 87,601, an increase of 964 over 1903, or 1.11 per cent; Northwestern Elevated Railroad Co., 70,204, an increase of 1,938, or 2.84 per cent; Metropolitan West Side Elevated Railroad Co., 112,413, a decrease of 358, or .32 per cent; Lake Street Elevated Railroad Co., 42,829, a decrease of 1,214, or 2.75 per cent.

Crawfordsville, Ind., Controversy.

The Crawfordsville (Ind.) council has instructed the city clerk to issue a permit to the Indianapolis & Northwestern Traction Co. to use the streets. The council also requested Judge Baker, of the United States Circuit Court, to modify his order which sustained the demurrers of the Crawfordsville Traction Co. and the city of Crawfordsville to the complaint of the Indianapolis & Northwestern Traction Co., as reported in the "Review" for December, 1903.

A Wholly Necessary Precaution.

"The conductor has orders to restrain ladies from alighting from moving cars, and to use force if necessary. It is not a pleasure to give such an order as that. But it is wholly necessary. Some appear to resent it when in a moment of confusion they are preparing to step off a moving car and the conductor lays a restraining hand upon them. That isn't just fair. If people will persist in taking wholly superfluous chances, we must use all diligence to restrain the use of their judgment which is manifestly shockingly bad. The conductor doesn't do that to be "funny" or to be "fresh." He is trying to prevent you from breaking a limb. The cars may have too much momentum to stop exactly at the crossing, but PLEASE WAIT."—Extract from Detroit United Weekly, Issued by Detroit United Ry.

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SUMMARY OF CONTENTS.

POWER HOUSE ACCESSORIES.

Distinct individuality in the construction and equipment of modern power plants of a given class depends mainly upon differences in the arrangement and combination of various types and makes of generally approved apparatus and accessories, and only very slightly upon the use of really new or unusual devices. The design of a generating station of high efficiency and greatest practicable economy must of course be dictated largely by conditions of location, water facilities, fuel supply, etc., but these requirements are fulfilled by intelligent selection and arrangement of standard details of equipment.

The new Manchester street station of the Rhode Island Co., at Providence, as described elsewhere in this number, presents few exceptional features of design, but is nevertheless of interest as a thoroughly modern installation of more than average size. It is probably the only plant in New England, outside of the city of Boston, having a double decked boiler house. This arrangement was made necessary by the change from all horizontal units, as contemplated in the original plans, to vertical units of two-thirds greater power for the direct current machines, practically without loss of floor space. Provision for the additional boilers by placing them in a second row at the ground level was prevented by the limitations of the site, and the second bank had to go up onto a higher floor. The arrangements for spouting coal from the overhead storage bin past the upper bank of boilers to the first floor and for spouting ashes from the upper stokers past the lower boilers to the basement are well worked out, as indicated in the drawings.

Usually the convenience of operation of a station of this character is enhanced by the use of one or more small, yet important, devices suggested by the general or special conditions at the individual plant. In the Providence station the ringing of a gong at regular intervals of twenty minutes as a signal to the oilers to make their periodical rounds is a noteworthy feature of this sort. It is not claimed as being original at this plant, but its use is nevertheless not at all common and is worthy of attention. The clock upon the boiler room wall midway of the length of the engine room is arranged to close an electrical circuit three times an hour, ringing the gong hung just below the clock. This regular signal, so simply and reliably arranged for, can hardly fail to prove of material value as contributing to engine efficiency by promoting uniformity of lubrication and coolness of bearings, and to oil economy by avoiding wastes due to excessive use of lubricant at irregular intervals.

Another feature of the Manchester street power house, quite unique in this class of work, yet obviously of decided merit, is the installation of the modified form of ship telegraph apparatus for signaling between the engine room floor and the elevated switchboard galleries. In marine practice, for which this system was originally designed, there is used for each propelling engine, one set of this apparatus, the set consisting of duplicate dial stands, one at the bridge and the other in the engine room. A lever handle at each stand mechanically operates the indicating pointer at the other dial, a gong sounding as the pointer moves from any one position to the next. Receipt of the order is acknowledged by placing the engine room lever handle at the same position, the pointer at the other dial then showing that the order has been understood and is being obeyed. When the order has been executed and the engine is working as directed, the engineer may advise the captain of the fact by moving his lever away from the ordered setting and immediately returning it thereto, this operation sounding the bridge gong at least twice and calling attention to the accomplishment of the desired change.

In adapting this signal system to power plant work separate sets of the apparatus for the several units would be impracticable and unnecessary. The sets are therefore merely in duplex, two stands being used at each end. One indicates the unit, the other shows the order to be executed. In the Providence plant there are five main generating units, two motor driven exciters and one marine engine driven exciter set to be provided for on one stand. The other stand has its dial arranged to indicate the various details of manipulation which may require to be communicated either way between the engine room floor and the switchboard galleries. In generating stations of any considerable size, and especially where the switchboard attendant is more or less isolated

from the engineer's natural post of duty, the use of such a positive means of communication is certainly an item of value in facilitating rapidity and accuracy in securing desired results, without requiring more than momentary distraction of attention of either operative from his work.

THREE-CENT FARES IN CLEVELAND.

In the January "Review" reference was made in these columns to a proposed 90 days' trial by the Cleveland Electric Railway Co. of a three-cent fare ordinance which had been adopted by the Cleveland city council, and which was to go into effect January 24th. It transpired that after the agreement to give the new ordinance a trial had become looked upon as a certainty, unforeseen difficulties arose which threatened its successful consummation, and the Cleveland Electric Railway Co., which is about to seek a renewal of franchises, as a precautionary measure, applied for a restraining order, which was granted January 23rd, enjoining the city from putting the ordinance into effect. Arguments for a permanent order were to have been made before the federal court February 13th, but the case was passed for one week by agreement.

The president of the Cleveland Electric Railway Co., Mr. H. E. Andrews, and Mayor Johnson have for months been trying to agree upon some plan of reducing fares, in consideration of the renewal of all existing franchises and the granting of franchises for extensions of certain routes. The mayor insisted upon a three-cent fare between the outer limit of the proposed zone, which is practically coextensive with the city, and the business center of the city; and on through lines a three-cent fare from one limit of the zone to the other limit on the opposite side of the city. The plan discussed contemplated a charge of two cents for transfers and an additional two cents for rides beyond the zone limits. The mayor was of the opinion that the company could afford to operate at these reduced rates, but was willing to try and secure the passage of the ordinance with an option in it to the company to accept the grant at any time within three or four months, in consideration for putting the new fares into immediate effect; and the company was unwilling to agree to accept a franchise at such rates of fare without an opportunity to make a trial.

At later conferences the mayor asked that the city have the right, within two months after the passage of a franchise ordinance to repeal it if the arrangement proved unsatisfactory to the public, and was willing to give the company two months after the expiration of the city's option to repeal, in which to determine whether to accept or reject the proposed renewal. There was also to be a provision in the proposed ordinance that the company should not be required, during the life of the grant, to pay anything for pavement or renewal of pavement, for car licenses or for bridge rentals, nor to make any contribution toward the cost of separating grades at steam and street railway crossings. There was also a provision that the city might purchase the property at the end of the 20-year term at a price to be fixed by arbitration, to which price 20 per cent was to be added.

It is understood that the mayor submitted this plan to several members of the city council and that they were unanimously opposed to it. At the present writing nothing definite has been decided upon.

PROPOSED PERMANENT WAY ASSOCIATION.

It has been the general feeling for some time past that need exists for an association devoted to the special branches of street railway work represented by the construction and maintenance of way departments. The inability of the American Street Railway Association to extend its scope beyond the more general limits and give adequate attention to the details of various departmental practices has already led to the formation of the American Railway Mechanical and Electrical Association, and this society has found itself so fully occupied with its proper subjects of power and rolling stock as to cause opposition to the proposal of admitting permanent way interests and subjects to its membership list and its convention time. An association devoted to the construction and maintenance of way departments would have little in common with that of the master mechanics and might meet at the same time as the latter and quite independently of it, yet in like connection with the convention of the A. S. R. A.

That the track, overhead and underground construction are matters of importance is evident from the fact that the expenditures in installation and maintenance of these branches of a traction system equal or exceed those of power supply and rolling stock. The problems of way construction are by no means small, and are not to be solved by application of mathematical formulas. The questions as to relative merits of different types of construction are numerous and are to be decided only by experiment and experience. Such being the case, reduction of the whole matter to any considerable degree of standardization can be effected only by interchange and record of ideas and conclusions based upon actual practice. The advisability of forming a "way" association of the same general character as that of the master mechanics has been recognized by various engineers, and a movement looking toward the desired end is now well started. Mr. Fred G. Simmons, superintendent of construction and maintenance of way for the Milwaukee Electric Railway & Light Co., has taken the initiative, after consultation with several engineers in similar positions, and has addressed to a number of such gentlemen a circular letter stating briefly the proposition, and accompanied by a blank form to be filled out with expressions of opinion in regard to various phases of the subject, in a preliminary way. The object of this initial movement is to lay the project before as many interested persons as possible, with a view to opening the subject and bringing it into shape for further and possibly definite consideration in connection with the next meeting of the A. S. R. A.

Mr. Simmons' communication has been sent merely to a few of his personal acquaintances, and it is highly desirable that others interested in the formation of such a society should address him, stating their attitudes in regard to the project and the extent to which they will be able and willing to co-operate with him in its consummation. We commend the proposition most heartily and would urge all heads of permanent way departments and others in associated positions to lend their aid and support to the movement thus started. The preliminaries to be given attention include principally the choice of an organization committee, whose duty it shall be to outline a plan of organization, a name for the association, the requirements for membership, the grading of members, the membership fees and dues, etc. The question as to whether membership shall be granted only to companies or personally to individuals is one which must be decided. The blank sent out by Mr. Simmons asks suggestions upon all these points, so that an organization committee may be selected and the matter formulated into such shape as to permit the accomplishment of definite results in connection with the coming convention of the A. S. R. A.

We quote as follows from the letter sent out by Mr. Simmons:

"There is probably more money expended through this division of the various electric railways of the country than any other single department; less discussion of matters pertaining to this important work has been had, and the practice of no one department is probably less uniform. It is reasonable to assume that an intelligent, painstaking and thorough comparison of results obtained throughout the country could in no other case lead to such far-reaching economy for all concerned as in the practice of track laying. 'Will your track last ten, twelve, fifteen or twenty years?' What more important question can you ask the electric railways of the country?

"In order to broaden somewhat the scope of the proposed organization, it has been suggested that under the title 'Way' be included the right of way, roadbed, track, poles, overhead line, and underground conduits and feeders. A plan of organization similar to that of the American Railway Mechanical and Electrical Association might be used; or such changes made therefrom as would be suggested as advisable. The membership of that association might be briefly outlined as follows:

"Active members: Heads of departments; membership fee, $5 per year.

"Associate members: Owning or operating companies or individual owners; membership fee, $20 per year.

"Junior members: Lesser employes engaged in this work where either their companies or departmental heads are members; membership fee, $3 per year.

"In order that a consensus of opinion on this important matter may be arrived at, a form of blank circular is enclosed herewith.

[illegible] much like you to fill out and return to the undersigned [illegible] which the work of organization would be taken up and governed by the persons and in the manner indicated by a majority of said replies. The rough idea as now in the mind of the writer contemplates an association similar in aims and purposes to the Mechanical and Electrical Association already cited; to meet at the time and place chosen by the American Street Railway Association for its yearly convention, and to act as an offshoot of the said American Street Railway Association, receiving and furthering suggestions therefrom, and endeavoring in every way to improve and perfect, toward some reasonable degree of uniformity, the practice of the way departments of the gigantic electric railway interests represented therein.

"The writer has reason to believe from interchange of ideas with many of the departmental heads in charge of this class of work throughout the country that a large number of them are as firmly convinced as himself that such an organization can not be formed too soon, and it is therefore with considerable hope of good results that this letter is launched, upon the idea that there must be a beginning if there is to be progress. A plan of organization may be advisable by which the heads of departments can become active members even though the company they represent does not affiliate with the association. We think the companies should join wherever possible, as we are convinced that the matter of twenty or twenty-five dollars for a membership fee and the expenses of a representative at the annual meetings would soon be repaid an hundred fold by the benefits to be derived therefrom.

"Your advice and help is earnestly solicited in order that a thorough and comprehensive organization may be effected."

We see no room for question as to the possibilities for good to result from an active association along the lines indicated and believe that the need is urgent for its formation as quickly as practicable. The initiative of Mr. Simmons should be followed and the furtherance of his plans assisted by the hearty co-operation of all engineers and companies interested in progress toward highest efficiency and greatest possible uniformity in way construction. The usual result of energetic work by societies of this nature is a gradual, yet comparatively rapid, reduction of general practice toward a uniformity which naturally brings greater and greater approach toward standardization. Such must be the result of the proposed association of permanent way interests, with correspondingly valuable possibilities for economy in many directions.

Railway Company Grants Transfers.

February 11th the New York City Railway Co., which was formerly known as the Interurban Street Railway Co., issued an order to its conductors to give transfers at Broadway and 14th St., Broadway and 23rd St., Sixth Ave. and 23rd St., and Madison Ave. and 116th St., these being regarded as four chief points in dispute between the company and the Transit Reform Committee of One Hundred which has been endeavoring for more than a year to obtain transfers at all intersecting points on the company's lines. Some time ago a decision was handed down by the Appellate Term court upholding the law which provided for such transfers under a penalty of $50 in each case where a transfer is refused. It is stated that suits amounting to about $1,000,000 have been brought, or were to be brought, against the street railway company since the decision was handed down by the court. January 25th one justice awarded judgments amounting to $750 against the company in lots of $50 each for refusing transfers at various points during the past six months. Suits aggregating $10,000 were said to be already on the city court calendars. One man, a lawyer, secured nine judgments of $50 each, and he had entered 250 cases representing damages of $12,500. It seems that a great many impecunious persons took advantage of the $50 penalty provision and rushed to lawyers with their claims, the law having been construed to be capable of enforcement even when the complainant had purposely ridden on the cars to make a case against the company.

In the appellate term of the supreme court at New York City, January 19th, a decision was rendered in a suit which had been brought against the Interurban Street Railway Co., which reversed the decision of the municipal court that the company was not liable to penalty for not giving the plaintiff a transfer at Broadway and 23rd St., it having been held by the lower court that the cited section of the railroad law did not apply to the defendant. The higher court, in reversing the ruling, gave the company leave to appeal the case to the appellate division.

January 26th Judge O'Brien of the Court of Appeals at Albany handed down an opinion in a case which had been appealed from the decision of the lower court refusing the representative of the Transit Reform Committee of One Hundred a writ of mandamus to compel the company to issue transfers at 125th St. and Eighth Ave., the decision being on the technical point that mandamus was not the proper procedure. The judge ruled that under the railroad law the railroad commissioners have the power to investigate complaints of neglect of duty on the part of railroad companies, and it is provided that any decision or recommendation of that board may be enforced by mandamus. This was regarded as a partial victory for the company and the reform committee looked forward to a long-drawn-out battle lasting at least a year, when the company of its own accord acceded to the important points in dispute.

President Vreeland has stated that the company withheld transfers at certain points because there would be particular danger to the public if transfers were issued.

Chicago City Railway Co.

The annual report of the Chicago City Railway Co. for the year ending Dec. 31, 1903, shows the gross earnings to have been $6,435,565, an increase of $22,383 over the previous year; the passenger receipts were $6,381,246, an increase of $13,888; operating expenses and taxes, $4,648,342, an increase of $311,837; depreciation, $100,000, a decrease of $80,000; net income, $1,687,224, a decrease of $209,454; dividends (same as 1902), $1,620,000; surplus for the year, $67,224, a decrease of $209,454; ratio of operating expenses and taxes to gross earnings, .7223, an increase of 4.61 per cent; ratio of operating expenses and taxes to passenger receipts, .7284, an increase of 4.73 per cent; passenger receipts per day, $17,483.

The report shows the total car miles run during the year as 32,535,123, a decrease of 136,811. There were carried 128,304,455 fare passengers, an increase of 206,646, and 66,883,346 transfer passengers, an increase of 11,089,784. The percentage of transfer passengers to fare passengers was 52.13 per cent.

The report of the president, Mr. D. G. Hamilton, states that the gross earnings do not show the expected and normal increase, owing to the 14 days' strike of employes in November, and also owing to the unfavorable weather conditions during January and December. While the passenger receipts increased less than one-fifth of one per cent, the transfer passengers carried increased 20 per cent, due to the enforced inauguration of the present transfer system. Over 50 per cent of the fare passengers carried were carried on transfers. The large increase in expenses was attributed to the increases in wages, cost of fuel, material and supplies, cleaning streets, removal of snow, insurance, taxes and the strike expenses.

The report points out certain improvements which were made in 1903, and needed improvements which will be made in 1904, the latter to include additional cars and power plant apparatus, as well as construction and reconstruction work.

Regarding the franchise negotiations between the company and the city, the report states that "a tentative ordinance is under consideration, by which it is hoped a fair and business-like settlement of the questions involved may be made." Pending the settlement the company will efficiently maintain its plant and equipment and make such improvements as will enable it to furnish the best service possible under existing conditions.

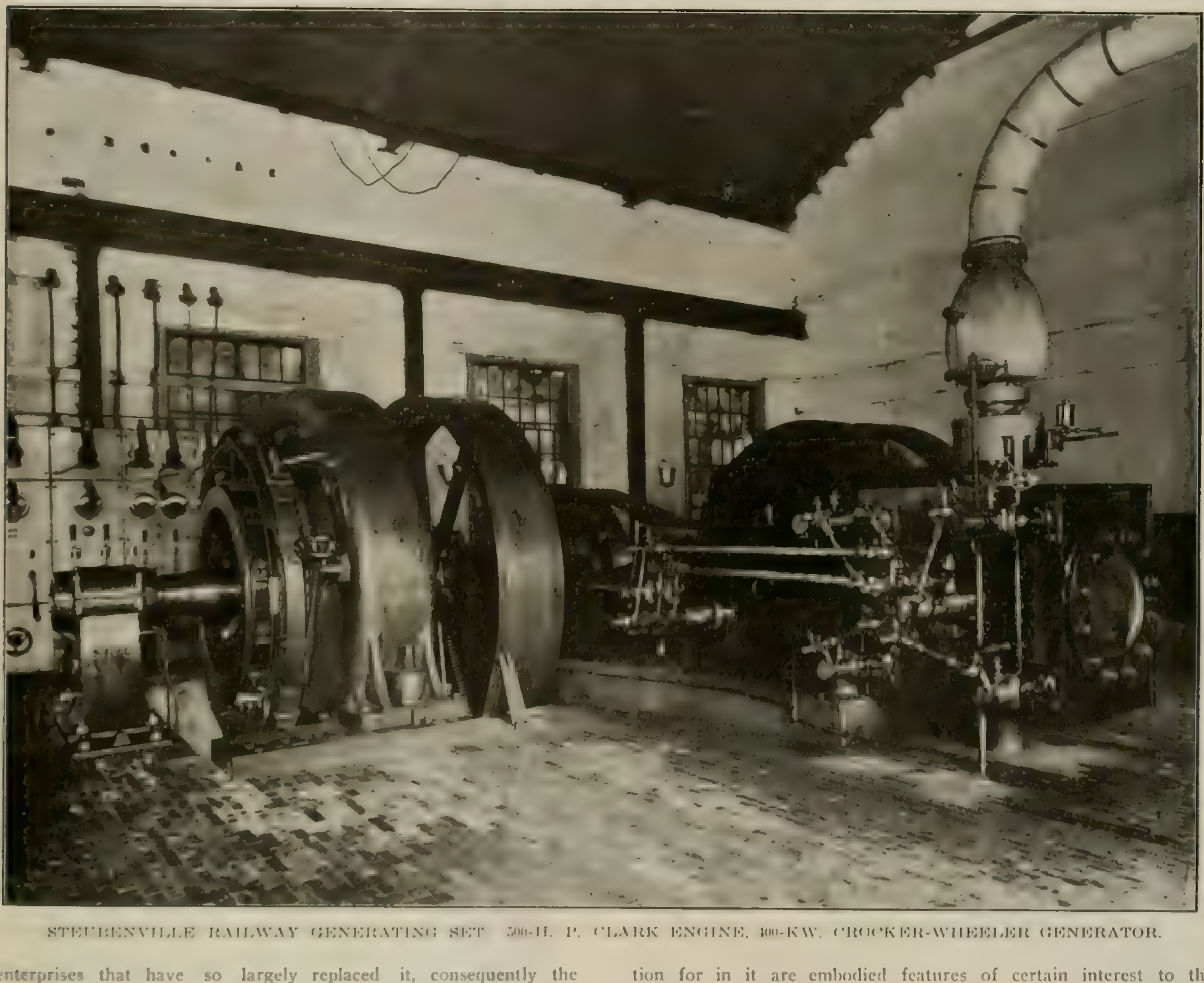
The New York Central & Hudson River Railroad Co., in conjunction with the General Electric Co., proposes to lay a special track near Schenectady, N. Y., on which to test the new electric locomotives which have been ordered. An effort will be made to exceed the speed attained by the German military electric line betwen Berlin and Zossen last year.

The Railway System of the Steubenville Traction & Light Co.

Describing the Company's Railway System and Power House Which Includes a Gas Producing Plant, an Electric Lighting Plant and an Electric Traction Plant.

A gas producing plant and an electric traction and lighting company may seem to have but little in common, and yet the Steubenville Traction & Light Co., of Steubenville, Ohio, owes its origin directly to the local branch of the American Gas Co., of Philadelphia, Pa., a corporation operating artificial gas plants in many cities throughout the country. In other words the original gas manufacturing business has gradually declined in importance to little more than a side issue when compared with the electrical enterprises that have so largely replaced it, consequently the corporate name has been changed to correspond. However, it should not be inferred that the gas business is neglected, for in its appointments and processes it is kept admirably up to date. Only a short time ago the furnaces and their auxiliary equipments were thoroughly overhauled, repaired and modernized by the addition of many minor improvements. Still, the fact remains that selling artificial gas in this part of Ohio is about as profitable as "carrying coals to Newcastle," inasmuch as natural gas is plentiful and cheap; and it was apparently with an instinct to self-preservation that the departure was made into electrical lines.

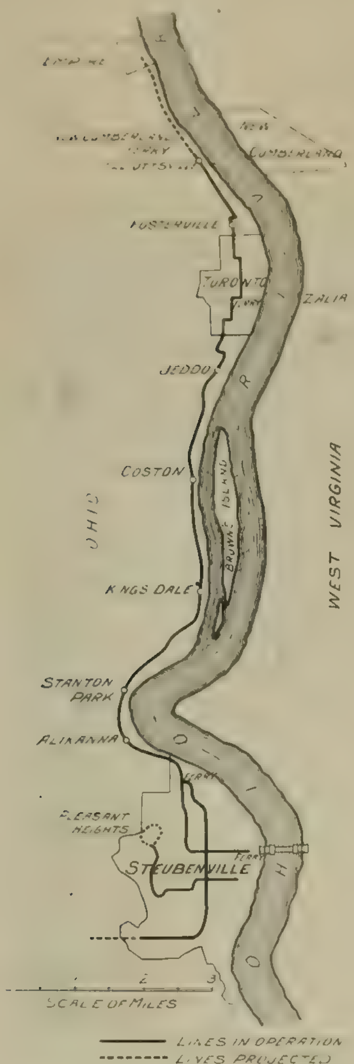
In this discussion the gas end of the business will not be considered at all, and the electric light end only as it enters into the description of the power plant. As an index to the proportions of the latter, however, it may be said that the company is supplying at the present time, about 6,000 incandescent lamps for store and house illumination and a large number of small motors on its alternating current circuits, and on its arc circuits 245 arc lamps of 2,000 candle-power each, for city service in street lighting. The company's traction system will be the central object of attention for in it are embodied features of certain interest to the readers of the "Review." Among them may be mentioned an excellent type of track construction and a car equipment that is unusual for the territory covered or the population served (about 30,000), and one that would do credit to a more pretentious system. From an operating standpoint the numerous ticket forms, the arrangements for carrying freight, and the system of regulating promotions and maintaining discipline are of interest, and in connection with the power plant the history of its rapid recuperation after a total destruction by fire, though familiar to some, is sufficiently remarkable to deserve repetition.



STEUBENVILLE RAILWAY GENERATING SET 500-H. P. CLARK ENGINE, 400-KW. CROCKER-WHEELER GENERATOR.

The street railway property includes about eighteen miles of

track, of which about four miles is a single belt line, around and through the heart of the city, reaching all depots, city and county buildings, public library, hospital, etc., and passing through the principal residential and manufacturing districts. The longest line is the interburban division, about 12 miles long, extending from the center of Steubenville through Alikanna, Stanton Park, Kingsdale, Costonia, Markle's, Jeddo, Toronto, and Fosterville to its present terminus about a mile north of Toronto, directly opposite New Cumberland, W. Va., connection being made between the two points by ferry. Part of this line is also traversed by the cars of the Toronto local division which passes through the principal business and residential streets of that town. Within Steubenville the company also operates what is known as the Pleasant Heights line, a division two miles long, which runs to the hill top suburb of the city, and a Market and 6th Street line three miles long, which runs over a section of the interurban track.



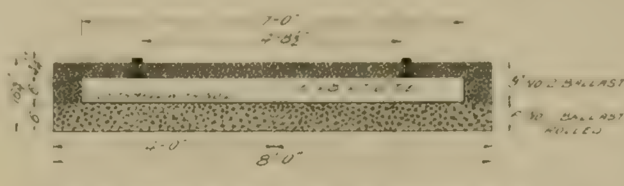
LINES OF THE STEUBENVILLE TRACTION & LIGHT CO.

As may be seen from the map, the interurban line for the greatest part of its length runs along the banks of the Ohio river, passing through one of the most beautiful sections of the Ohio Valley—a country noted for its picturesque scenery. At a distance of about three miles out on this line from the center of Steubenville is located Stanton Park, a pleasure resort, owned and developed by the street railway company. It is situated near the river on a little plateau among the hills and commands a view in both directions, the equal of which would be hard to find throughout the valley. The grounds comprise about 86 acres of forest and glens and are transected by a stream which has been artificially expanded into a small lake. About the park have been erected a number of quaint buildings in Dutch and English rustic style, which accommodate a small theater, a storage battery plant and a home for the keeper and his family, and shelters for a merry-go-round, photo-gallery, shooting gallery, roller coaster, refreshment booth, and various other stand novelties. The placing of the buildings and the layout of the paths and roads with their rustic bridges and benches have been executed in a harmonious and artistic manner, the construction work of which involved considerable engineering in the way of grading, drainage and supplying water, lighting, and the installation of fire protective apparatus, but this is beyond the intended scope of the present article. The storage battery plant, since it is associated with the railway work, will be described later in detail.

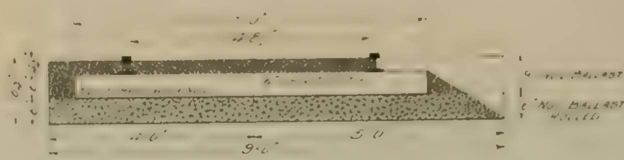
Track and Overhead Construction.

All of the lines are single track, with turn-outs located at intervals of about two miles on the interburban line, and more frequently within the city limits where the cars are run on a headway of about 8 minutes. The maximum grade is about 7½ per cent and of but short extent. It occurs on the interurban line near Stanton Park. Within the city limits the maximum grade is but 6½ per cent and it is here that the only curves of short radius exist. There are two steam railroad crossings, at which points derailing switches, made by the Cleveland Frog & Crossing Co., have been provided in accordance with the Ohio laws.

The roadbed as constructed is unusually good and should prove



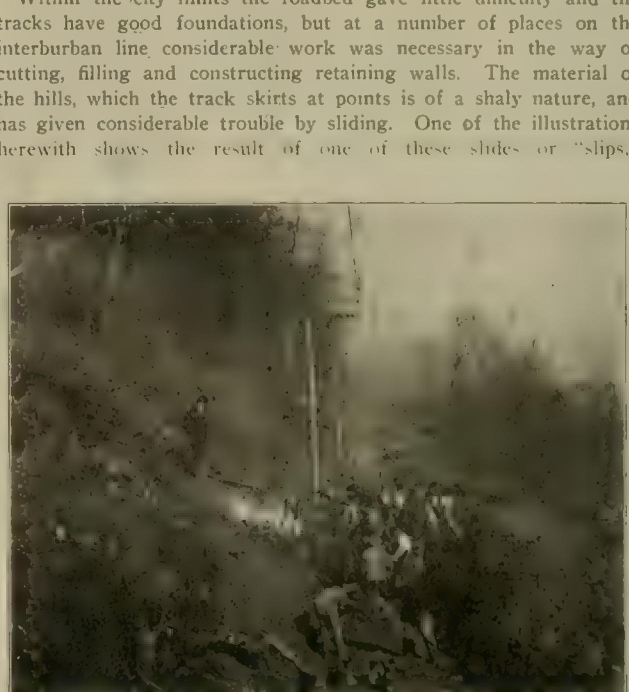
CROSS SECTION OF TRACK IN CENTER OF ROAD



CROSS SECTION OF TRACK ON SIDE OF ROAD

of an enduring character. A sketch herewith shows the scheme of the track construction. A trench is first excavated to a depth of 18 in. in which 6 in. of broken stone is laid and thoroughly rolled. On this white oak ties, 6 by 8 in. in cross section and 7 ft. long are placed, 2 ft. between centers and upon these are laid the 60-lb. rails. In the open country the track is ballasted with broken stone well tamped to the top of the tie; in unpaved streets and pike roads broken stone is filled in to the top of the rails and covered with limestone screenings, and on paved streets broken stone is rammed between the ties, this covered with limestone screenings and again rammed, while over all is spread sand upon which the paving bricks are finally laid.

Within the city limits the roadbed gave little difficulty and the tracks have good foundations, but at a number of places on the interburban line considerable work was necessary in the way of cutting, filling and constructing retaining walls. The material of the hills, which the track skirts at points is of a shaly nature, and has given considerable trouble by sliding. One of the illustrations herewith shows the result of one of these slides or "slips,"

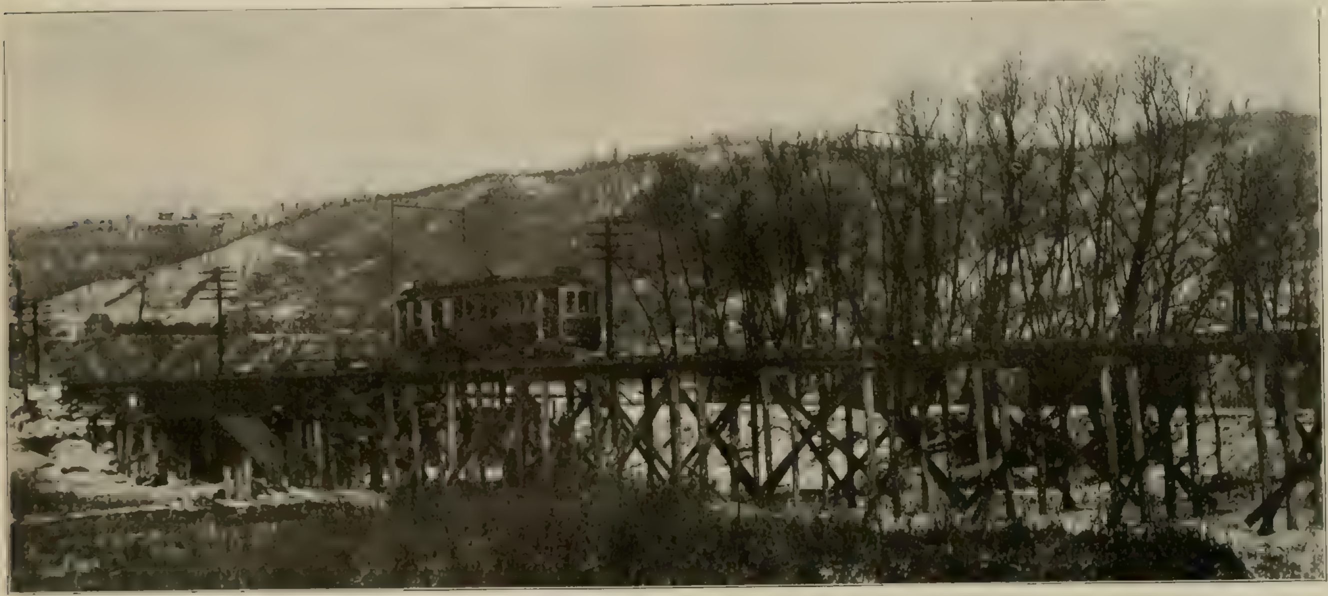


REPAIRING A "SLIP."

as they are called. But gradually these difficulties are being overcome and the conditions corrected to diminish likelihood of their recurrence.

In all city streets the rails are 6 in. high, 60 ft. long and weigh 60 lb. per yard, and in the open country a 4½-in. rail of the same weight is used. All rails, switch pieces, railroad crossings, short curves, etc., were made by the Johnson Co., of Lorain, Ohio,

and the Carnegie Steel Co., of Carnegie, Pa. Tie rods are provided every 10 ft.; guard rails and rail braces on all curves. An additional safeguard is provided where the track runs close to the edge of high walls and embankments, or at curve approaches to bridges, which consist of a 6x8-in. wooden stringer laid outside of, and 8 in. from the rail and bolted to every tie. The joints are bonded with No. 0000 "Protected" rail bonds, single bonds being used in Toronto and on all 4½-in. rails, and double bonds on the Steubenville streets. Cross bonds are placed every three rail lengths from Steubenville as far as Stanton Park and also in Toronto. The bond holes were drilled in the field and the bonds compressed with screw presses and then carefully coated with pitch.



TRESTLE OVER CROXTON'S RUN.

One of the important features of the road construction was the building of the trestle over Croxton's run near Fosterville above Toronto, shown in one of the views herewith. It is about 325 ft. long and includes the longest bridge of the system, one of plate-girder construction 75 ft. long, supported on wooden bents. The trestle proper, leading to the bridge from the south, is of wood. The smaller bridges of the system are also of plate-girder construction and are supported by heavy bents on stone foundations. The one at Costonia, however, is supported directly on stone foundations. With few exceptions all stone work such as that used in retaining walls, etc., is heavy rubble masonry laid in cement mortar.

In the overhead construction which is indicated in several of the cuts, there are two general methods for supporting the wires. On the streets span construction is used, the trolley wires being suspended from cross wires extending between cedar poles, while on the county roads and private right of way, flexible brackets, designed by the Ohio Brass Co. and mounted on cedar poles, are used. All poles run from 30 to 35 ft. in length, averaging from 12 to 14 in. in diameter at the butt and 7 in. in diameter at the top, and are embedded in the soil to a depth of from 6 to 7 ft., the bases being first well coated with pitch. After the poles are set the ground around them is tamped down hard and guy wires strung wherever necessary. The trolley is No. 0000 grooved copper wire and is supported by galvanized steel span wire 5-16 in. in diameter, made up with two globe strain insulators on each pair. The trolley wire is anchored at frequent intervals and is provided with line breaks so that sections may be cut out in case of trouble. Switches connecting with these sections are located in boxes on poles convenient to the office, car barn and battery house, as indicated in the diagram of circuit breakers and switches. The trolley feeder cables consist of about three-fourths of a mile of No. 0000 copper wire and approximately 9½ miles of 795,000 c. m. aluminum cable. The rail feeders are about 1¼ miles in length and are 500,000 c. m. copper cables. At intervals of every third of a mile lightning arresters are installed, and between Stanton Park and Steubenville, there is a system of electric block signals. There is also a telephone system extending the full length of the line with five fixed stations in Steubenville, and connecting boxes on poles every quarter of a mile outside of the city. Portable telephone sets are carried on all interurban cars which may be readily connected with these stations. In this way communication may be quickly established with the barn or office to report trouble from any part of the line and receive instructions.

STANDARD INTERURBAN CAR

Rolling Stock

The car equipment includes three enclosed interurban cars each 41 ft. long, built by the Jackson & Sharp Co., two having smoking compartments and the third a baggage compartment at one end. These are each mounted on two Peckham No. 14-B-3 trucks with four No. 12-A Westinghouse motors, one on each axle, and are equipped with Christensen air brakes in addition to hand brakes, air whistles, Newark air sanders and Mosher arc head lights. The

seats are of the "walkover" pattern, of rattan, and each car will accommodate 50 persons. The car interiors are finished in satin oak and are brilliantly lighted by 22 16-candle power incandescent lights. The open interurban cars, four in number, are of the same make but 3 ft. longer, they also have cross seats and a center aisle, and are capable of seating 56 persons. The trucks, motors,

VIEW IN BOILER ROOM, SHOWING STIRLING BOILERS.

air brakes and lighting equipment are the same as those used on the closed interurban cars.

For city service the following are the closed cars: Four of Stephenson make on McGuire A-1 suspension trucks, with two 12-A Westinghouse motors, and four Laclede bodies on 21-E Brill trucks with two No. 49 Westinghouse motors, These are 28 ft. long and capable of seating about 30 persons.

The open cars for city service are 30 ft. long, four being Laclede and eight American Car Co. bodies. Four of the latter are mounted on McGuire A-1 suspension trucks, two having 12-A Westinghouse motors and two G. E. 800 motors, and four are on Lord Baltimore trucks with G. E. 57 motors. The Laclede cars have Brill trucks and No. 49 Westinghouse motors. These twelve cars have side seats with an aisle through the center and will seat about 28 persons. The side steps bolt up, the passengers being obliged to enter and leave at the ends. This avoids accidents by preventing people from riding on the steps, and is a distinct advantage in bad weather.

The open and closed cars on the Pleasant Heights line are 30 ft. long, were built by the American Car Co., and are equipped with Brill trucks, No. 56 Westinghouse motors and arc headlights. They have cane covered seats with a center aisle and a seating capacity for 38 persons.

The total equipment consists of thirty-one cars, all of which are equipped with International fare registers, trolley catchers, Hunter illuminated signs and those of the closed type with either Gold street car heaters, or those built by the Consolidated Car Heating Co. In addition there is a McGuire sweeper used for cleaning the track of snow or dirt, which is equipped with two No. 49 Westinghouse motors on the trucks and a G. E. 50-h. p. motor to drive the brooms. For construction work and repairing an open work truck, four hand push cars, two of which are equipped with towers, a velocipede hand-car and a tower repair wagon are kept in readiness at the barn. For wrecking purposes an old car body filled with tackle and all necessary tools is used as a trailer and can be quickly taken to any point where it may be needed.

The Power Plant.

The central power station is located on High and South Sts., occupying part of a 240 x 180-ft. plot which accommodates in addition to the engine-generating and boiler plants, two gas holders, with a capacity of 85,000 cu. ft., a retort house, an elevated water tank, and a store house containing an oil room, work shop and storeroom for miscellaneous supplies. The accompanying plan shows the relative positions of the component parts and the general layout of the most important piping.

The boiler house is a one-story brick building, 54 by 90 ft., with a steel-truss, slate-covered roof and brick-paved floor, rendering it thoroughly fire proof. Coal is stored in an adjoining shed, 38 x 65 ft. in area, having a capacity of 500 tons. It is of iron-clad frame construction with composition roof and brick pavement, and has a trestle leading into it connecting with a spur from the Wheeling & Lake Erie R. R., so that the coal may be brought directly into the shed and dumped. A narrow gage track runs through the boiler room passing in front of the boilers and thence through a passage over a Fairbank 6 x 8-ft. platform scale into the storage shed, and the coal is brought on a small push car to the front of the furnaces as needed. The ashes are removed in a wheel hopper to the ash dump. The fuel used is a bituminous slack coal purchased from local mines and the Dillonvale field.

For the generation of steam there are five Stirling water-tube boilers and space has been left for the future installation of one more of the same size as the last one erected. The latter is of 350 h. p. capacity, contains 264 3¼-in. tubes and has McClave shaking and dumping grates with a combined area of 54 sq. ft., and a McClave argand steam blower in the ash pit for supplying forced draft. The remainder of the boiler equipment includes two double batteries of two 272-h. p. boilers each, all of which have McClave grates and blowers with the exception of one which is fitted with a Merrill gas burner. The draft is regulated by throttling the steam supplies to the blowers by means of Spencer damper regulators. The large boiler delivers its products of combustion through a 54-in. steel stack 110 ft. high and the others discharge into a smoke header which connects to the base of a circular brick stack, 8 ft. in diameter and 120 ft. high, built by the Adam Weber Sons, New York. Outside of the boiler house and

RESULT OF FIRE IN ENGINE AND GENERATOR ROOM.

running its length, there is a wooden box 2 ft. square which serves as a muffler for the blow-off of steam from the safety valves.

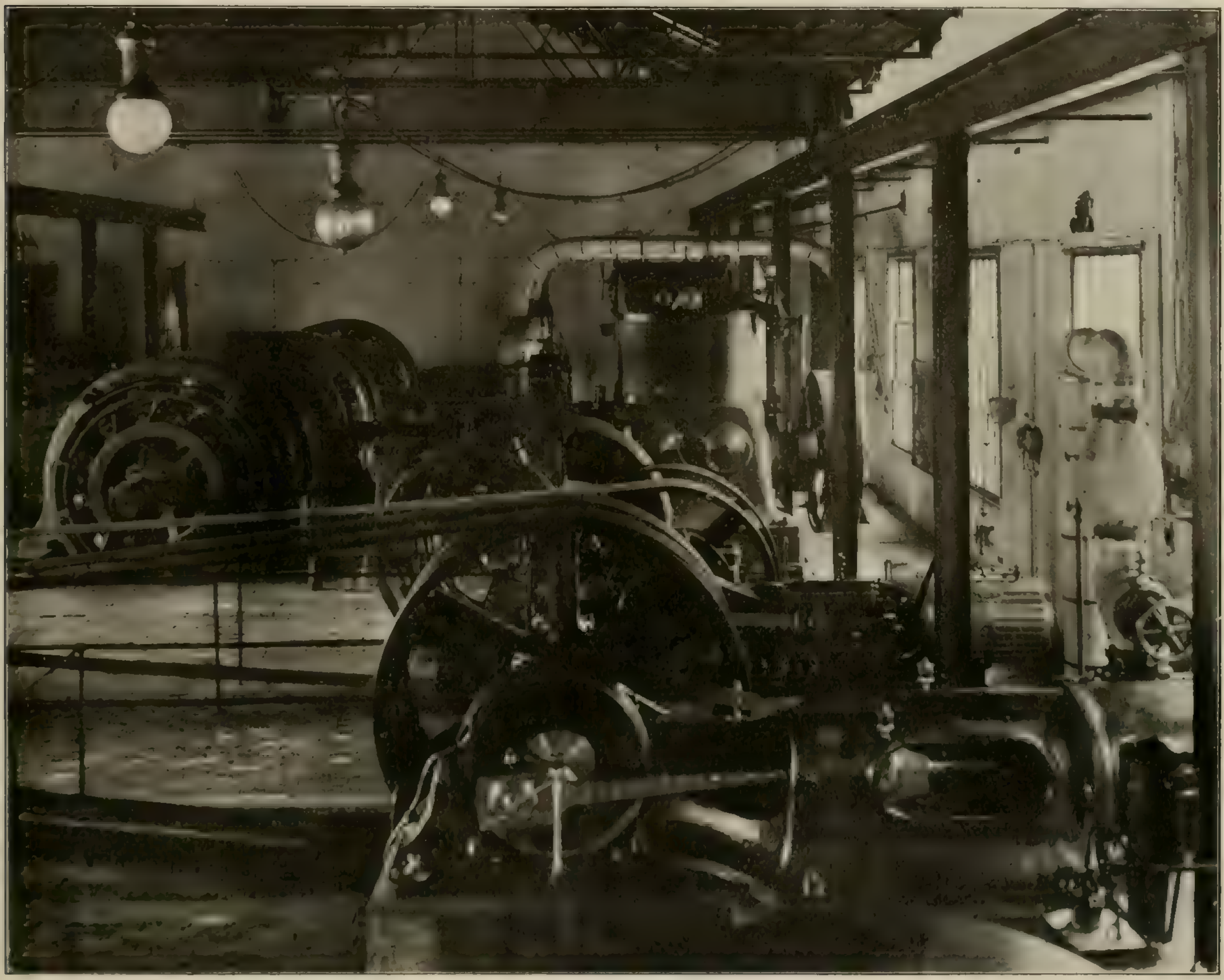
The boilers generate steam at a pressure of somewhat less than 150 lb., the safety valves being set for that pressure, and deliver through 9-in. connections to an overhead main carried along the passage at the rear of the boilers, to which is connected a steam pressure gage and a Bristol recording gage. This header gradually increases in size to 16-in. and continues underground

through an insulated brick-lined conduit about 150 ft. long, to the engine room, where it connects near the center of a 12-in. live-steam header under the floor. The header is drained by means of traps, and from it the branches to the individual engines are taken up through the floor and down with two right angle bends, through Austin separators to the steam chests. All steam piping between the boilers and engines is covered with H. W. Johns-Manville Co's. sectional magnesia covering.

The engine room is 120 ft. long by 43 ft. wide, is 21 ft. under the eaves and 33 ft. high to the peak of the gable roof. A 10-ton hand-power crane built by the Whiting Foundry Equipment Co., having a span of 37 ft., travels the long way of the building so as to serve any part of the room. The walls and floor are of brick, the former 13 in. thick and the trusses are of steel, supporting a slate roof. The door and window frames and sashes are of wood and form the only combustible material in the structure, so that it is practically impossible for the plant to be visited by another fire such as the one which destroyed it about a year ago.

The accompanying reproduction of the ruins gives an idea of the extent of that disaster, and causes one to better appreciate how remarkable was the rapidity with which operations were restored. Part of the traction service was resumed the day following the fire, the store and house lighting a week later and the street lighting two weeks after. As soon as it was safe to go on the site the builders were set to work and a temporary roof was in place over the dynamo and engine room within 36 hours. An alternator was ordered by telegraph, delivered by express, and erected in time to restore the incandescent lighting supply six days after the fire. In much the same manner Brush arc machines were obtained and put in operation for the street lighting service within fourteen days. Power was purchased from another plant for about twenty-two days in sufficient amount to operate one-third of the regular equipment of cars. By that time the one Crocker-Wheeler generator previously in place and the Westinghouse machine were repaired and put into service and two new Crocker-Wheeler machines of larger size were also installed. The eight 50-ft. span steel trusses which support the present roof were made up and delivered within two weeks from the time of ordering. The switchboards were of course entirely destroyed and new ones of more modern type than before were erected.

The exhaust pipes from the engines pass directly through the floor, and connect by horizontal runs to an exhaust main in the tunnel with the live-steam header. At its largest end it is 18 in. in diameter and connects with a feed-water heater located in the adjoining room.

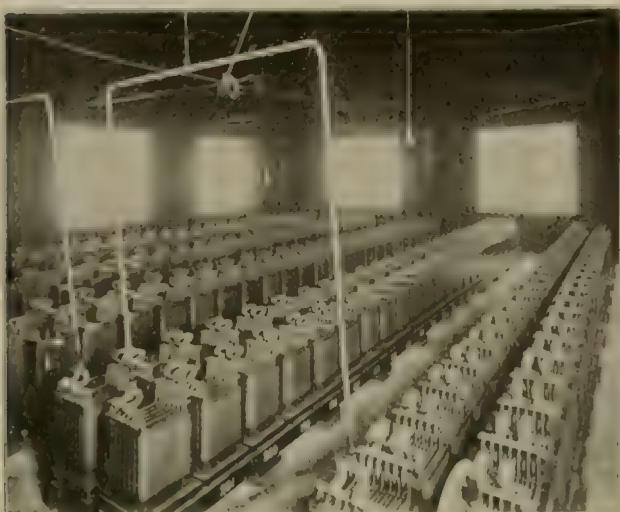


RAILWAY EQUIPMENT END OF GENERATING ROOM.

The heater is of an original design and consequently its construction may be of interest. It is contained in a shell of 3-8 in. steel, 23 ft. high and 47 in. in diameter, which was originally used as a water tank. The exhaust inlet is at the side of the heater just above the water line and is 18 in. in diameter. The riser for the escape of excess steam is also 18 in. and leads from the top of the heater to a point above the roof, the top being 40 ft. from the floor. Water is introduced through a 2½-in. connection which ends in a ring of 2½-in. perforated copper pipe placed on the inside near the upper head of the heater. The water supply is governed by a Foster regulating valve, controlled by a float which acts in a vertical pipe 6 in. in diameter and 2 ft. long connected to the heater at the bottom with an elbow. This being

on the outside of the heater has the advantage of being always accessible. A 2-in. blow-off is taken from the bottom of the heater and an overflow is provided to the sewer through a 4-in. loop seal of sufficient height to cause it to act when the depth of water in the heater exceeds 6 ft. The feed-water outlet is 5 in. in diameter.

When the feed water is introduced through the copper coil it falls downward through the rising vapor emitted by the exhaust and partially condenses the steam, from which it receives its heat. It was found when it was first tried that the heater was extremely noisy, its operation being attended with continual rumbling and a



INTERIOR OF A STORAGE BATTERY ROOM

succession of mild explosions. The only way that this could be accounted for was that the steam was condensed so rapidly that it tended to produce a vacuum in the heater. Acting on this assumption, though it seemed improbable, a 3-in. vent was provided near the top of the shell to admit air, when the annoying noises were stopped at once, proving the theory to be correct. It also demonstrated that the heater would have been an effective condenser, before the vent was opened, if it had not been such a nuisance to the neighborhood that it was complained of. Even in its present condition it is clear that the heater is not imposing a burden on the engines for the back pressure cannot exceed the atmospheric.

There are several alternatives for the supplying of feed water so that it is practically impossible for the plant to be tied up from an inability to receive water. Two sources of city water supply connect to the header which supplies the heater, and either of these may be drawn upon directly by either one of the two cross-connected feed pumps. In addition a tank of 30,000 gallons capacity connects to the same header, and, being kept full, serves as a reservoir to tide over the improbable contingency of having both sources of city water out of commission, and as a last resort a large supply may be drawn through a connection from the large gas holder water tank. The feed pump deliveries connect through two separate lines, one to the front of the boilers to the regular feed line, and one connecting with the blow-off line at the back of the boilers. By this arrangement, in case of emergency, the boilers may be fed for a short time through the blow-off. As a further alternative, the boilers may be fed by a 2½-in. Penberthy injector, or a 7½ x 5 x 6-in. pump located in the boiler room. The regular feed pumps are single acting with 14-in. steam pistons, 18-in. water rams and a stroke of 14 in. They are of the outside center-packed type, and together have a capacity for supplying 2,000 boiler horse power.

Generating Equipment.

Electricity for the traction lines is generated by four direct-connected railway sets, all contained in the south half of the engine room. Two 24 x 30-in. corliss-type engines built by Clark Brothers, Belmont, N. Y., running at 150 r. p. m. and rated at 700 h. p., are associated with Crocker-Wheeler railway-type generators having a normal capacity of 400 kw. each, at 550 volts. Another set of the same style consists of a 22 x 30-in. Clark engine of 500 h. p., at 110 r. p. m., direct-connected to a 350-kw., 550-volt Crocker-Wheeler generator. There is also an 18 and 30 x 16-in. Westinghouse vertical compound engine, which runs at 250 r. p. m., and is direct connected to a 250-kw., 550-volt dynamo of the same make. This set is not used ordinarily, but is kept as a reserve in case of emergency. The average maximum load of the railway plant is 1,200 amperes, and the maximum possible capacity with all the machines running at their normal load is about 2,500 amperes.

One of the large sets is shown by itself in one of the accompanying cuts. The engine is of a horizontal, simple type with heavy bed construction and corliss-type valve gear having separate eccentrics for the admission and exhaust valves. It is operated non-condensing on a steam pressure of 150 lb. and obtains its speed regulation through a fly-wheel governor. The generator is of the standard railway type, as built by the Crocker-Wheeler Co., the essential features of which are cast-iron internally-flanged magnet frames in which the mild-steel poles are cast-welded, and iron-clad armatures consisting of toothed cores of laminated mild steel, in the slots of which the windings are retained by wooden wedges fitting in notches at the tip of the teeth. The field coils are in three parts, one for series, and the other two for shunt excitation, which are individually wrapped, taped and insulated, and, to improve the heat radiating qualities, are held apart by small wooden wedges. A special feature is the parallel movement type of brush-holder. Each one consists of four sets of copper leaves which carry the current and control the movement of the brush from or toward the commutator, always maintaining the same angle with its surface, so that they wear away evenly. As they become shorter they may be extended and clamped in a new position without altering the surface of contact. A helical spring regulates the brush pressure and since it carries no current, is not inclined to heat and vary its tension. The brush-holder arms are independently adjustable to conpensate for any inequalities among the magnetic circuits, and when the various circuits are in equilibrium, to secure the position of sparkless commutation, the entire rocker ring may be revolved by the hand wheel.

Current for the incandescent and arc lighting is furnished by belt-driven machines located in the northern half of the plant. For incandescent lighting there are two General Electric two-phase 60-cycle 2,300-volt compensated revolving field type of alternators.

END VIEW OF CAR BARN

One of 150 kw. capacity is driven with a speed of 600 r. p. m. by a 225-h. p. 16½ x 18-in. simple horizontal Buckeye engine, running at 225 revolutions per minute. The other has a capacity of 100 kw., running at 900 r. p. m., and is driven by a 14½ x 16-in. Buckeye engine rated at 150 h. p. at 240 r. p. m. From the same engine a 120-light Brush arc dynamo is driven at 500 r. p. m., a friction clutch on the shaft of the engine being used to disengage either machine while allowing the other to run. The remainder of the arc lighting equipment includes two 120-light Brush machines both

driven at 500 r. p. m. by an 18 x 20-in. simple horizontal Clark engine, having a capacity of 300 h. p. at 175 r. p. m., and a Western Electric 125-light arc dynamo driven at 525 r. p. m. by a 14 x 16-in. Buckeye engine rated at 125 h. p. at 240 r. p. m. All the lighting engines are supplied with steam at a pressure of 100 lb., whereas it will be remembered the railway engines receive full boiler pressure, 150 lb. On each of the lighting engines there is a Foster reducing valve to give the 100-lb pressure, and in connection with it a steam gage to indicate the actual pressure obtained.

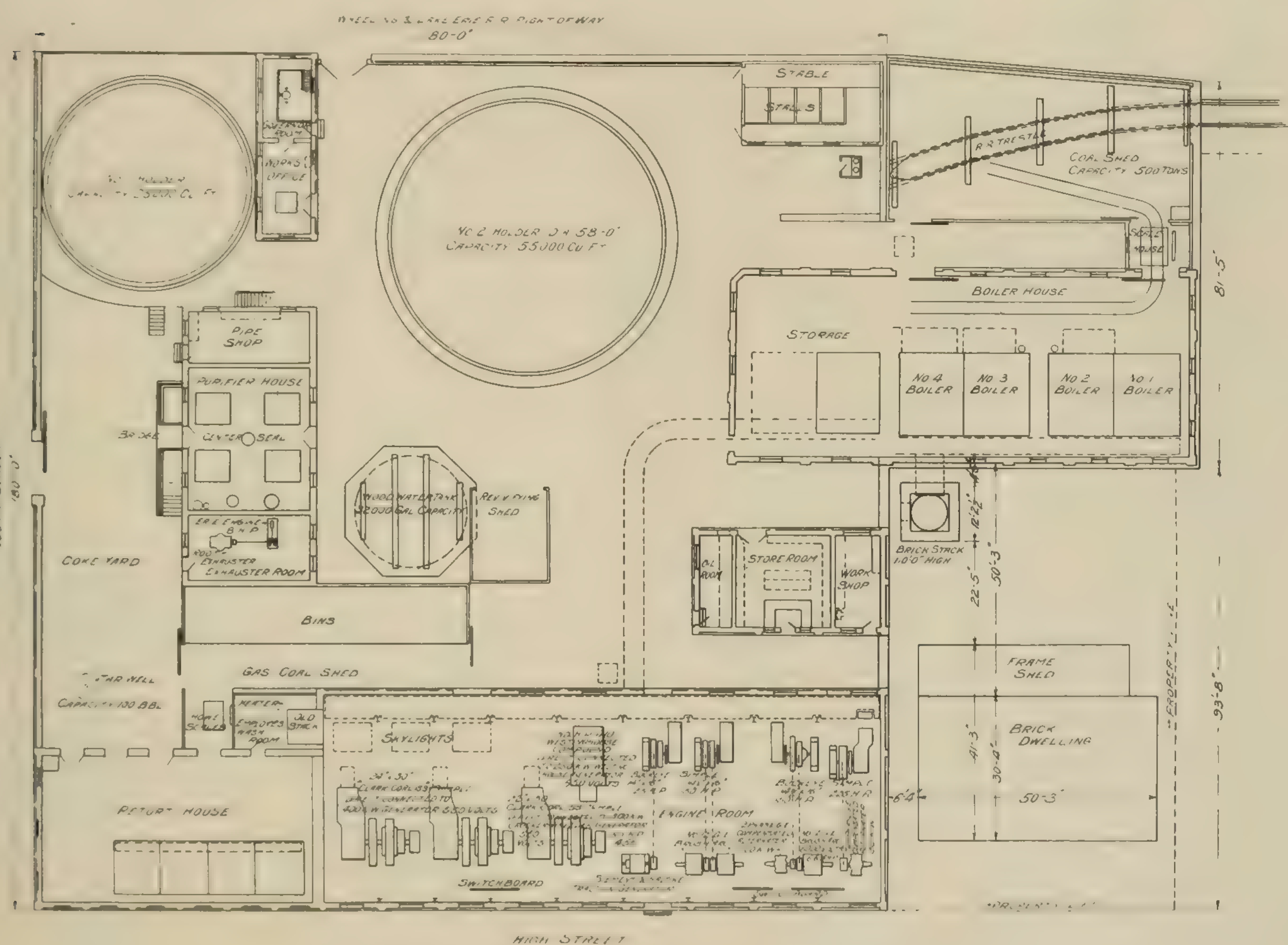
Switchboards.

The separation of the railway work from the lighting has already been suggested in the location of the engines and generators. The individualizing of the various branches is carried still further in the wiring and in the control of the distributing system. Separate switchboards are provided for the railway work, incandescent lighting and arc lighting, each being placed as near as possible to the machines with which it is associated, as the plan indicates.

The railway board was built by the Westinghouse company and contains 6 panels of blue Vermont marble, 90 in. high, 24 in. wide and 2 in. thick, four for generators and two for the distributing circuits. Each of the generator panels includes a circuit-breaker, [illegible] dynamo switch [illegible]. The equalizing switches instead of being placed on the board are supported on pedestals near their respective generators. The extreme left-hand panel serves the Westinghouse generator, the next three the Crocker-Wheeler machines and the two right-hand panels control four distributing lines, two each. One feeder supplies the city lines, another the interurban line and storage battery, the third the South Fourth St. line and the fourth the Pleasant Heights line. On the board there is a circuit-breaker, ammeter and single-pole switch for each line and for the feeder connecting to the storage battery there is an underload circuit-breaker, in addition to the overload breaker. A large gong, which can be heard in all parts of the room, is arranged to give warning as soon as a circuit-breaker opens. The board also contains a Weston station voltmeter, supported on a bracket at the left end of the board, a Thomson intergrating wattmeter at the bottom of one of the distributing panels and tank lightning arresters. The negative bus bar connects with the rails and the positive with the feeders to the trolley wires. An accompanying diagram shows very clearly the arrangement of lines, cables and switchboards for the street railway work, and for the arc and incandescent lighting.

The incandescent lighting board, built by the General Electric Co., is 8 ft. high by 15 ft. long and contains two panels for the alternators and three for distributing lines. It is provided with integrating wattmeters, a synchronizing outfit to serve the two alternators, and for each machine a ground detector, an ammeter in each phase, a voltmeter for the exciter current, a single-pole switch to control the exciting field current, and synchronizing lamps, a rheostat for each exciter, a three-pole switch for putting the exciters together, plug switches for synchronizing, plug switches for the voltages of each phase, six double-throw distributing-circuit switches and a high potential fuse plug in each phase of each side on each of the distributing lines. All high-potential switches are of the oil form and are placed on the back of the board with controlling handles on the face. Above the board there are two transformers for stepping down the pressure for the exciter current. The alternating current is distributed at the generated pressure of 2,300 volts and is stepped down to about 110 volts by transformers, placed on poles near the buildings to be supplied.

The arc lighting switchboard built by the Western Electric Company, of Chicago, contains two panels of blue Vermont marble, each 3 x 8 ft. and is surmounted by a clock. It is arranged for four dynamos and twelve distributing circuits, as on each of the



PROPERTY OF THE STEUBENVILLE TRACTION & LIGHT CO.

panels. Each circuit supplies 20 to 80 series arc lamps and is provided with an ammeter and a current indicator. The connections are made by plug connectors.

Storage Battery Plant.

The storage battery sub-station located at Stanton Park is used principally for supplying current to the further end of the interurban line. The building is of frame about 50 ft. long by 30 wide and two stories high, the upper floor being fitted up as an apartment for the keeper and his family. On the first floor there is a battery room the full width of the house 38 ft. long and in the front a switchboard room. The board is of black slate and contains two panels, upon the right one of which are the following instruments: —a circuit-breaker, a voltmeter, an ammeter, a multiple-point switch for placing the voltmeter on either the battery or the line, and two single-pole single-throw switches, and a single-pole double-throw switch by the manipulation of which the battery may be cut out and the feeder allowed to supply the line clear to the end, or the feeder may be cut out and the battery connected to supply the line above that point, or the battery may be connected to float on the line, giving or taking current to balance the fluctuations of under and overloads. The lower part of the panel contains a double-pole double-throw switch, in the upper position of which the battery may be charged, while in the lower position it is floating on the line. The battery consists of 252 cells of the Electric Storage Battery Co's. F 13 "Chloride" accumulator. These are arranged in five sets to give a pressure of 550 volts and have a maximum discharge of 280 amperes in one hour.

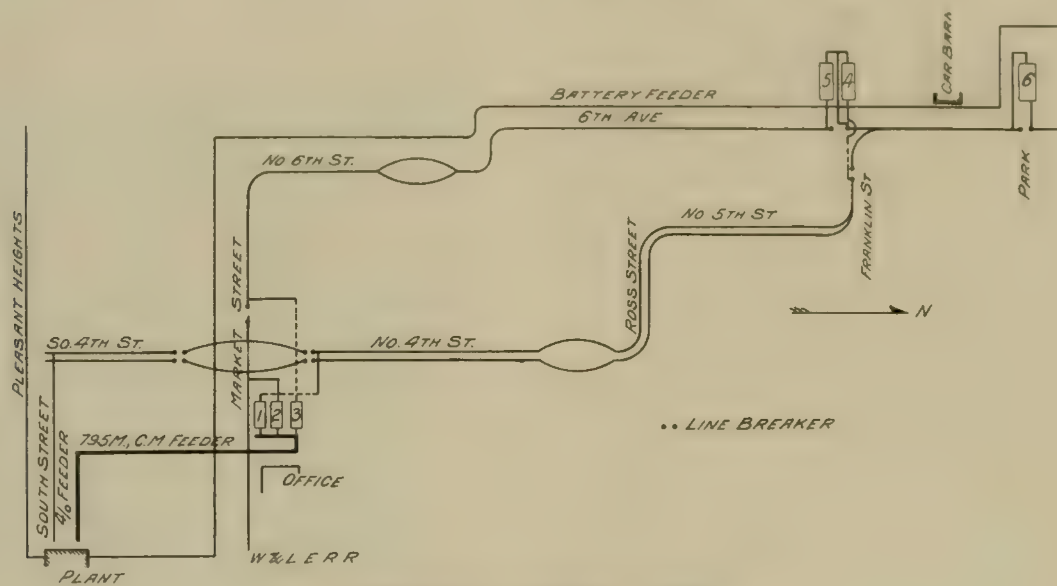
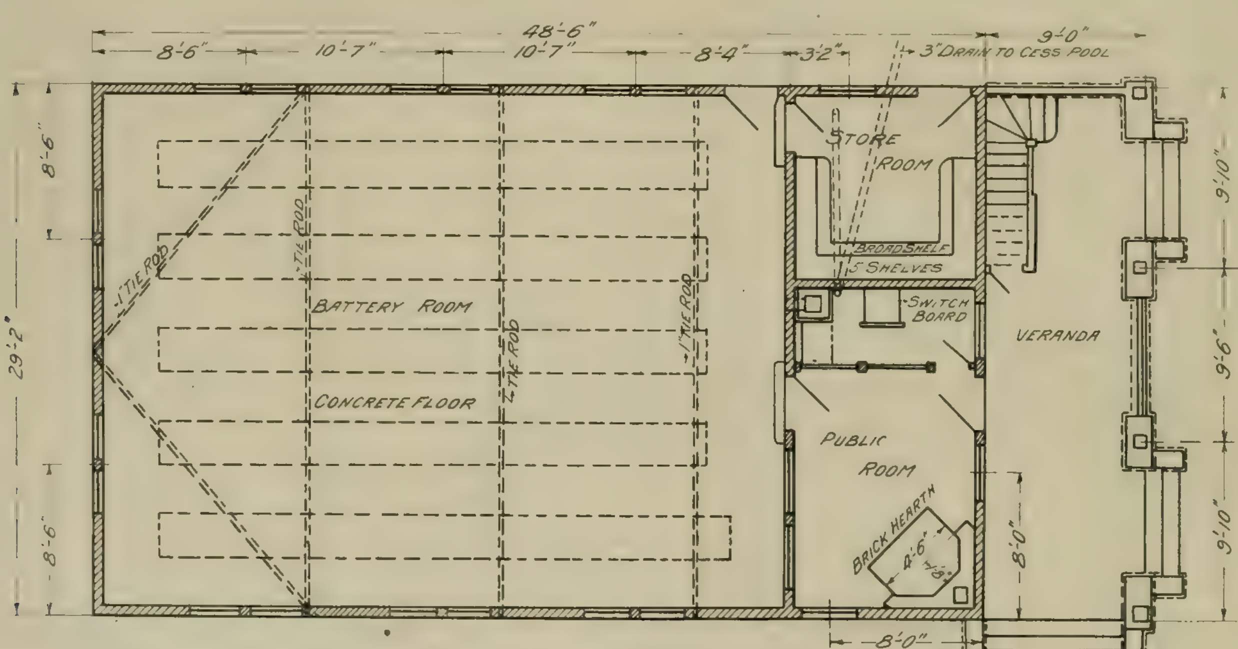


DIAGRAM OF OVERHEAD WIRING.

The lighting of the park grounds and buildings is supplied by alternating current from the power station, there being two transformers for the purpose of stepping down the pressure to 110 volts. The left-hand panel has five alternating current wattmeters to measure the power consumed in the lighting and five double-throw switches to control the distributing circuits; one for the roller coaster, one for the merry-go-round, one for the casino, one for the south park and woods, and one for the north park and lake.



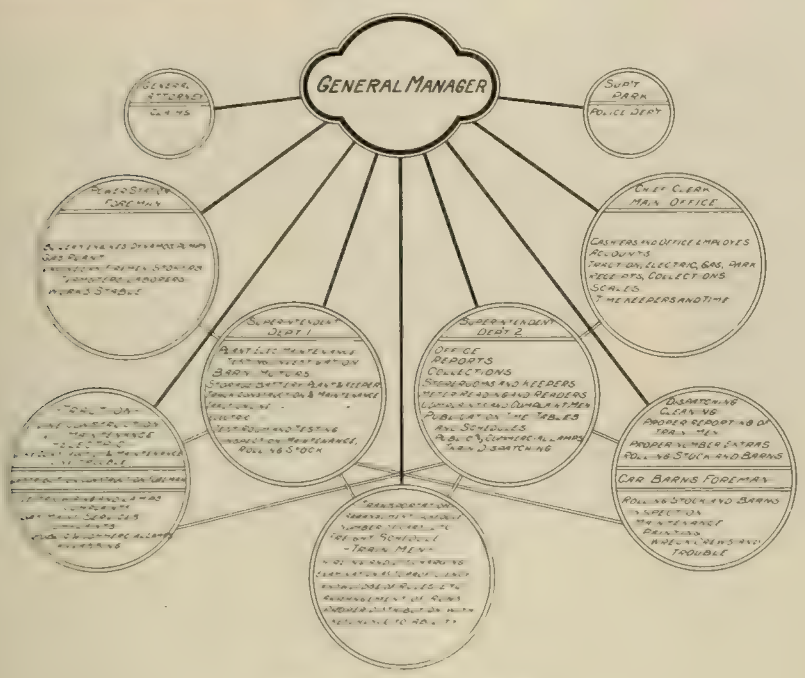
STORAGE BATTERY BUILDING AT STANTON PARK.

Car Barn.

For convenient access to all the lines the car barn could scarcely be better situated than at the intercession of 6th and 7th Sts. It is 45 ft. wide by 200 ft. long and of complete fire-proof construction, i. e., brick walls, slate roof, steel trusses, beams and columns,

slag floor and Kinnear steel rolling doors. There are four tracks extending the length of the barn which, near the entrance, pass over a pit 30 ft. long by 35 ft wide. About 24 cars can be accommodated in the barn at a time and three cars in the repair shop. The surplus equipment is stored in the old barn, about 800 ft. away from the new one.

Adjoining the barn there is a frame paint shop and a repair shed containing a brick and concrete construction pit arranged for making necessary repairs. Both pits are provided with screw



ORGANIZATION DIAGRAM.

motor and armature lifts and overhead chain hoists. There is also a triangular frame extension containing an office, waiting room for the employes, bins for storing sand, etc., lockers, wagon room and stable. The entire group of buildings is wired in strict accordance with the National code, and otherwise carefully protected against fire with fire plugs, hose and chemical extinguishers.

Operation.

In the operating of the road there are several commendable features which might be mentioned in passing. For instance the interurban road besides its passenger service carries freight, at the risk of the sender, delivering it at the nearest point on the road to its destination. Shipments are received by agents in both Steubenville and Toronto. If the consignee is not on the line of the road, the freight is left with one of these agents for delivery. When a shipment is made a receipt is given which is good for a five cent fare on any car, an excess of that amount being charged at the time the cash is paid. By thus making it an object to return the receipt coupon the company is able to keep a check on the amount of business done. Outside of this there are a number of standard ticket forms in use. A green ticket sold at six for a quarter or twenty-five for a dollar is good on all roads except the Pleasant Heights line. A special form coupon ticket applies on the interurban line between its extremes, New Cumberland and Steubenville, one coupon being taken up at the start and one at each of the intermediate points, Toronto, Costonia and Alikenna. Within the limits of Toronto only, a special ticket sold at thirteen for 50 cents is valid. There is also a complimentary ticket form and a monthly commutation ticket which may be used for not more than 24 trips. On the Pleasant Heights road there is a special form of ticket, good only on that line.

The apportioning of the various runs to the motormen and the conductors is determined by their seniority, the most desirable being given to the oldest men and so on down the line. Promotions are then made from any certain run to the one considered the next better whenever a vacancy occurs. It is at the option of the individual to retain his own run, but he forfeits his position in the scale unless he moves up when he is given the opportunity, as a fixed rank applies to a given run. In addition to the regular men there are of course a number of extra motormen and conductors kept at the car house to supply the places of absentees. These men are also graded, the senior being in line for the first vacancy in the regular staff but always beginning at the bottom. The men are required to report 10 minutes before time for their cars to leave, and register on a Day time clock. They then register when taking car out, at meal relief time and at the end of run, being paid only for actual time on car. If a regular man is not on hand to take out his car according to schedule, one of the extras takes his place, and if he later appears he is obliged to take his chance at supplying. Unless he has such an opportunity he receives no pay for that day. As a punishment for infraction of rules or neglect of duty a man is removed from his regular run for a certain length of time according to the gravity of the offence, and required to serve as a supply until he is reinstated, or else remain at home without salary. Another penalty for disobedience is the lowering of the man's rank, giving him a run to correspond. The company's scale of wages varies according to the length of service, regardless of previous experience or ability.

Organization.

The general office and waiting room of the company is on the corner of 4th and Market Sts., in the heart of the business section of Steubenville, and at a converging point of all cars. In the accounting department a thorough system prevails of books, blanks, general ledgers, trip sheets, register report forms, time sheets, pay rolls, requisitions and records of stores, classification cards, storekeepers' reports, monthly statements, etc. The organization is very commendable in the exact way in which the duties of the several departments and their connection with one another are defined. The accompanying chart explains this graphically and concisely and is included as preferable to a wordy description. The general manager, J. Charles Ross, has his headquarters at the main office. J. F. Flood, superintendent of department No. 1, has his office at the car barns; Henry Jackson, chief engineer, is located at the power plant; James Kenney is the chief clerk; Lewis Richards, jr., engineer of outside lines, and S. E. McCoy, car barns foreman. Hon. W. McD. Miller is secretary and general attorney for the company. The officers of the American Gas Co. are Morris W. Stroud, president; S. P. Curtis, general superintendent, and R. L. Babcock, secretary.

Carmen Discharged by Appellate Court.

A decision was handed down by the United States Court of Appeals at New Orleans February 9th by which the decision of the lower court was reversed in the case of the 17 carmen indicted for conspiracy, after the New Orleans street car strike in 1902, for obstructing and retarding the United States mail.

The decision stated that "the indictment does not use the necessary statutory words in describing a crime which was the alleged purpose of the conspiracy. This defect in the indictment is clearly fatal unless it can be aided by other parts of it. It is true that it is stated that they 'did knowingly, willingly and feloniously combine, conspire, etc.,' to commit an offense against the United States. These words, 'knowingly, etc.,' form no part of the description of the crime, which is the alleged purpose of the conspiracy." The court then refers to the part of the indictment naming 11 men as being instrumental in stopping the mails, and says, "The offense charged is a conspiracy. This offense does not consist of both the conspiracy and the acts done to effect the objects of the conspiracy, but to the conspiracy alone. The motion in arrest of judgment should have been granted."

Snow Fences for Electric Railways.

Electric railway operators who have battled with snow storms such as have prevailed throughout the country this winter will be interested in the portable snow fences which have been successfully utilized by the Old Colony Street Railway Co. on certain of its interurban lines in Massachusetts, where there are cuts and flats with which the company has trouble every year on account of the snow. These fences have saved the company a great many dollars by avoiding the necessity for shoveling snow, and by obviating the tying up of its lines.

SNOW FENCE IN POSITION.

One of the accompanying illustrations shows part of one line which was effectually protected by the snow fence last winter, and another view shows the snow on the track at the end of the fence in a place where there was not fence enough to cover. The third illustration is a diagram of a section of the fence. The company obtains the right to erect the fences from the owners of the property through which the lines pass, in the majority of cases it being over cultivated fields. In the fall, just before the ground freezes, the fences are set up. In the spring they are removed and stored.

The fences are built of ordinary spruce, the standards being 2 x 4 in. and the fence boards 1 x 6 in. and 16 ft. long. The cost is about 16 cents per running foot. This year the company erected 1½ miles additional fence, in consequence of the excellent results obtained last year.

DETAILS OF ONE SECTION OF SNOW FENCE.

The Metropolitan Street Railway Co., of Kansas City, has installed a duplex signal service on the 12th St. incline, where a serious collision occurred November 4th, as mentioned in the "Review" for November.

New Hampshire Electric Railways.

The annual report of the New Hampshire railroad commissioners for the year ending June 30, 1903, shows that of the 18 electric railway companies operating in the state but one, the Manchester Street Ry., paid a dividend. The street railroads in the state have 229 miles of track, $3,552,119 in stock, $2,066,000 in bonds and $1,109,003 liabilities. The gross income was $834,894; operating expenses, $796,795; taxes and interest, $103,250, and the returns show a deficit of $65,161. The Manchester road had a divisible income of $31,857. Other roads reporting a divisible income were the following: Chester & Derry Railroad Association, $2,161; Concord Street Ry., $318; Concord & Manchester Ry., $1,116; Portsmouth Electric Ry., $950; Haverhill, Plaistow & Newton Ry., $1,347.

PORTION OF ROAD WITHOUT SNOW FENCE.

A law passed by the legislature of 1903 requires "traction" companies that own or operate railways in the state to make returns. There are two such companies—the Manchester Traction, Light & Power Co., and the New Hampshire Traction Co. The former reported gross earnings for the year of $286,816, to which were added $31,230 dividends and $888 interest on funds advanced to constituent companies. Its operating expenses were $112,568; fixed charges, $76,613; divisible income, $129,953, from which 6 per cent dividends on $1,650,000 of stock were paid. Its capital stock June 30th was $1,934,100; funded debt, $1,457,000; current liabilities, most of which have since been capitalized, $278,006; accrued interest, $18,405.

The six New Hampshire companies controlled by the New Hampshire Traction Co. made returns which show their gross earnings was $36,821 less than operating expenses, and $91,588 less than operating expenses and fixed charges combined.

A Classification of Lighting Accounts Conforming to the Street Railway Accountants' Association Standard.

BY C. L. S. TINGLEY, SECOND VICE-PRESIDENT, AMERICAN RAILWAYS CO., PHILADELPHIA, PA.

The conditions confronting the accountant of a company which operates both electric railway and electric light properties, who at the same time desires to conform to recognized standards and to have his own accounts uniform, as discussed editorially in the "Review" for January, 1904, were brought to the attention of the writer about three years ago. At this time the subject had never been discussed by the Street Railway Accountants' Association, and the final report of the National Electric Light Association had not been presented. The preliminary reports of the latter association indicated, however, a scheme of classification different from that of the Street Railway Accountants' Association, and one that for this reason would tend to confusion in the office of a small property where two or three clerks would be called upon to handle both classes of accounts.

Because of this divergence in the standards the writer prepared a classification of accounts for the light and power department of the business which is presented here, and which it is hoped will be of interest to others similarly situated.

CONSTRUCTION AND EQUIPMENT ACCOUNTS

A. ORGANIZATION—Includes all expenses incurred in effecting organization, and such capital exploit expenses as may be properly connected therewith, including such legal expenses as are directly incurred by reason of the organization of properties or the acquirement of properties.

B. ENGINEERING AND SUPERINTENDENCE—This account includes wages and expenses of engineers, draftsmen, inspectors, superintendents, etc., on preliminary and construction work.

C. ROYALTIES, FRANCHISE AND LICENSE—Includes all royalties or licenses paid to licensors and the amounts represented or paid for in connection with city, town and other franchises.

D. REAL ESTATE AND BUILDINGS—Includes all land, buildings, sheds, docks, wharves and fences, together with brick stacks, traveling cranes, elevators, and such investment costs as can be considered a part and parcel of the building.

E. STEAM PLANT—(a) Includes boilers with settings, and steel stacks belonging with boilers, provided such stacks can be easily removed without injury to the building.
(b) Includes engines with settings.
(c) Pumps, heaters, condensers, tanks, piping, etc., shafting, belting, conveyors and economizers.

F. ELECTRIC GENERATING PLANT—Includes all electrical equipments located in generating stations, together with station wiring.

G. SUB-STATION PLANT—Includes conduits, cables, unlocated in sub-station, together with station wiring.

H. OVERHEAD LINES—Includes poles, wires, cross-arms, mast-arms, and all installation expense connected with overhead main lines or services in connection therewith.

I. UNDERGROUND LINES—Includes conduits, cables, underground conductors, junction boxes, manholes, and all installation connected with underground mains or services.

J. ARC LAMPS—Includes only the actual cost of arc lamps, [illegible]

K. METERS AND TRANSFORMERS—Includes actual cost of meters, meter appliances, transformers installed on outside lines [illegible]

L. TOOLS AND INSTRUMENTS—Includes boiler-room tools, engine-room tools, linemen's tools, meter, arc lamp and other re- [illegible] and all portable testing instruments. All tools bought [illegible]

M. OFFICE FURNITURE AND FIXTURES—[illegible]

N. INTEREST AND DISCOUNT—[illegible]

O. MISCELLANEOUS—This account includes miscellaneous expenses, office expenses, wages of clerks and all other expenses in connection with construction that would not be allowed in any of the accounts enumerated above.

INCOME ACCOUNTS.

MUNICIPAL LIGHT (incandescent, arc).
COMMERCIAL LIGHT (incandescent, arc).
COMMERCIAL POWER SERVICE.
RAILWAY SERVICE.
MERCHANDISE SALES (all job work billed net profits only).
RENTALS.
MISCELLANEOUS RECEIPTS.

EXPENSES.

I. MAINTENANCE.

A. Lines and Structures.

1. Overhead Lines—To this account should be charged all labor and material for maintaining and repairing poles, wires, cross-arms, mast-arms, arc suspension, brackets, insulators, pins, wires and transformers, lightning arresters, fuses and other cut-outs outside the station.

2. Underground Lines—To this account should be charged all labor and material for maintaining and repairing man-holes, conduits, underground and sub-marine cables, together with services in connection with same.

3. Arc Lamps—This account includes the cost of all repairs, replacements and repair parts in connection with the same.

4. Meters and Transformers—To this account should be charged the cost of all repairs, renewals and all incidental expenses for the maintenance of meters and transformers.

5. Buildings and Fixtures—To this account should be charged all labor and material for the proper maintenance and repair of buildings and fixtures used in the operation of the plant (For full definition see page 30, Street Railway Accountants' Standard Classification).

B. Equipment.

6. Steam Plant—To this account should be charged all expenditures for labor, materials, tools, etc., incident to repairs and renewals of steam plant, as per page 32, Street Railway Classification.

7. Electric Generating Plant—To this account should be charged all expenditures for labor, materials, etc., incident to repairs and renewals of electric generating plant, as per page 33, Street Railway Classification.

8. Sub-Station Plant—To this account should be charged all labor, material, freight, etc., incident to renewal and repairs of all electric equipment located in sub-station, together with the sub-station wiring.

9. Tools and Instruments—To this account should be charged all labor and material for renewal and repair to plant and instruments, as covered in Account L.

II. OPERATING.

A. Generating Plant.

10. Power Plant Wages—To this account should be charged all expenditures for labor in the generating station, except labor employed in making repairs and renewals.

11. Fuel for Power—To this account should be charged all expenditures for coal, oil or gas used as fuel, or other fuel used in power plant, including freight and hauling.

12. Water for Power—To this account should be charged all expenditures for water used to produce steam.

13. Lubricants and Waste for Power Plant—To this account should be charged all expenditures for lubrication of power plant, including oil, waste, grease, rags, etc.

14. Miscellaneous Expenses of Power Plant—To this account should be charged all expenditures for operation of power plant, not otherwise provided for.

15. Hired Power—To this account should be charged all expenditures for power purchased from other companies or power plants.

B. Distribution.

16. Operating Arc Lamps and Meters—To this account should be charged all wages and expenses of trimmers, patrolmen and inspectors; also inner and outer globes and carbons, and the cleaning of same; and the cost of all labor and sundries account of installing, removing or exchanging of arc lamps; the expense of reading

COMPARATIVE RECORD. Month ending 19

	Arc Lamp	Kilowatt Hours					
	Hours Totals	Arc Series	A. C. System	Railway	Power		Totals
At Switchboard this Month							
" " same Mo. last Year							
Differences							

Kilowatt Hours, Fiscal Year to Date							
At Switchboard to Date							
" " same period last Year							
Differences							

Receipts per Kilowatt Hour							
	Lighting Circuits			Railway	Power		Totals
This Month							
Same Month last Year							
Differences							
Fiscal Year to Date 19							
" " " " 19							
Differences							

CUSTOMERS RECORD

	Arc System		Incandescent System				
	Municipal	Commercial	Municipal	Commercial	Railway	Power	Totals
Added during Month							
Totals at end of Month							
" same Month last Year							
Differences							
Fiscal Year to Date 19							
" " " " 19							
Differences							

	Lamps Connected			Horse Power Connected			
Added during Month							
Totals at End of Month							
" same Month last Year							
Differences							
Fiscal Year to Date 19							
" " " " 19							
Differences							

Record of Meters							
	K. W.	K. W.	K. W.	K. W.	K. W.	K. W.	K. W.
Added during Month							
Totals at End of Month							
" same Month last Year							
Differences							
Fiscal Year to Date 19							
" " " " 19							
Differences							

Record of Transformers							
	K. W.	K. W.	K. W.	K. W.	K. W.	K. W.	K. W.
Added during Month							
Totals at End of Month							
" same Month last Year							
Differences							
Fiscal Year to Date 19							
" " " " 19							
Differences							

RED INK DENOTES DECREASE.

Distribution Supplies Used											
	Incandescent Lamps						Arc Lamp Carbons				
KIND						KIND					
8 c.p.											
10 "											
12 "											
16 "						Alternating					
20 "											
25 "											
32 "											
50 "											
Cost											

Lubricants and Waste						Arc and Globes				
Cylinder										
Engine										
Dynamo										
Waste										
Cost										

	19	This Month 19	19	Fiscal Year 19	
Fuel pounds					
Fuel Cost, $ per					$ per
Pounds of Coal per K. W. H.					
Pounds of Water per K. W. H.					
Ratio Avg. Load to Connected Load					
Ratio Max. Load to Connected Load					

Daily Averages for Month						
	K. W. H. Output	Wages	Fuel			Water
This Month						
Previous Month						
Differences						

Daily Averages for Fiscal Year to Date						
This Year						
Previous Year						
Differences						

REVERSE OF MONTHLY REPORT SHEET.

meters and the cost of all labor and sundries in connection with installing, removing, replacing, or exchanging of meters, together with the wages and expenses incident to inspection of same.

17. Operating Sub-Stations—To this account should be charged the cost of all labor and material for the operation of storage battery, static or rotary transformer, or motor generator sub-stations.

18. Miscellaneous Distribution Expenses—To this account should be charged all distribution expenses not otherwise provided for.

19. Stable Expense—To this account should be charged all new horses, wagons, harness to replace others worn out; feed for horses and shoeing of the same; wages of stablemen, repairs to wagons, harness, bicycles, etc.

20. Customers' Repairs and Renewals—To this account should be charged all repairs or small renewals (except incandescent lamps) or petty services or connection made on the premises of light or power customers, for which the lighting company should bear the expense, either labor or material; such charges as are not properly chargeable to the customers, including free wiring of all description for the benefit of the customer, and all expenses for transformer or end of main line service, to be charged to this account, and not to investment.

21. Renewals of Incandescent Lamps—To this account should be charged all lamps furnished free to customers.

III. General.

22. Salaries of General Officers—See page 44 Street Railway Classification.

23. Salaries of Clerks—See page 44 Street Railway Classification.

24. Printing and Stationery—Charge to this account all expenditures for printing, stationery and stationery supplies, except as otherwise provided. The cost of printing signs, posters and other advertising matter should be charged to advertising and soliciting. The cost of printing briefs and other legal papers should be charged to legal expense.

25. Miscellaneous Office Expense—See page 46 Street Railway Classification.

26. Store Room Expense—See page 46 Street Railway Classification.

27. Advertising, Canvassing and Soliciting—This account should include salary of contract agent, soliciting agents, together with all compensation for the procurement of central station business, including the cost of advertising of every description, including printing, hand-bills, posters, folders, etc. and the expense of distributing and displaying the same.

28. Miscellaneous General Expenses—See page 48 Street Railway Classification.

29. Loss and Damage—See page 48 Street Railway Classification.

30. Legal Expenses—Includes salaries and expenses of attorney's fees, court costs, together with the printing of briefs and other legal papers.

31. Rent of Lands and Buildings—See page 49 Street Railway Classification.

32. Insurance—See page 49 Street Railway Classification.

33. Merchandise Sales—To this account should be charged the expense for all wiringdone for customers or parties other than the company for which the company is to be reimbursed.

34. Treasurer's Office—This account includes postage and other expenses of the Treasurer's office as apportioned pro rata.

It will be observed that the general scheme is that of the Street Railway Accountants' standard, and where possible to do so the classification is made identical by incorporating the definitions of that standard.

There are usually variations in conditions which render it necessary for a company to open on its books accounts not specified in any standard system that may be adopted, and this is done in practice by subdividing accounts on the books and bringing them together in the monthly statements, thus giving the greater detail without interfering with the ease of making comparisons. In like manner should any efforts that may be made to secure an agreement between the present standards of the two national associations representing the railway and lighting industries fail to accomplish that result, substantial identity could be had by keeping the names of the accounts as shown in the Lighting standard and merely rearranging them to conform to the Railway standard items of classification.

The identity of an account in either system could be easily shown by keeping its old number, showing it in parenthesis, and prefixing a new number. Thus the account "Water for Power" which is No. 3 in the National Electric Light standard, is in subdivision "Operating" under general head "Cost of Manufacture," would be No. 12 (3) in the lighting accounts of a company operating street railways also, and would appear in the subdivision "Generating Plant" under the general head "Operating."

It will be noted that the classification divides on the line of Maintenance and Operation rather than Generation and Distribution, and for the reason already stated, that on small properties with a few clerks handling both railway and lighting accounts, it tends to prevent confusion; but in order that the cost of manufacture may not be lost sight of a place is provided in the form of Monthly Report submitted where the manufacturing cost per kilowatt hour is shown in detail, which cost covers both operation and maintenance charges.

The first noticeable divergence from the National Electric Light Association's classification other than the question of grouping is in the treatment of transformers which it places under the caption of "Maintenance Overhead System," and which the writer's classification has grouped with meters under the title, "Meters and Transformers." This was done at the especial request of the Operating Department in order that transformer maintenance might stand out more prominently than it would in the other grouping.

The next point is that the National Electric Light Association groups under "Maintenance Miscellaneous Station Equipment" all that that caption would imply, together with tools and instruments; whereas the writer's classification has grouped all steam plant under one head, all electric generating plant under another, and provided a separate account for tools and instruments.

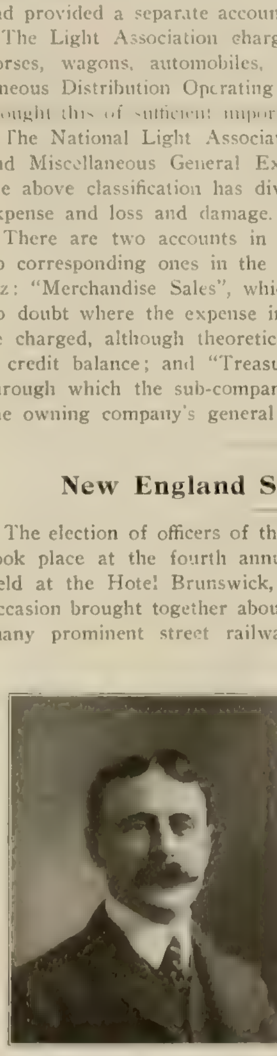
The Light Association charges its stable expenses, renewals of horses, wagons, automobiles, bicycles, harness, etc., to "Miscellaneous Distribution Operating Expenses"; whereas the writer has thought this of sufficient importance to be made a separate account.

The National Light Association has grouped the office expense and Miscellaneous General Expense under one heading; whereas the above classification has divided it. This is also true of legal expense and loss and damage.

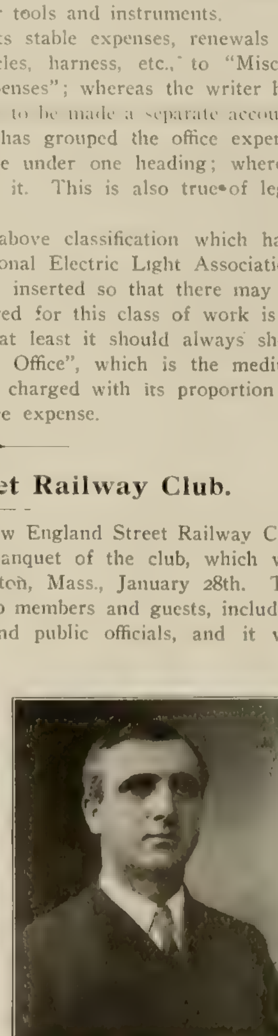
There are two accounts in the above classification which have no corresponding ones in the National Electric Light Association, viz: "Merchandise Sales", which is inserted so that there may be no doubt where the expense incurred for this class of work is to be charged, although theoretically at least it should always show a credit balance; and "Treasurer's Office", which is the medium through which the sub-company is charged with its proportion of the owning company's general office expense.

New England Street Railway Club.

The election of officers of the New England Street Railway Club took place at the fourth annual banquet of the club, which was held at the Hotel Brunswick, Boston, Mass., January 28th. The occasion brought together about 400 members and guests, including many prominent street railway and public officials, and it was



J. H. NEAL.



J. J. LANE.

designated the most successful gathering in the association's history. Addresses were delivered by the retiring president, Mr. H. E. Farrington, and the newly elected president of the club, Mr. J. H. Neal. Other speakers included Mr. Henry M. Whitney, president of the Boston Chamber of Commerce; Gen. William A. Bancroft, president of the Boston Elevated Railway Co.; Hon. Russell A. Sears, of the legal department of the Boston Elevated Railway Co., and the railroad commissioners of the New England states, with the exception of Rhode Island.

The election of officers was held at a business meeting which preceded the post prandial exercises, and resulted as follows:

President, J. H. Neal, chief of department of accounts, Boston Elevated Ry., Boston, Mass.

Vice-presidents for states: Maine—I. L. Meloon, superintendent Sanford & Cape Porpoise Ry., Sanford. New Hampshire—H. A. Albin, superintendent Concord Street Ry., and Concord & Manchester Ry., Concord. Vermont—C. K. Jones, manager Brattleboro Street Ry., Brattleboro. Massachusetts—John T. Conway, superintendent Division 1, Old Colony Street Ry., Quincy. Rhode Island—D. F. Sherman, treasurer Providence & Danielson Ry., Providence. Connecticut—J. K. Punderford, general manager Fairhaven & Westville R. R., New Haven.

Secretary, John J. Lane, editor Street Railway Bulletin, Boston, Mass.

Treasurer, Nathan L. Wood, with the Frank Ridlon Co., Boston, Mass.

Executive Committee: H. E. Farrington, master mechanic Boston & Northern Street Ry., Chelsea, Mass.; C. F. Baker, superintendent motive power and machinery Boston Elevated Ry., Boston, Mass.; W. D. Wright, superintendent of equipment Rhode Island Co., Providence, R. I.; E. A. Sturgis, superintendent motive power and machinery Worcester Consolidated Street Ry., Worcester, Mass.; Louis Pfingst, street railway supplies, Boston, Mass.; R. W. Conant, street railway supplies, Cambridge, Mass.; D. E. Manson, assistant manager Westinghouse Electric & Manufacturing Co., Boston, Mass.

Finance Committee: J. H. Neal, president; James F. Wattles, secretary Rand Avery Supply Co., Boston, Mass.; Fred F. Stockwell, Barbour-Stockwell Co., Cambridgeport, Mass.

Mr. J. H. Neal, president of the New England Street Railway Club, although a young man, has for more than 15 years been identified with the street railways in Boston, and at present fills the responsible position of chief of department of accounts for the Boston Elevated Railway Co. Mr. Neal has always taken great interest in his work and has reached a most enviable position as an expert accountant. He started in the business as a clerk. Mr. Neal has invented several railway appliances which have attained prominence. He is a very active member of the New England Street Railway Club and has been its secretary and treasurer during the past two years.

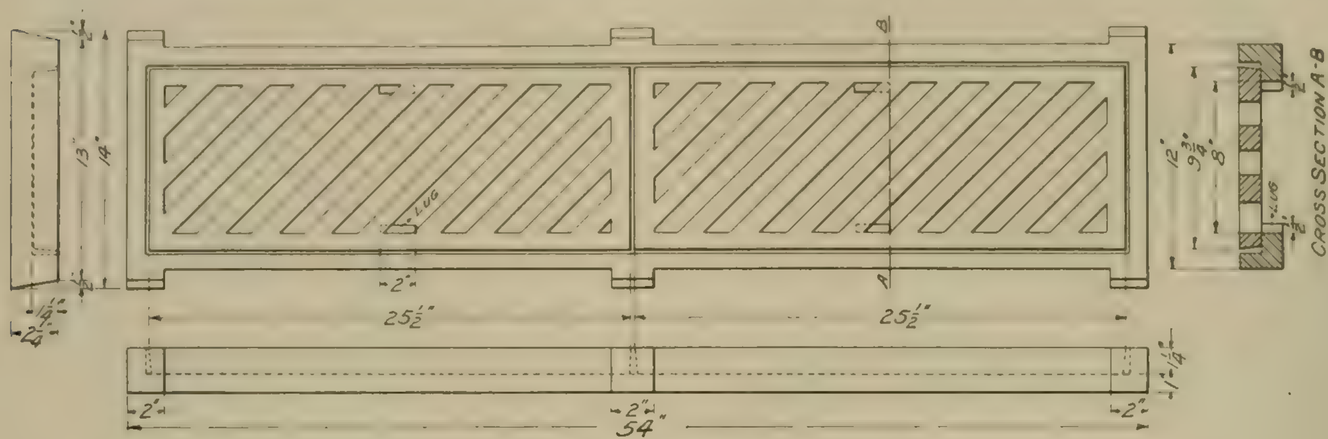
Mr. John J. Lane, the newly elected secretary of the club, has been engaged in the newspaper business, as proprietor, publisher, editor or special correspondent, for 28 years, and during the past two years has been editor of the club's official publication, the Street Railway Bulletin. He was for many years special correspondent for the Boston Globe and Boston Herald, with headquarters at Laconia, N. H., and during the time established and managed several daily and weekly newspapers. About nine years ago, he went to Boston to accept an editorial position with the Associated Press and remained with that organization until he resigned to become editor of the official publications of the New England Street Railway Club.

The Hannibal (Mo.) Railway & Electric Co. carried 660,074 passengers during 1903, an increase of 237,328 over 1902.

Track Catch Basin Grate and Setting.

Considerable trouble is frequently experienced in finding a satisfactory cover or grating for track drains between rails in city streets. With the customary form of grating having the openings parallel with the rails accidents not infrequently occur by reason of horses catching the caulks of their shoes in the slots which results in either tearing off the shoe or throwing the horse.

With the object of securing good track drainage without this objectionable feature the form of cover illustrated herewith has been devised. It will be noticed that the openings are at an angle of 45° to the rails and this arrangement has been found to prevent the possibility of catching the caulks of the horses' shoes and also gives better drainage, as the oblique openings do not clog so readily as either horizontal openings or round holes.

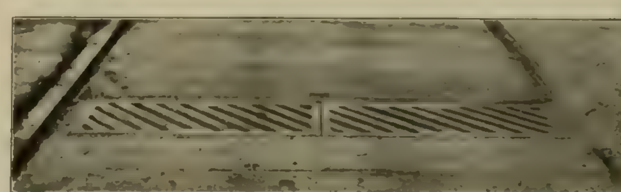


DETAILS OF COVER.

These drains have been found to work satisfactorily on suburban lines where tracks are filled in to the head of the rails, although they were primarily designed for city work in macadam or other pavement.

The grates are made in two sections, as shown, to facilitate handling, and one man can set or remove the grate without aid.

The weight of grate and setting complete is 244 lb. and should cost about 2½ cents per lb., or $6.10 complete. This does not include the cost of brick basins, which necessarily vary with the location. An average cost for city work where sewer connections are handy will be about $4.00 for the brick basin, or $10.00 including basin and grate complete.



TRACK DRAIN WITH OBLIQUE OPENINGS.

Strikes of the Month.

January 25th the Bloomington & Normal Electric & Heating Co., of Bloomington, Ill., whose employes went out on strike January 1st, as reported in the "Review" for January, announced that it had broken off negotiations with the union, as all its cars were running on schedule time and the strike was considered a thing of the past. Fifty-six strikers still held out. The strikers imported an automobile bus to run in opposition to the street cars, but the bus driver got intoxicated, created a disturbance and was arrested and the bus taken out of service. An explosion, presumably from a dynamite cartridge, partly wrecked an East Front St. car and injured one of the passengers. The grand jury on February 9th returned 14 indictments against the strikers and sympathizers.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

NO FREEHOLD, FRANCHISES OR CONSTITUTIONAL QUESTION INVOLVED IN SUIT TO COMPEL LOWERING OF TUNNEL.

People vs. West Chicago Street Railroad Co. (Ill.), 68 N. E. Rep. 78. June 16, 1903. Rehearing denied Oct. 8, 1903.

A writ of mandamus having been asked for to compel the street railroad company to lower or remove a tunnel under a river so that it should cease to be an obstruction to the free navigation thereof, the supreme court of Illinois holds that no freehold was involved in the litigation; no franchises were involved; and the issues in the case did not involve any constitutional question.

RIGHT TO RUN CARS ON DOUBLE TRACKS IN EITHER DIRECTION.

Belton D. Stewart vs. The Washington & Great Falls Electric Railway Co. (D. C.), 31 Wash. Law Rep. 748. Nov. 4, 1903.

In operating a double track railroad, the court of appeals of the District of Columbia holds, the owner is bound by no rule that requires that he shall use the right-hand track for the running of cars in one direction, and the left-hand track for the running of cars in the reverse direction. He may run his cars on both tracks in either direction, as the needs of the business may require.

NO IMMEDIATE INJUNCTION WHERE NO PRIOR DEMAND HAS BEEN MADE FOR GUARD WIRES REQUIRED BY ORDINANCE.

Conshohocken Borough vs. Conshohocken Railway Co. (Pa.), 55 Atl. Rep. 855. May 11, 1903.

Where a road was in operation for some years which had not put up guard wires as required by a borough ordinance, and no formal demand that the guard wires be put up was made prior to the filing of a bill, the supreme court of Pennsylvania holds that a reasonable time for the erection of the guard wires must be given, and the bill must be dismissed if they were put in place within such time, which for this case was fixed at forty-five days; otherwise an injunction restraining operations would be awarded.

DUTY TO KEEP STREETS "IN GOOD REPAIR" DOES NOT REQUIRE REPAVING WITH NEW AND DIFFERENT KIND OF PAVEMENT ADOPTED BY CITY.

City of Williamsport vs. Williamsport Passenger Railway Co. (Pa.), 55 Atl. Rep. 836. May 4, 1903.

A street railway company incorporated by act of the legislature and given an absolute right to use the streets of a city without municipal consent, upon condition that it keep "in good repair" those portions of the streets occupied by its railway, the supreme court of Pennsylvania holds, cannot be required to repave them with a new and different kind of pavement adopted by the city. But, its duty to repair being a continuing one, it will, after the city has so repaved them, thereafter be the company's duty to keep in repair the new pavement laid by the city.

INJURY FROM SUDDEN STOPPING OF CAR TO PASSENGER STEPPING DOWN ONTO RUNNING BOARD FOR PURPOSE OF ALIGHTING.

Bainbridge vs. Union Traction Co. (Pa.), 55 Atl. Rep. 836. May 4, 1903.

When the plaintiff left his seat, where he was safe, and stepped down on the running board of the car, and remained there while it was in motion, the supreme court of Pennsylvania says that he voluntarily put himself in a place of danger, and took upon himself the risk of his position from any cause. That he stepped down on the running board of the moving car because he intended to get off at the cross street for which it had begun to slow down in response to his signal in no manner excused his negligence. With one hand grasping the rail, and the other holding onto a bag of tools, the risk which he took of being thrown from the car, while so standing on the running board, by its sudden stopping, was most imminent, and for his negligence in the assumption of such a risk he alone must bear the consequences.

ADMISSIBILITY IN EVIDENCE IN COLLISION CASE OF MUNICIPAL RULES OF ROAD.

H. E. Taylor & Co. vs. Metropolitan Street Railway Co. (N. Y. Sup.), 84 N. Y. Supp. 282. June 22, 1903.

The plaintiff's vehicle, going easterly along one street, was damaged by colliding with a street car going southerly upon another street. The appellate term of the supreme court of New York holds that it was reversible error to exclude a municipal ordinance offered in evidence, entitled "Rules of the Road—Right of Way," and ordaining that in all public streets and highways of this city all vehicles going in a northerly or southerly direction shall have the right of way over any vehicle going in an easterly or westerly direction. It says that disregard of the duly established rule of the road would not necessarily constitute contributory negligence in the driver, but, if found, it would be a circumstance within the consideration of the jurors, as every man proceeding lawfully may rightfully assume that others will conform their conduct to the requirements of statute and regulations having the force of statute.

PURCHASER OF EQUIPMENT ONLY OF ROAD NOT LIABLE FOR WAGES OF FLAGMAN AS ASSIGNEE OR SUCCESSOR OF FORMER OWNER.

Chicago & Northwestern Railway Co. vs. Fox River Electric Railway & Power Co. (Wis.), 96 N. W. Rep. 541 Sept. 29, 1903.

Where a company purchased the personal property constituting the equipment of a street railway, but "not including the franchises, leases, contracts, or power house machinery," the supreme court of Wisconsin holds that it was not liable as assignee or succesor of a former owner for the wages of a flagman at a railroad crossing, which such former owner had bound himself, his successors and assigns, by contract, to pay. It purchased the property from a company which had acquired the rights of such owner, and the court says that its purchase of the personal property of the former company in place on the street, using and occupying the same place, while operating its street railway system, under its franchise, was no legal basis for holding it assumed the former owner's right of occupancy in the street at the place of crossing, and thereby had cast upon it the burden of paying the expense of maintaining this crossing. Nor does the court consider that the agreement to pay the wages of the flagman attached to the fee of the land over which the street railway was constructed and operated.

DUTY TO LOOK FOR CAR UNTIL TRACK IS REACHED APPLIES TO MOTORMEN AS WELL AS TO OTHERS.

Bobb vs. Union Traction Co. (Pa.), 55 Atl. Rep. 972. May 18, 1903.

Where a motorman did not look for a car on a cross-street after he had started to cross the same when he had seen one approaching, and, if he had looked again before attempting to cross the track would have seen the car within 20 feet of him, and would have observed the ineffectual attempts of its motorman to stop it, the supreme court of Pennsylvania holds that, in an action brought by such first motorman to recover for personal injuries sustained,

it was clearly right to enter a nonsuit on the ground that he was negligent in attempting to cross the street without looking again for a car. It says that it was his duty to look again, notwithstanding that the rules of the company gave him the right of way. The court says that it has repeatedly held that the duty of persons walking or driving at a street crossing to look for an approaching car is imperative, and that it is not performed by looking when first entering the street, but continues until the track is reached. This rule is equally imperative in the case of motormen, and the one first reaching a street crossing with his car may not go on, and, by casting the whole burden of care on the other, imperil the property of the company and the lives of the passengers in his car.

ABUTTERS BARRED BY DELAY IN TAKING ACTION TO PREVENT LAYING OF SECOND TRACK—RIGHT TO CONDEMN TURNPIKES DOES NOT REACH ABUTTERS.

Hinnershitz vs. United Traction Co. (Pa.), 55 Atl. Rep. 841. May 11, 1903.

Where property holders along the south side of a turnpike were confronted in 1897 with unmistakable evidence that an electric railway which was projected, and of which the whole northerly track was laid, was in truth a double-track road, the intent to make it such being indicated by the original location and survey, as well as by the presence of a double-track line to the city limits, and by the building of a second track from a point that obviously suggested both the propriety and the design of connecting these two extremities by a second track south of and parallel with that first constructed, the supreme court of Pennsylvania holds that, in 1899, after two years, during which the road was temporarily operated in the condition in which it was, and when more than one-third of the second track was constructed, the property holders were barred by laches, or inexcusable delay in asserting their rights, from relief in equity.

It is too broad a construction of the grant in the act of May 14, 1889, giving the right of eminent domain to passenger railways as to turnpikes, the court holds, to say that it includes the right as to the soil under the turnpike, and therefore as against the abutting landholders. It is a qualified and limited right of eminent domain as against the turnpike company, the latter being the "owner or owners" meant in the condition that the railway company must make compensation "to the owner or owners thereof."

PROPERTY LEASED INCLUDED IN EXEMPTION FROM GENERAL TAXATION AS OWNED.

Merrill Railway & Lighting Co. vs. City of Merrill (Wis.), 96 N. W. Rep. 686. Sept. 29, 1903.

The company's power plant having been destroyed, the principal stockholders purchased a tract of land with water power appurtenant, and constructed thereon a power plant building, with connection with said water power and with a steam engine, and leased to the company for a period of five years all except four acres of said tract, together with the dam and water power and all flowage privilege; reserving, however, as appurtenant to the four acres not leased, the right to use all water power in excess of the needs of the company. The supreme court of Wisconsin holds that the power plant and water power, except so much of the latter as was reserved in appurtenance to the other lands of the fee owners, was "owned and actually and necessarily used" by the company "in the operation of its business," within the meaning of those words in subdivision 14 of section 1038 of the revised statutes of 1898, and was, therefore, not subject to general taxation, the statutes subjecting those engaged in operating street railways, with or without electric lighting and power plants, to a charge graduated upon their gross revenues, in lieu of other taxation, and as a part of that scheme said subdivision 14 containing the provision to the effect that upon payment of such license fee "all personal property, franchises, and real estate owned and actually and necessarily used by such person, company or corporation in the operation of its business, shall be exempt from taxation and other license fees." The suggestion was made that this exemption statute might be satisfied by a severance of titles in the specific real estate, and by treating as exempt merely the leasehold interest of the street railway company, and subjecting the other interests to general taxation, but the court says that such severance would be wholly foreign to the general scope and policy of the laws of the state for the taxation of real estate, and would render unworkable those providing for enforced collection.

NO LIABILITY FOR INJURY TO POLICEMAN PLACING BEAM TO HAVE CAR PUSH TRUCK UP GRADE—POWER OF OFFICER UNDER STATUTE—AUTHORITY OF MOTORMAN.

Connelly vs. Metropolitan Street Railway Co. (N. Y. Sup.), 84 N. Y. Supp. 305. June 22, 1903.

The plaintiff testified that he was a police constable, and, finding the tracks on a street blocked by a big coal truck which the horses could not move, the street being slippery and the grade upward, he placed a beam about five feet long against the rear of the coal truck and told the motorman to come up slowly, but the car came at full speed, smashed the beam, and injured him. As the appellate term of the supreme court of New York puts it, the plaintiff assumed direction of the defendant's servant and control of its machinery, which latter, not being adapted to his wants, he supplemented with an improvised appliance. He was hurt, as he claimed, through the negligent disobedience by the servant of the orders given him. For this the defendant was not liable, nor could he [it] be made so either by statute or by judicial legislation.

The plaintiff, the court says, claimed to act as in duty bound under the provision in the city charter that, "It is hereby made the duty of the police department and force, at all times of day and night, and the members of such force are hereby thereunto empowered to * * * regulate the movement of teams and vehicles in street." Under that statute, he might direct the movements of defendant's vehicle to and fro, for the purpose of clearing the street, or keep it still altogther; but he could not utilize the motive power for the movement of other vehicles, nor could he direct the defendant's servant to put the vehicle to a use for which he was not employed, and to which the defendant had, so far as appeared, never assented, expressly or impliedly. Whatever was necessary or proper for the service of the defendant was within the motorman's authority, but that was limited to its appropriate use. He was not authorized to depart from his defined function in order to operate the car in a manner foreign to the purpose of his employer. Pushing the coal truck up the grade was work which the motorman did primarily for the policeman, and in so doing he used the power and vehicle of the defendant for what was not contemplated either in its construction or operation or in his own employment. The motorman, it was true, denied that he was negligent, or that he in any wise disobeyed the instructions given by his incidental employer, the policeman. That mattered not here, however, as his negligence, if any, was not the negligence of the defendant.

SELECTMEN MAY PRESCRIBE CHEAPER CONSTRUCTION ON CONDITION THAT IT BE CHANGED IF NOT SATISFACTORY—FINANCIAL EMBARRASSMENT OF COMPANY IMMATERIAL—ORAL EVIDENCE INADMISSIBLE TO VARY WRITTEN GRANT OF LOCATION—PAYMENT OF EXCISE TAX DOES NOT RELIEVE FROM CONSTRUCTION REQUIREMENTS.

Selectment of Gardner vs. Templeton Street Railway (Mass.), 68 N. E. Rep. 340. Oct. 21, 1903.

It is provided by section 7 of chapter 112 of the Revised Laws of Massachusetts that, in case the selectmen of a town are of opinion that public necessity and convenience require the granting of a location, they may "prescribe how the tracks shall be laid and the kind of rails," and other appliances which shall be used, and that they may "impose such other terms, conditions and obligations in addition to the general provisions of law governing such companies as the public interest may in their judgment require." The supreme judicial court of Massachusetts is of opinion that in prescribing the original construction the selectmen could prescribe that the company, at its election, could use a cheaper rail without granite paving within the rails and for eighteen inches outside, on condition that, if that construction did not prove satisfactory to them, it should be changed within a specified time, and the more expensive construction carried into effect by the railway. The court

further holds that it was immaterial that what it denominated the present owner of the street railway was financially embarrassed, and was not able to carry the order of the selectmen into effect. The fact, if it was a fact, was also immaterial, that the selectmen ought to have been satisfied with the T rail. It is competent for selectmen, acting under said section 7, to prescribe the construction shall be done to their satisfaction. If they do so prescribe, their determination, at least in the absence of fraud, is final, and cannot be transferred to or controlled by the court. It was not competent to vary and control the written grant of location by evidence of what was orally agreed upon between the selectmen and the defendant The payment by the defendant of the excise tax under what are now sections 43-47 of chapter 14 of the Revised Laws exempted it from making repairs on the public ways (c. 112, sec. 44), but it had nothing to do with its duty to construct the road in compliance with the grant of location.

BURDEN OF PROOF ON PERSON INJURED GETTING ON OR OFF MOVING CAR—ATTEMPTING TO BOARD CAR SLOWING UP IN ANSWER TO SIGNAL.

Hunterson vs. Union Traction Co. (Pa.), 55 Atl. Rep. 543. May 4, 1903.

Where one is injured in stepping on or getting off a moving car, the supreme court of Pennsylvania holds, the burden is upon him to clearly demonstrate to the court why his case should go to the jury, as a rare exception to the rule. Whatever "rare exceptions" there may be to the rule that it is negligence per se (by itself) to step on or off a moving car, no recovery can be permitted where an injured plaintiff at a crossing signals an approaching car to stop, whose signal is heeded, and he so understands by the slackened speed of the car as it approaches the usual stopping place, but who, before it stops, and while running at a speed of three or four miles an hour, attempts to get on. It is the negligence of the injured person in such a case that is a contributing cause to his injuries, and he cannot escape the rule that his carelessness is in the way of his right to recover.

FILING OF EXEMPLIFICATION OF RECORD OF ADOPTION OF EXTENSION REQUIRED—STATUTE CONSTRUED TO GIVE TWO YEARS TO PROCURE MUNICIPAL CONSENT AND BUILD ROAD

Coatesville & Downington Street Railway Co. vs. West Chester Street Railway Co. (Pa.), 55 Atl. Rep. 844. May 11, 1903.

The supreme court of Pennsylvania holds that as section 4 of the act of May 14, 1889, originally and as amended by the act of June 7, 1901, requires that the exemplification of the record of the adoption of an extension by the board of directors shall be filed in the office of the secretary of the commonwealth, and expressly provides that "no right to actually construct the same shall vest until after thirty days from the filing of said exemplification," the filing is a condition precedent, and that the right to build an extension was not shown by showing the offering for filing of an exemplification which was refused filing.

By the amendment under the act of 1901 to section 1 of the act of 1889 companies were authorized to lay tracks on any street "upon which no track is laid under any existing charter, and in constant daily use for the transportation of passengers at the time of the application by another company for a charter to use such street, but whenever a charter, after the approval of this act, shall be granted to any corporation to build a road as provided by this act, no other charter to build a road on the same streets, highways, bridges or property shall be granted to any other company within the time during which, by the provisions of this act, the company first securing the charter has the right to commence and complete this work; provided, that the consent of the local authorities shall be promptly applied for, and shall have been obtained within two years from the date of the charter." This, the court says, excepted future companies, under charters granted after the date of the act, from the danger of having their privileges taken away before they could get their tracks actually laid, and restored, during the period of two years allowed for building, the exclusive privileges on the streets named that tracks "authorized to be laid" had under the original act. It was a fair and proper provision, without which the necessary period required for building would have been a vain and deceptive privilege, liable to be destroyed at any time without fault of the company by the superior activity or wealth or influence of a junior rival. And for the same reason—the substantial protection of the franchise granted, and to prevent such interferences as were shown to be probable—the time for obtaining municipal consent was enlarged to the time allowed for building, and made an absolute right. Under this section, if municipal consent has been promptly applied for, the want of it cannot be taken advantage of in any way to the prejudice of the company until the two-year limit has expired. Whether the two-year period in which to procure consent, allowed by the act of 1901, will be shortened or terminated by a positive act of refusal on the part of the municipality, or whether the full period may still be available for an opportunity to overcome objections, is not decided.

"RAILWAY" AND "RAILROAD" CONSIDERED SYNONYMOUS TERMS IN STATUTES—TRACTION MOTOR COMPANY TAXABLE AS RAILWAY CORPORATION.

City of Philadelphia vs. Philadelphia Traction Co. (Pa.), 55 Atl. Rep. 762. May 11, 1903.

The rule established by the decisions of the supreme court of Pennsylvania, the latter says, is that the words "railway companies" and "railroad companies" used in the statutes will be considered as synonymous, and either will be held to apply to both kinds of roads, unless there appears from the title of the act, its purpose or its context, something to indicate that a particular kind of road is intended. And the court holds that the act of 1858, which subjects to taxation for city purposes "the real property of railway corporations situate in the city, the superstructure and water stations alone excepted," applies to both steam railroads and passenger railway companies, and includes a traction motor company, which leases and operates street railways. It says that a traction company whose business is confined to the construction of appliances for street railway companies, or to the operation of motors, cables, electrical or other appliances for the traction of the cars of such companies, has but little resemblance to a street railway company, and more to a construction or power company. But when, as in this case, it operates a railway, and leases the property and franchises of various railway companies, and operates them on its own account, it is exercising the franchises of a street railway company, as it is authorized to do, and it enjoys the privileges granted to, and becomes subject to the liabilities imposed by law upon, such companies.

LIABILITY ON BOND FOR FAILURE TO BUILD ROAD BECAUSE OF NARROWNESS OF STREET—DUTY TO SECURE ADDITIONAL SPACE OR USE SINGLE LINE OF POLES OR UNDERGROUND CONDUIT WHEN NEEDED TO PERFORM CONTRACT.

Borough of Montooth vs. Brownsville Avenue Street Railway Co. (Pa.), 55 Atl. Rep. 1036. May 25, 1903.

This was an action to recover upon a bond given by the company to the borough to secure the construction of a street railway upon a certain street. It appeared from the testimony that for a distance of about 750 feet the width of the street was not more than 11½ feet, and the trial court held, as a matter of mathematical certainty, and therefore of law, that this was not sufficient to admit of the safe construction and operation upon it of a line of street railway. Being thus of the opinion that it was impossible for the company to perform its contract, he directed a verdict for it. But the supreme court of Pennsylvania holds that this was error. It says that it is the duty of the party making a promise to ascertain at the time whether or not performance is possible. If he neglect to inform himself, it is at his peril.

Moreover, the supreme court says that, as it read the evidence, it could not avoid the conclusion that there was sufficient in it to justify a finding that it was possible for the railway company to have complied with its agreement to build its line in accordance with the terms of the ordinance. It says that it did not seem to it that the problem which was presented was one to baffle the resources of the builders of modern street railways, even if for a distance of 750 feet they were confined to the use of about 11 feet in width of the highway. As the borough authorities had granted

the use of the street to the company to build its street railway upon, it was to be presumed that other provisions, by means of widening the street or otherwise, would be made for a sidewalk, if it were needed. If the public needs required it, the street could be widened, either by the borough in the usual way, or the railway company could secure additional space by the purchase of ground from the abutting owners. The mere matter of additional expense to the company was no sufficient excuse for failure to comply with its contract. The argument for the company proceeded entirely upon the assumption that it was not bound to make any effort to secure additional space which might be made available, if needful to enable it to build the road upon the right of way granted by the borough. The court does not regard this position as tenable.

The supreme court further says that, if a double line of poles were thought necessary upon the 750-foot portion, permission might have been obtained to set them outside the line of the street, and upon either side. But even if confined to the limit of space which was clearly available, it seemed that methods were open to adoption, which would have made compliance possible. It did not appear from the evidence that double lines of poles were absolutely necessary, as instances were cited in which single lines of poles to support overhead wires were in practical use. It seemed also, that, by means of an underground conduit, the power could be conveyed and the system successfully operated without the use of any poles at all.

LIABILITY FOR INJURIES SUSTAINED BY PASSENGER IN JUMPING FROM CAR TO ESCAPE FROM AN IMPENDING COLLISION—PRESUMPTION FROM COLLISION AND INJURY TO PASSENGER—BREAKING OF BRAKE CHAIN ON OTHER CAR—BURDEN OF PROOF—MEASURE OF CARE AS TO CARS AND APPLIANCES—COMING AND GOING OF CARS ON SAME TRACK NOT EVIDENCE OF NEGLIGENCE—WHEN JUMPING FROM CAR NOT CONTRIBUTORY NEGLIGENCE.

Palmer vs. Warren Street Railway Co. (Pa.), 56 Atl. Rep. 49. July 9, 1903.

As an electric car on which Mrs. Palmer was a passenger approached an up grade, a car with a trailer attached was seen descending and coming towards it on the same track. The brake chain on the descending car had broken, and the motorman was unable to control it. The motorman of the car on which Mrs. Palmer was riding, seeing that a collision was inevitable, stopped his car, and, having reversed the current, started it backwards. The other cars were gaining on it, until it seemed that the collision could not be avoided, and a number of the passengers on the car with Mrs. Palmer, including herself, jumped from it just before the cars collided. For the injuries sustained in jumping from the car this suit was brought.

The supreme court of Pennsylvania says that if Mrs. Palmer had remained on the car and been injured by the collision, no one would think of questioning the presumption of the defendant's negligence. The collision itself, without more, would have been evidence that some one in the employ of the company had blundered, or neglected his duty. As a matter of fact, the collision was due to the breaking of a brake chain; but the case was within the unbending rule, applicable to railroad and street passenger railway companies alike, that, where a passenger on a car is injured without fault of his own, there is a legal presumption of negligence, casting upon the carrier the onus (burden) of rebutting it. And it was immaterial that the collision was not due to any defect in the car on which the plaintiff was riding, or the machinery connected with it, but to a broken appliance on the car that ran into it; for the presumption of the defendant's negligence arises not only when the injury is caused by a defect in the road, cars, or machinery, or by want of diligence or care in those employed, but by any other thing which the company can and ought to control as a part of its duty to carry the passenger safely. The other thing here which was under the control of the company was the chain that broke on another car which ran into the one on which the plaintiff had been a passenger.

But, the court continues, the plaintiff was not bound to wait for the collision. It was rather for her, under the instinct of self-preservation, to try to escape from its danger, and, in seeking to avoid it, she was not necessarily chargeable with neglect of her own safety in exposing herself to another risk by jumping from the car. The company had confronted her with the peril from which she would have escaped, and it was and ought to be responsible to her for whatever naturally followed. In trying to save herself, she was, at the same time, unconsciously trying to save the company from the consequences of its negligence, and of her effort to do so it ought to be the last to complain, unless it was manifest that she acted rashly and imprudently. A well-grounded fear that a collision is about to take place, which will result in fatal or even serious injury to the passenger, is a justification to him to leap from the car. The presumption of the common carrier's negligence is not confined to the cause of injuries resulting from actual collision, but extends to those caused by an effort to escape it, when made on a well-grounded belief that it will occur. The collision itself would admittedly be due to the presumed negligence of the company, and to no other cause could be attributed the manifest danger of it, from which the plaintiff in this case attempted to escape. The court's instructions, therefore, should have been that there was a presumption of the company's negligence, and that there was no burden upon the plaintiff to prove it until the defendant had first rebutted the presumption of it. The court's instructions should also have made it clear that, if the jury should find the plaintiff acted from a well-grounded fear of imminent danger, she was not guilty of contributory negligence in jumping from the car.

More is required of a common carrier, the court holds, than mere reasonable precaution against injuries to passengers, and care that its cars and appliances are to be measured by those "in known general use." While the law does not require the utmost degree of care which the human mind is capable of imagining, it does require that the highest degree of practical care and diligence shall be observed that is consistent with the mode of transportation adopted; and cars and appliances are to be measured by those which have proved by experience to be the most efficacious in known use in the same business.

No error, the court further holds, was committed in saying that the fact that there was a car coming and going on the same track was not in itself evidence of negligence by the defendant company.

BAR BREAKING LETTING MOTOR DROP—DOCTRINE OF RES IPSA LOQUITUR APPLICABLE TO BREAKING OF APPARATUS.

Murray vs. Pawtuxet Valley Street Railway Co. (R. I.), 55 Atl. Rep. 491. May 28, 1903.

A wrought-iron suspension bar placed edgewise in front of a motor from side to side of the truck was about four feet long, five-eighths of an inch thick, and five inches wide, except in the middle about a hole, which it had in the center and through which a bolt or pin on the front end of the motor passed, where the width had been increased to preserve its strength. By the breaking of this bar in the center, from the hole downward, the pin was allowed to drop out and the forward end of the motor to fall upon the ground, which caused the car to stop suddenly and injure a passenger. The supreme court of Rhode Island holds that the burden of proving that the accident was due to the negligence of the defendant was sustained by the presumption of negligence arising out of a consideration of the cause of the accident itself. It says that the mere fact that the bar broke and let the motor fall was inferentially evidence of negligence on the part of the defendant. "Res ipsa loquitur" (the matter speaks for itself) is the maxim applicable to cases where the cause of injuries to passengers arises from the breaking down of apparatus wholly under the control of the common carrier. However, the defendant having satisfied the jury by evidence, not only that it purchased the broken appliance from a reputable maker and dealer in such commodities, but had made daily inspections of the same by an expert employed for that purpose, without any attempt upon the part of the plaintiff to meet it with evidence tending to show that the bar was unlike or inferior to other bars in use for like purposes, or that it was too thin, too narrow, or too weak, and without offering evidence tending to throw discredit upon the kind of inspection that was made, or upon the competency of the inspector, the court holds that the jury was justified in arriving at a verdict for the defendant.

Fast Express Cars for Coeur d'Alene.

Thirty miles to the east of Spokane, Wash., is Coeur d'Alene in the heart of the Coeur d'Alene silver mining district of Idaho, said to be the richest in the "white metal" production of the world. An electric line has lately been opened between Spokane and Coeur d'Alene, which is the second in that mountainous state, the other

COEUR D'ALENE EXPRESS CAR, AMERICAN CAR CO.

being at the capital, Boise City. The American Car Co., of St. Louis, has lately shipped two baggage and express cars to the new road, one of which is shown in the engraving. Other cars built by the same company for this line are three combination passenger and baggage semi-convertible cars of the Brill patented type, and three straight passenger semi-convertibles of the same system. Although connected by a branch with the main line of the Northern Pacific Railway, transportation facilities will be greatly increased by the frequent train service of the electric line, and as the speed will rival that of the steam railroad, much of the express and baggage traffic of the district will undoubtedly be diverted to the new road.

INTERIOR OF COEUR D'ALENE EXPRESS CAR.

The cars are built for carrying heavy loads, and with wide sliding doors at the sides, and swinging doors at diagonally opposite corners, are capable of receiving large pieces of baggage. They are 40 ft. long over the crown pieces, and 8 ft. 4 in. wide over the sills. The cars are mounted on Brill 27-E-1 trucks, with 6 ft. 6 in. wheel base, and 33-in. wheels, have solid forged side frames, and are capable of making 60 miles an hour.

The South Side Elevated Railroad Co., Chicago, recently purchased 15 strips of land adjacent to its road to provide for the third track for its proposed express service.

The offices of the Columbus Railway & Lighting Co. will be remodeled at a cost of nearly $[illegible]. The front wall of the building will be replaced by one of gray pressed brick, with stone trimmings. The company will occupy the entire block.

Financial.

The earnings of the Winnipeg (Manitoba) Electric Railway Co. for 1903 amounted to $287,270. The earnings for December amounted to $27,734.

The annual report of the Lake Street Elevated Railroad Co., of Chicago, not being ready the annual meeting has been adjourned until March 3rd.

The gross earnings of the Toledo & Western Railway Co. for the year ending Dec. 31, 1903, were $185,163, the operating expenses being 57 per cent.

The City Electric Railway Co., of Port Huron, Mich., reports that the earnings of the road for the six months ending Dec. 31, 1903, amounted to $50,614.

The gross earnings of the Chicago & Milwaukee Electric Railway Co. for 1903 amounted to $292,247 and the net was $193,620, the net showing an increase of $72,874. The net for January, 1904, was $8,175, an increase of $2,711, or 49.61 per cent.

The net earnings of the Columbus Railway & Light Co. for 1903 were $126,000 in excess of the previous year. The gross earnings for the six months ending December 31st amounted to $898,000.

The Aurora, Elgin & Chicago Traction Co. has, issued second mortgage bonds amounting to $500,000 to secure needed capital.

The East St. Louis & Suburban Railway Co. reported gross earnings for 1903 of $1,049,381, as compared with $754,761 in 1902, an increase of $294,619.

The gross earnings of the St. Louis Transit Co. in December, 1903, amounted to $600,703, as compared with $550,551 the previous year. For the year 1903 the gross earnings were $7,284,439, as against $6,444,653 the preceding year.

The Columbus, Delaware & Marion Electric Railroad Co. reported for the six months ending Oct. 31, 1903, gross earnings of $84,398; operating expenses, $43,580; net earnings, $40,818.

The Indianapolis & Northwestern Traction Co. recently filed a supplemented mortgage to the Knickerbocker Trust Co., of New York, for $3,000,000, covering all the company's holdings, real and personal, in the counties of Boone, Hamilton, Marion, Clinton, Montgomery and Tippecanoe.

The New York railroad commissioners have granted to the Long Island Electric Railway Co., of Brooklyn, permission to issue a mortgage of $500,000, the proceeds to be used in new construction.

The Northampton (Mass.) Street Railway Co. reported a deficit for the year ending Sept. 30, 1903, of $3,346, as against a deficit of $3,492 the previous year.

The annual statement of the Northern Texas Traction Co., of Ft. Worth, for the year ending Dec. 31, 1903, is as follows: Earnings from operation, $465,394; operating expenses, $261,357; net earnings, $204,037; fixed charges, $100,000; taxes, $11,370; net income, $92,666; operating ratio, .56.

The Fox River Electric Railway & Power Co., of Green Bay, Wis., reports gross earnings for 1903 of $74,480; operating expenses, $71,291; construction and new cars, $69,791. A total of 1,538,805 passengers was carried.

The Tampa (Fla.) Electric Co. reported for November, 1903, as follows: Operating expenses $17,256, against $12,677 the year before, or an increase of 36.1 per cent.; net earnings, $9,617, as compared with $9,311 in November, 1902, an increase of 3.2 per cent; surplus, $7,[illegible], compared with $7,[illegible] the year before.

The Savannah (Ga.) Electric Co. reported operating expenses for November, 1903, of $[illegible], against $[illegible] last year; net [illegible]

ings, $22,095 against $19,748 last year; surplus, $11,042 against $10,025 last year. The operating expenses increased 5.5 per cent and the net earnings increased 12.6 per cent.

The operating expenses of the Terre Haute (Ind.) Electric Co., for November, 1903, were $27,400, as compared with $22,450 the previous year, an increase of 22.2 per cent; net earnings, $14,091 as compared with $11,500, an increase of 22.5 per cent; surplus, $5,543, as compared with $5,020.

The Cincinnati, Dayton & Toledo Traction Co., Hamilton, O., reported for the year ending Dec. 31, 1903, as follows: Earnings from operation, $514,778; operating expenses, $289,245; net earnings, $225,533; charges, $192,323; net income, $33,210.

It is announced that the Blue Grass Consolidated Traction Co., of Lexington, Ky., has been bonded for $700,000. The Southern Mutual Investment Co., of Lexington, is to take $100,000 of the bonds and the rest will be divided between the Cleveland Trust Co. and the Cincinnati Trust Co. The sale of these bonds contemplates the consolidation of the Georgetown & Lexington Traction Co. and the new interurban line to Paris.

The net earnings of the Indianapolis & Cincinnati Traction Co., for the three months ending Jan. 31, 1904, increased $2,319, the largest increase being in January, $973. Mr. A. A. Anderson is general superintendent of the company.

The directors of the United Traction Co., of Albany, N. Y., voted to issue mortgage bonds amounting to $6,500,000, to be applied for the redemption of outstanding bonds to the amount of $3,496,000; the redemption of debenture bonds valued at $765,300, and for extensions and betterments to cost $1,339,000. There is a rumor that the company will absorb the Albany & Hudson Railway Co., as well as other lines in that section. The Central Trust Co., of New York, will be trustee of the redemption fund.

TORONTO RAILWAY CO.

The annual report of the Toronto Railway Co., presented at the annual meeting January 20th, shows the gross earnings for 1903 to have been $2,172,037, an increase of $337,179 over 1902; operating expenses, $1,200,823, an increase of $185,462; net earnings, $971,263, an increase of $151,714; net income, $628,349. Dividends paid during the year amounted to $326,548. The operating ratio was 553, the same as for 1902.

Mr. J. C. Grace was elected a director, vice Mr. James Ross, resigned.

WEST CHESTER TRACTION CO.

At the annual meeting of the West Chester (Pa.) Traction Co. the following statement was submitted for the six months ending Dec. 31, 1903: Net earnings, $27,163; expenses, all charges, $15,457; earnings from all other sources, $268; net income, $11,074; less taxes, accrued interest, $8,917; net surplus over all, $3,057.

The election of directors resulted as follows: Marshall H. Matlack, R. T. Cornwell, Jonas Rice, Mayer Schomberg, John W Woodside, John A. Brill, Samuel A. Boyle, jr.

KNOXVILLE TRACTION CO.

The comparative statement of the Knoxville (Tenn.) Traction Co. for the year ending December 31st is as follows:

	1902.	1903.	Increase.
Earnings from operation	$212,378	$262,770	$50,393
Operating expenses	117,968	137,567	19,599
Net earnings	94,410	125,203	30,792
Fixed charges	67,910	66,657	*1,252
Net income	26,500	58,545	32,045

*Decrease.

CLEVELAND & SOUTHWESTERN TRACTION CO.

Following is the statement of the Cleveland & Southwestern Traction Co. for December:

	1902	1903	Increase
Gross receipts	$24,710	$33,417	$8,707
Operating expenses	17,049	21,708	4,059
Net earnings	7,660	11,709	4,049
For the 12 months:			
Gross receipts	$300,845	$445,167	$144,322
Operating expenses	171,614	264,231	92,617
Net earnings	129,230	180,936	51,706

SOUTH SIDE ELEVATED R. R.

The yearly statement of operating statistics of the South Side Elevated Railroad Co., of Chicago, issued January 28th, is as follows:

Gross earnings	$1,679,310
Operating expenses	994,375
Net earnings	684,934
Interest and dividends	442,883
Surplus	242,051

The gross earnings in 1902 amounted to $1,483,843. The net earnings for 1903 show an increase of about $63,000.

TWIN CITY RAPID TRANSIT CO.

Following is the comparative statement of the Twin City Rapid Transit Co. for the year ending December 31st:

	1902	1903	Increase
Earnings from operation	$3,612,211	$4,063,938	$451,727
Operating expenses	1,630,170	1,878,050	247,880
Net earnings	1,982,041	2,185,888	203,847
Fixed charges	711,718	731,041	19,323
Net income	1,270,323	1,454,847	184,524
Preferred dividend	210,000	210,000	
Common dividend	769,263	825,550	56,287
Surplus	291,060	*419,297	200,237

*Used for betterments and new construction.

Statement for December, 1903:

		Increase.
Earnings from operation	$359,183	$27,852
Net earnings	201,528	21,653
Surplus	123,008	21,150

NORTHWESTERN ELEVATED R. R.

Following is the income account of the Northwestern Elevated Railroad Co., of Chicago, for the year ending Dec. 31, 1903, compared with the previous year:

	1902.	1903.	Increase
Gross earnings	$1,410,998	$1,542,039	$131,041
Operating expenses	464,401	545,245	80,844
Net earnings	946,597	996,702	50,105
Fixed charges	757,174	704,257	37,083
Net income	189,423	202,534	13,111
Previous surplus	282,297	471,729	189,432
Surplus forward	471,720	674,263	202,543
Operating ratio	....	6076	....
Operating ratio, inc. mtnce. reserve..	....	.4259	....

The statement of charges includes "loop account, ½ cent per passenger carried," of $124,666, as against $116,774 in 1902. Maintenance of equipment, including operating expenses, amounts to $66,415, which includes $36,000 charged into operating expenses and set aside for future needs. The daily average of passengers carried in 1903 was 68,310, as against 63,986 in 1902.

SYRACUSE RAPID TRANSIT CO.

Following is the comparative statement of the Syracuse (N. Y.) Rapid Transit Co. for the six months ending December 31st:

	1902.	1903.	Increase.
Earnings from operation	$369,173	$422,443	$53,269
Operating expenses	203,067	239,156	36,088
Net earnings	166,105	183,286	17,181
Miscellaneous earnings	2,560	2,201	*358
Total net earnings	168,665	185,488	16,822
Fixed charges	114,150	121,705	7,555
Surplus	54,515	63,782	9,266
Operating ratio	.55	.566	.016

*Decrease.

The report for December, 1903, is as follows: Earnings from operation, $73,217; operating expenses, $43,067; net earnings, $30,150; miscellaneous earnings, $432; total net earnings, $30,582; fixed charges, $20,245; surplus, $10,336.

ROCKFORD & INTERURBAN RY.

Following is the statement of the Rockford & Interurban Railway Co. for 1903:

Earnings from passengers	$183,181
Earnings from mail and express	6,229
Earnings from rent of tracks and terminals	9,180
Miscellaneous earnings	2,041
Total gross earnings	200,633
Operating expense, inc. taxes	115,642
Net earnings	84,991
Fixed charges (less taxes inc. in operation)	33,564
Surplus applicable to dividends	51,426
Dividends paid, 4 per cent	30,000
Surplus	21,426
Operating ratio, inc. taxes	.5763
Same, exc. taxes	.5600

The surplus applicable to dividends equals nearly 7 per cent on the capital stock. The average earnings per mile of main track were $5,900; average number of cars per day, 16.62.

LAKE SHORE ELECTRIC RY.

Following is the comparative statement of the Lake Shore Electric Railway Co., Cleveland, O., for December:

	1902.	1903.	Increase.
Earnings from operation	$38,962	$46,415	$7,453
Operating expenses	30,184	35,313	5,129
Net earnings	8,777	11,102	2,325
Fixed charges	20,370	20,370	.....
Deficit	11,607	9,268	*2,338
For the 12 months:			
Earnings from operation	$466,051	$616,484	$150,433
Operating expenses	305,878	395,771	89,893
Net earnings	160,173	220,712	60,539
Fixed charges	240,745	240,745	.....
Deficit	80,572	20,033	*60,539

*Decrease.

TOLEDO, BOWLING GREEN & SOUTHERN.

Following is the statement of the Toledo, Bowling Green & Southern Traction Co. for the year ending Dec. 31, 1903:

Earnings from operation	$288,301
Operating expenses	172,198
Net earnings	116,103
Fixed charges	73,996
Net income	42,106
Reconstruction work	3,624
Surplus	38,482
Bal. Jan. 1, 1903	12,983
Surplus Dec. 31, 1903	51,465

At the annual meeting the number of directors was increased from five to seven.

NORTHERN OHIO TRACTION & LIGHT CO.

The comparative statement of railway earnings of the Northern Ohio Traction & Light Co. for December follows:

	1902.	1903.	Increase.
Earnings from operation	$51,533	$55,435	$3,902
Operating expenses	31,863	36,289	4,426
Net earnings	19,670	19,146	*524
For the year:			
Earnings from operation	$653,567	$773,035	$119,468
Operating expenses	374,569	440,643	66,074
Net earnings	278,998	332,392	53,394

*Decrease.

Including the earnings of the lighting department, the company's statement for December, 1903, shows a surplus of $7,097, a decrease of $4,424; the net income for the year is $131,569, an increase of $2,486.

PHILADELPHIA CO.

Following is the comparative statement of the Philadelphia Co. and affiliated corporations for December:

	1902.	1903.	Increase.
Earnings from operation	$1,353,114	$1,429,282	$76,168
Expenses and taxes	693,878	748,379	54,501
Net earnings	659,236	680,902	21,666
Miscellaneous income	11,834	21,202	9,368
Total earnings and income	671,070	702,105	31,035
Fixed charges	312,526	336,096	23,570
Total income	358,543	366,009	7,466
Dividend, Phila. Co. Pref.	23,936	23,936	.....
Surplus	334,607	342,072	7,465
For the 12 months.			
Earnings from operation	$13,773,034	$15,313,790	$1,540,756
Expenses and taxes	7,792,184	8,877,697	1,085,513
Net earnings	5,980,850	6,436,093	455,243
Miscellaneous income	463,605	401,543	*62,062
Total earnings and income	6,444,456	6,837,636	393,180
Fixed charges	3,699,821	3,872,917	173,096
Total income	2,744,634	2,964,719	220,085
Dividend, Phila. Co. Pref.	288,105	287,230	*875
Surplus	2,456,528	2,677,489	220,961

*Decrease.

INTERNATIONAL TRACTION CO.

The comparative statement of the International Traction Co. system, of Buffalo, for December is as follows:

	1902.	1903.	Increase.
Gross earnings	$309,871	$325,464	$15,593
Operating expenses (ex. taxes)	169,957	190,072	20,115
Net earnings	139,914	135,391	*4,522
Fixed charges (int., taxes, etc.)	132,822	134,365	1,542
Net income	7,091	1,026	*6,065
Net income, July 1st to date	149,480	213,543	64,063
Operating ratio (ex. of taxes)	.558	.591	.033
For the quarter ending December 31st:			
Gross earnings	$904,171	$976,449	$72,278
Operating expenses	492,990	571,851	78,860
Net earnings	411,180	404,597	*6,583
Fixed charges	390,134	397,473	7,339
Net income	21,046	7,124	*13,922
Operating ratio	.554	.593	.439
For six months ending December 31st.			
Gross earnings	$1,923,689	$2,174,765	$251,075
Operating expenses	999,654	1,164,777	165,122
Net earnings	924,035	1,009,987	85,952
Fixed charges	774,554	796,444	21,889
Net income	149,480	213,543	64,063
Operating ratio	.529	.544	.015

*Decrease.

TOLEDO RAILWAYS & LIGHT CO.

Following is the statement of the Toledo Railways & Light Co. for December.

	1902.	1903.	Increase
Earnings from operation	$139,608	$154,494	$14,886
Operating expenses	63,889	75,336	11,447
Net earnings	75,719	79,158	3,439
Fixed charges	38,756	39,292	536
Net income	36,963	39,866	2,897
For the 12 months:			
Earnings from operation	$1,459,091	$1,663,794	$204,703
Operating expenses	726,779	856,526	129,747
Net earnings	732,312	807,268	74,956
Fixed charges	459,037	488,200	29,163
Net income	273,275	319,068	45,793

MONTREAL STREET RY.

The operating statistics of the Montreal Street Railway Co. for December are as follows:

	1902	1903	Increase
Earnings from operation	$177,367	$189,266	$11,899
Operating expenses	113,917	128,032	14,115

Net earnings	[illegible]	[illegible]	*2,216
Fixed charges	[illegible]	[illegible]	*133
Net income	[illegible]	[illegible]	[illegible]
For the [illegible] months:			
Earnings from operation	[illegible]	[illegible]	[illegible]
Operating expenses	[illegible]	[illegible]	[illegible]
Net earnings	[illegible]	[illegible]	[illegible]
Fixed charges	[illegible]	[illegible]	[illegible]
Net income	[illegible]	[illegible]	[illegible]

*Decrease

ELGIN, AURORA & SOUTHERN.

The statement of the Elgin, Aurora & Southern Traction Co. for December compares as follows:

	1902	1903	Increase
Earnings from operation	$34,680	$35,582	$902
Operating expenses	21,870	23,142	1,272
Net earnings	13,100	12,430	*670
Fixed charges	9,040	9,255	215
Net income	4,059	3,184	875
For the six months:			
Earnings from operation	$223,877	$242,260	$18,383
Operating expenses	125,710	140,030	14,320
Net earnings	98,167	102,230	4,063
Fixed charges	54,297	55,118	821
Net income	43,869	47,112	3,243

*Decrease.

DETROIT UNITED RY.

The comparative statement of the Detroit United Ry., including the Rapid Railway System and the Sandwich, Windsor & Amherstburg Ry., for 12 months, is as follows:

	1902	1903	Increase.
Gross earnings	$3,961,403	$4,386,975	$425,572
Expenses and taxes	2,260,786	2,613,977	353,191
Net earnings	1,700,617	1,772,998	72,381
Other income	31,247	38,863	7,616
Total income	1,731,864	1,811,861	79,997
Fixed charges	948,902	1,000,000	51,098
Net income	782,952	811,861	28,909
Dividends	500,000	500,000	
Surplus	282,952	311,861	28,909

Brill Convertible Cars for Spokane, Wash.

Twelve convertible cars lately completed by the J. G. Brill Company for the Washington Water Power Co., of Spokane, Wash., are the first of the type to have the sections between the double corner posts and the first corner posts solidly panelled. The purpose of this arrangement is to enable 4-ft. seats with capacity for three passengers to be placed longitudinally at the car corners and thus increase the space at the car doors so that passengers may move in and out freely. Formerly a seat for one passenger was placed at each corner, but there was not sufficient room between the end of the aisle and the door for ingress and egress. This was not an objection when the car was open and the side entrances could be used. In the new arrangement there is a clear space from the door to cross-seats of 5 ft. 3 in., and 4 ft. between the longitudinal corner seats. Passengers occupying the corner seats may leave or enter at the side entrances next to the seats or by the platforms. It is expected that in the future all double-truck convertible cars, and the longer single-truck cars, will include this feature. The extra space at the door will be appreciated by managers of city systems, as crowding at the car doors is in a large measure obviated, and much time is saved by thus facilitating the movement of passengers.

CONVERTIBLE CAR FOR SPOKANE—J. G. BRILL CO.

Another interesting feature of these cars is the Narragansett Z-bar sill, enabling the use of double steps without exceeding restricted limits. The Washington Water Power Co. was the first to have convertible cars with the builder's patented Narragansett sills. This combination was first made in a lot of 16 cars built for Spokane last fall. The double step aids passengers to enter and leave the cars more rapidly and safely, and this of course is a benefit to the railway company because of shortening the stops. It is interesting to note that this railway company purchased the second Brill convertible car that was built, and after determining its wearing qualities and capacity to retain heat, purchased another car of large dimensions, and later the 16 convertibles just referred to.

The large double sash windows of the solidly panelled sections are raised into the roof pockets on the same system as the rest of the windows. The runways which guide the metal trunnions at the sash corners are entirely of metal, so there is no possibility of sticking. From center to center of side posts is 2 ft. 6½ in. The side posts are 3⅜ in. thick, and the corner posts 3¾ in. Length of cars over end panels, 30 ft. 5 in.; over vestibules, 40 ft. 9½ in.; from panels over crown pieces, 5 ft. 2 in. Width over Z-bar sills, 7 ft. 2 in., and over posts at belt, 7 ft. 11¼ in. Sweep of posts, 4½ in.; thickness of corner posts, 3¾ in.; side posts, 3⅜ in.

The movable panels are composed of two sheets of thin flexible steel held apart by horizontal slats which are tapered at the ends to allow slight compression at the edges of the outer metal sheet, thus making it water tight. When the panels are raised into the roof pockets, their position is directly behind the headlining. The cars are handsomely finished in ash and have ceilings of decorated birch, giving a light and pleasant effect. Guard rails on either side are of a single piece and held under the water board by patented gravity catches when not in use.

The cars are mounted on Brill "Eureka" maximum traction trucks having solid forged side frames, and a wheel base of 4 ft. The driving wheels are 33 in. in diameter and the pony wheels 22 in. The axles are 4 in., and the trucks are equipped with 38-h. p. motors. Sandboxes of the maker's patented type have extra large hoppers occupying all the available space under the corner seats. Other patented specialties are: Heavy channel iron radial draw bars, "Dedenda" alarm gongs, angle iron bumpers, and folding gates.

Louisville Railway Relief Association.

The report of the Louisville Railway Relief Association for the year ending Dec. 31, 1903, shows the receipts to have been $3,089.36 and the disbursements $2,385.95. There was a balance on hand Jan. 1, 1903, of $4,395.04, and the balance on Jan. 1, 1904, was $5,098.45. During the year there was paid out in sick benefits $1,705.50; death benefits, $300. The report is published in pamphlet form, pocket size, and contains the reports of the president and financial secretary, a list of the beneficiaries during the year, and a copy of a resolution which was adopted as a mark of appreciation of the Louisville Railway Co's. kindness in assisting at the Christmas Tree entertainment. The president urged all eligible employes of the company, who are not members of the association, to join.

The officers of the association for 1904 are: President, J. T. Funk; vice-president, Jacob Fishback; financial secretary, J. W. Mitchell, 12th and Jefferson Sts.; recording secretary, H. C. DeVoe, 18th and Walnut Sts.; medical director, J. Buschmeyer, M. D.

Report of Massachusetts Street Railways.

The Massachusetts Railroad Commissioners' advance report for the year ending Sept. 30, 1903, has just been received and contains returns from 109 street railway companies. Eight new companies were organized in the year under the general law and five companies were dropped from the list, three having been consolidated during the previous year and two having been succeeded by new corporations following the sale of railways by receivers.

During the year the Gloucester & Rockport was consolidated with the Boston & Northern, the Haverhill & Andover with the Middleton & Danvers, the Middleton & Danvers with the Boston & Northern, the Greenfield & Deerfield with the Greenfield, Deerfield & Northampton, the Reading, Wakefield & Lynnfield with the Lawrence & Reading, the Lawrence & Reading with the Boston & Northern, the Milton with the Blue Hill, the Phillipston with the Templeton and the Eastern with the Bristol & Norfolk.

Owing to consolidations there were but 100 companies existing at the end of the year. Of these, 74 were operating their railways; 20 railways were operated by other companies under lease, or contract, one had organized and was constructing its railway and five had organized but had not commenced construction of their roads.

During the year there was added 78.722 miles of new track to the Massachusetts companies' mileage. There has also been added .555 mile of side track, making a total addition of 79.277 miles reckoned as single track. The Massachusetts companies now own 2,158.973 miles of street railway lines, 363.937 miles of second main track and 147.822 miles of side track, making the total length of track owned, 2,670.732 miles exclusive of the track in the subway. Of this mileage 52.131 miles of main track were operated outside of the state.

Street Railway Mileage Owned, 1902 and 1903.

MILEAGE OWNED.	1902.	1903.	Increase.
	Miles	Miles.	Miles
Length of railway line, . . .	2,111.293	2,158.973	47,680
Length of second track, .	332.895	363.937	31.042
Total length of main track,	2,444.188	2,522.910	78.722
Length of side track, . . .	147.267	147.822	.555
Total, reckoned as single track,	2,591.455	2,670.732	79.277

The gross assets of the companies Sept. 30, 1903, were $158,864,214. The gross liabilities at the same date including capital stock were $123,121,411. The total amount of dividends declared last year was $3,586,248, an increase of $447,537 over the preceding year. Forty-four out of the 109 companies paid dividends ranging from 1 to 10 per cent and 65 companies paid no dividends. The highest dividend paid was 10 per cent and the lowest 1 per cent.

The accompanying table gives the total capital stock, net divisible income, dividends declared and the percentage of dividends on total capital stock for the last ten years:

Capital Stock, Net Income and Dividends, 1894–1903.

YEARS	Capital Stock	Net Divisible Income.	Dividends Declared.	Percentage on Total Capital Stock.
1894, . .	$26,971,275	$1,812,668	$1,610,886	5.97
1895, . .	27,906,685	2,257,355	1,606,196	5.76
1896, . .	30,727,818	2,280,776	1,802,847	5.87
1897, .	32,670,273	2,593,147	1,965,243	6.02
1898, .	38,933,917	2,534,002	2,076,233	5.33
1899, . . .	41,380,143	2,502,942	2,318,398	5.60
1900, . . .	48,971,168	3,037,502	2,409,871	4.92
1901, .	54,069,933	3,398,183	3,417,117	6.32
1902, . .	60,036,328	3,388,851	3,138,711	5.23
1903, . . .	68,401,480	3,602,917	3,586,248	5.24

The average cost of the street railways of the state per mile of main track was $26,014 for construction, $9,994 for equipment, and $12,546 for lands, buildings and other permanent property, making a total average cost of $48,555 per mile of main track. The cost and capital investment per mile of main track for the last 10 years is given in the following table:

Cost and Capital Investment per Mile of Main Track, 1894–1903.

YEARS.	Construction	Equipment	Other Permanent Property.*	Total Cost per Mile.	Capital Investment per Mile.†
1894, . . .	$26,748	$11,528	$15,356	$53,632	$52,963
1895, . .	23,984	10,479	14,266	48,729	49,120
1896, . .	23,396	9,805	12,840	46,041	46,373
1897, . .	22,755	9,374	12,329	44,458	44,683
1898, . .	22,537	8,957	11,735	43,229	44,958
1899, . .	22,863	8,518	11,598	42,979	45,040
1900, . .	23,443	8,510	11,684	43,637	44,273
1901, . .	23,953	8,678	11,666	44,297	45,757
1902, . .	24,495	9,026	11,889	45,410	46,261
1903, . . .	26,015	9,994	12,546	48,555	48,621

* Chiefly lands, buildings and power plants. † Outstanding capital stock and net debt.

The total income of the companies from all sources for the last fiscal year was $27,027,651, and the total expenditures including dividends were $27,010,982, leaving a net balance of $16,668 to be added to the surplus of previous years.

The total number of passengers carried during the last year on the 109 railways reporting was 504,662,243, an increase of 39,187,861 passengers over the previous year. The total number of miles run by street cars was 107,506,812 an increase of 7,226,125 miles over the previous year. The following table shows the volume of traffic for 10 years:

Volume of Traffic for Ten Years, 1894–1903.

YEARS	Total Passengers Carried.	Average Number per Mile of Main Track Operated	Total Car Miles Run.
1894, ...	220,464,099	–	36,722,978
1895, ...	259,794,308	238,963	43,655,560
1896, ...	292,358,943	226,452	53,613,685
1897, ...	308,684,224	212,403	61,577,917
1898, ...	330,889,629	207,982	68,206,418
1899, ...	356,724,213	205,098	73,367,235
1900, ...	395,027,198	200,262	81,750,768
1901, ...	433,526,935	195,683	93,005,225
1902, ...	465,474,382	188,787	100,280,687
1903, ...	504,662,243	192,548	107,506,812

The following table gives the percentage of operating expenses to gross earnings for the last 10 years:

Percentage of Operating Expenses to Gross Earnings, 1894–1903.

YEARS.	Gross Earnings from Operation	Operating Expenses	Percentage of Expenses to Earnings	Net Earnings.
1894, ...	$11,119,846	$7,729,059	69.51	$3,390,787
1895, . . .	13,184,342	9,088,086	68.93	4,096,256
1896, ...	14,844,262	10,563,371	71.16	4,280,891
1897, ...	15,815,267	10,904,040	68.95	4,911,227
1898, ...	16,915,405	11,672,731	69.01	5,242,674
1899, ...	18,151,550	12,378,488	68.20	5,773,062
1900, ...	19,999,640	13,159,947	65.80	6,839,693
1901, ...	21,766,340	14,565,141	66.92	7,201,199
1902, ...	23,486,474	15,912,852	67.75	7,573,622
1903, ...	25,540,811	17,519,367	68.59	8,021,444

[illegible]

Gross and Net Earnings from Operation per Car Mile Run and per Passenger Carried, 1894-1903.

YEARS	Average per Car Mile			Average per Passenger		
	Gross Earnings	Expenses of Operation	Net Earnings	Gross Earnings	Expenses of Operation	Net Earnings
	Cents	Cents	Cents	Cents	Cents	Cents
1894,	30.28	21.05	9.23	5.04	3.50	1.54
1895,	30.20	20.82	9.38	5.07	3.50	1.57
1896,	27.69	19.70	7.99	5.08	3.61	1.47
1897,	25.68	17.71	7.97	5.12	3.53	1.59
1898,	24.80	17.11	7.69	5.11	3.52	1.59
1899,	24.74	16.87	7.87	5.09	3.47	1.62
1900,	24.46	16.10	8.36	5.06	3.33	1.73
1901,	23.40	15.66	7.74	5.02	3.36	1.66
1902,	23.42	15.87	7.55	5.05	3.42	1.63
1903,	23.76	16.30	7.46	5.06	3.47	1.59

of persons employed by the street railway companies and also the number of cars, vehicles and electric motors owned are given in the following table for each of the last ten years:

Employees and Equipment, 1894-1903.

YEARS	Employees	Cars.	Other Vehicles	Electric Motors.
1894,	7,451	4,058	1,790	3,906
1895,	8,048	4,426	1,755	4,704
1896,	9,130	4,913	1,876	5,958
1897,	9,716	5,314	1,953	6,908
1898,	10,416	5,734	1,997	7,643
1899,	11,944	6,042	2,076	8,530
1900,	12,766	6,531	2,371	9,545
1901,	14,749	6,997	2,488	11,284
1902,	15,292	7,144	2,577	12,504
1903,	15,823	7,403	2,644	13,611

The whole number of persons injured in connection with street railway operation during the year was 3,974, of whom 84 received fatal injuries. The number of passengers injured was 2,568, of whom 16 were injured fatally.

The following table gives a summary of accidents reported during the last two years:

Summary of Accidents Reported in 1902 and 1903.

KILLED AND INJURED	Killed		Injured		Totals	
	1902.	1903.	1902.	1903.	1902.	1903.
Passengers,	18	16	2,861	2,552	2,879	2,568
Employees,	10	9	237	152	247	161
Other persons,	57	59	1,070	1,186	1,127	1,245
Totals,	85	84	4,168	3,890	4,253	3,974

The New London (Conn.) Street Railway Co. has granted a permanent increase of pay to its employes without solicitation. For the first six months' service the rate is 18 cents an hour; for the next 18 months, 19 cents, and 20 cents an hour after two years' service. The raise takes the place of the bonus which has been given to the men each year.

Los Angeles Notes.

The refusal of the Pacific Electric and Los Angeles Railway companies to exchange transfers at 9th and Main Sts., has aroused the indignation of residents of 9th street and others, who are in favor of universal transfers. January 1st the Pacific Electric Railway Co. began to operate the E. 9th St. line, which had been operated by the Los Angeles Railway Co., which issued transfers to all of its connecting lines. A committee of E. 9th St. residents requested the two companies to exchange transfers. The request being refused, it was decided to test the state law which requires two street railway companies to exchange transfers when the majority of the stock of both is owned by the same parties. Several persons boarded cars of the Los Angeles Railway Co., paid their fares and asked for transfers to the 9th St. cars. On being refused, they boarded the 9th St. car and, on refusing to pay a second fare, were ejected from the car. Some of them have brought suit against the company and the matter is still in the courts.

The railway companies claim that they are not controlled by the same interests and are therefore not bound to exchange transfers. The people, on the other hand, declare that if the companies are not so controlled they are violating another law which prohibits two such companies from operating on the same track for more than five consecutive blocks. There are several places in the city where this is done, and the people also point to the fact that these same companies do exchange transfers at other points in the city. It is feared by the citizens that the Pacific Electric Railway Co. is seeking to gain control of 9th St. in order to use it for an outlet for its numerous interurban lines, and that eventually the company will abandon its local line there.

The Los Angeles Interurban Railway Co. has acquired the properties of the California Pacific Railway Co., the Los Angeles Traction Co. and the Los Angeles & Glendale Electric Railway Co., which is under construction. Mr. Epes Randolph, vice-president and general manager of the Pacific Electric Railway Co., is president, and Mr. S. B. McLenegan has been appointed superintendent in charge of operation. The systems embraced by this organization are a part of the holdings of the Hunington-Hellman syndicate.

It is reported that Mr. Abbot Kinney has sold his Santa Monica line to the Los Angeles Pacific Railway Co. for $280,000, this being the actual cost of the road as far as it is built. The road was begun some time ago and Mr. W. S. Hook, of the Los Angeles Traction Co., was interested with Mr. Kinney. Since the Traction interests were purchased by Mr. Huntington Mr. Kinney has had no means of getting his cars into the city.

Mr. Richard Nelson, mechanical foreman of the mechanical and labor departments of the Pacific Electric and Los Angeles Railway companies, has resigned and Mr. G. H. Snyder has been appointed to succeed him.

For some time the Pacific Electric Railway Co. has been troubled with wire thieves who have made several raids on its storage yard. At the last raid the thieves came with a horse and wagon and were making off with several coils of wire when they were detected by the company's watchman and one of them was shot. Other members of the gang have been run down by the police.

May Charge Ten Cents for Fare.

The right to charge more than five cents for a fare from Cincinnati to Carthage, O., has been sustained by the Circuit Court at Cincinnati. Citizens of Carthage brought suit against the Mill Creek Valley Street Railway Co. and the Cincinnati Street Railway Co. to secure a reduced rate, the contention being that the route between Fountain Square, Cincinnati, and Gas Hall, Carthage, is an extension of the old Main St. line that runs from Fountain Square to the Zoo, and hence the companies could charge but five cents. The companies asserted that the route from the Zoo to Carthage is an independent line under grant of the county commissioners of March, 1889, and the court upholds this contention.

The West Chester, Kennett & Wilmington Electric Railway Co. has inaugurated a through freight service between Wilmington, Del., and Toughkenamon, Pa., which includes Hockessin, Yorklyn and Kennett Square.

Graphical Mathematics.—II.

BY A. G. HOLMAN, M. E.

In the "Review" for January, 1904, page 27, attention was called to the substitution, for convenience, of small articles to represent larger objects. In this way pebbles could be moved about, arranged in groups, a small number of the same taken from or subtracted from a larger number or two numbers added.

A convenient portable arrangement for recording numbers in a crude way, in fact, a system by which counting could be done even without a knowledge of the names of numbers, would be a flat stone or a strip of bark, upon which marks could be made. To make a record of the number of sheep in a flock (Fig. 8) it would only be necessary, as the animals passed by the observer, to make a tally mark for each animal. But it is evident that with increasing numbers this process would soon become decidedly tedious and unsatisfactory. Laziness, the step-mother of invention, would prompt some abbreviation of the tally marks.

For the record of a single object the primitive tally mark or the picture of one finger extended (Fig. 9) could not be improved upon, and the figure 1 has come down to us from antiquity practically unchanged. For the sign of two, two marks could be made more quickly if they were joined and probably the first figure was two tally marks joined or a representation of two fingers held

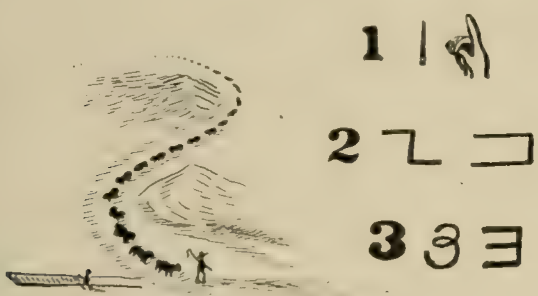


FIG. 8. FIG. 9. FIG. 10. FIG. 11.

up to represent that number (Fig. 10). For ease of writing, and perhaps to make it more distinct from the sign for three, the two marks were afterward drawn in opposite directions. In the same manner three would combine three marks (Fig. 11), and the middle one would gradually develop into a loop. Figure four undoubtedly began as a representation of a four-sided figure or square (Fig. 12), which is still quite closely followed in the written character. Eight was simply two fours combined (Fig. 13), and afterward modified for convenience in writing.

The origin of the other characters in our ordinary system of figures, known as the Arabic numerals, can be readily conjectured along the same lines. Possibly the character for nought or zero was an attempt either to indicate a dish with "O" in it (Fig. 14) or a figure with no sides.

Thus it will be seen that even "figuring" was made possible by the graphical idea which supplied it with figures.

Turning again to more direct dealings with lines to represent numbers, let us draw upon another trade for an illustration. To secure a frame regularly graduated and a method of comparing the relations of numbers thereon, we are not dependent upon bricks, as described in the last paper. The carpenter can produce a sort of picket fence (Fig. 15) which will serve the same purpose. Let this be taken as a crude illustration of an evenly graduated scale. Although fences are more often the basis for a discussion of crops or a law-suit, it can be shown that they have mathematical qualities. If the spaces between pickets were numbered the addition of 12 and 19 could be done by taking the measurement with a stick of the distance occupied by 12 spaces and laying off this distance to the left of the 19th space, when the end of the stick would fall upon the 31 as the sum. Subtraction could be done by reversing the process. If in place of a fence and a long stick, a graduated line and a pair of dividers were used the same operation could be performed in a more convenient way.

Next in order would be a problem in multiplication. For a simple illustration, say that the product of 8 multiplied by 5 was required. Multiplication is, in principle, only the repeated additions of the number. Thus, to multiply 8 by 5, take the space of 8 pickets and lay it off five times along the fence and the result of 40 will be obtained. Division is the reverse process. To divide 40 by 8 see

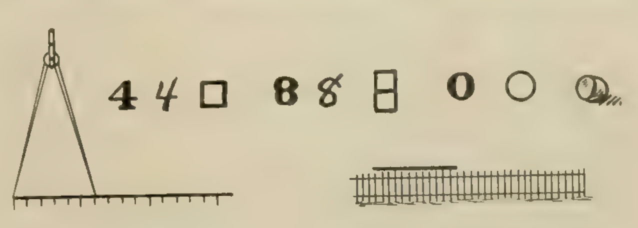


FIG. 12. FIG. 13. FIG. 14.
FIG. 16. FIG. 15.

how many times the 8 picket space can be laid off upon the 40 pickets.

It is evident that these operations can also be performed by stepping off the measurements with dividers upon a line or rule marked with equidistant spaces (Fig. 16).

Another possible problem in division would be to divide a certain quantity into any required number of equal parts. If one-fourth of 40 was required it could by trial be found upon the fence. But suppose one-third of 40 were asked for. Such a question in relation to a division of animals, where only units can be dealt with, would show the result of 3 groups of 13 each and a remainder of one. But in the division of a strip of land, for instance, there can always be an exact division graphically into equal parts, but not directly by the methods thus far examined.

When a stick is broken over the knee into two equal lengths the problem of division by two is solved. The same treatment of the two pieces amounts to a division of the total length by four. The land could be spaced into parts representing division by any multiple of two by the doubling up of a cord which was the same length as the strip. The division into any number of equal parts not a multiple of two must be done by trial or by some method differing from those considered.

A new use for the picket fence now presents itself (Fig. 17). Suppose that the line AB, which is some length between 6 and 7 spaces on the fence, is to be divided into ten equal parts. If the

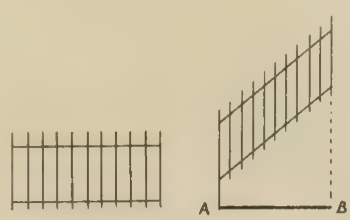


FIG. 17.

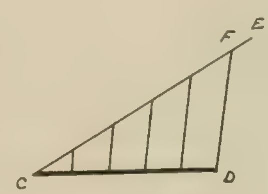


FIG. 18.

pickets are nailed on with one nail in each rail the fence can be swung up on an angle and shut up, so to speak, until the width occupied by ten spaces is the exact length of the line AB. But as the nails have not moved on the rails the pickets are still equidistant from each other, and therefore by the swing of the fence the problem is solved. It is upon this principle that a line may be divided into equal parts without the trial process of spacing with dividers, for if from one end of the line CD (Fig. 18) another line CE is drawn at any angle with it, and the required number of divisions are stepped off of any convenient length on this line, then by joining the last division with the other end of the given line, as FD, and drawing other lines parallel with it, the line CD will be equally divided as required. The value of the process arises from the fact that multiplication, or the running off of spaces on CE, can be performed without any experimenting.

The expedient of division by a swinging lattice or divided diagonal is utilized in a simple instrument designed for spacing an indicator diagram into equal parts so as to compute the average width. As diagrams vary in length this instrument, arranged prac-

tically like the [illegible] form above illustrated, can be set up to accommodate the exact length.

It may be noted here that while graphical operations are usually considered as approximations, certain results are shown with exactness which cannot always be expressed in figures.

One-third of a line 13 inches long cannot be exactly expressed in decimals, but the division can be definitely shown on a drawing. The exact relation between the diameter and circumference of a circle cannot be exactly expressed numerically, even with 300 places of decimals, but the actual lines unquestionably bearing the true relations can be graphically produced.

A mechanical problem once presented to the writer was solved

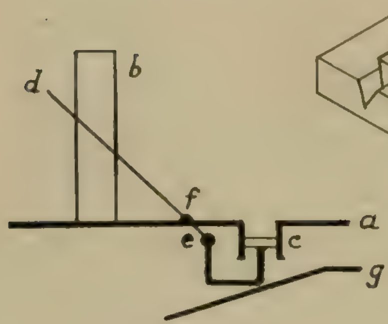


FIG. 19.

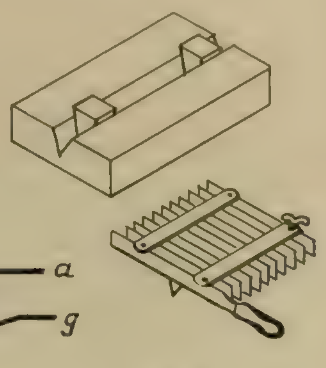


FIG. 20.

by the method last considered. As an illustration of the possible usefulness of the present line of study it may be of interest. An apparatus was to be designed for druggists' use which would separate the total quantity of a prescription for powders into any desired number of equal parts. One of the plans submitted is outlined in the annexed figure (Fig. 19), in which a is a table sliding horizontally under the end of the glass tube b, in which the powder to be divided can be placed; c is a short cylinder of the same diameter as the tube, and attached to the slide, with a piston working therein; d is a graduated scale connected with the piston at e and pivoted at f. Each space on the scale is equal in length to e f; f is exactly at the height of the bottom of the tube, and e is at the same height as the top of the piston. Then, by the principle of diagonal division, when the division on the scale corresponding to the required number, 12 for instance, is brought opposite the top of the powder in the tube, the piston is one-twelfth of that distance from the top of the cylinder. Setting the stroke of the piston at that point the slide is moved back and forth under the tube. At each forward stroke the cylinder measures off one powder from tube and at backward stroke the piston connection strikes the incline g, brings the piston to a level with surface of slide, where the charge can be conveniently removed.

For certain materials the cleaning of the piston and cylinder and tube becomes a troublesome detail. A simpler device on the same principle is shown in the sketch annexed (Fig. 20). A metal block has a V-shaped groove and movable blocks. A shutter has a series of slats with V-shaped wings. The material to be divided is placed in the groove between the blocks. The shutter is closed up until the required number of wings exactly matches the space between blocks. The slats are then clamped in position by the thumb screw, the wings pressed into the groove and the shutter pushed along the groove, when the divided portions will drop successively from the end of the groove.

The next paper will explain the arrangement of simple forms of calculating machines based on the principles already considered and present other methods of graphical work.

North Dakota Owns a Trolley Line.

An electric railway has just been completed at Bismarck, N. D., which was built under the direction of an electrical engineer employed by the state, with labor paid by the state, under authorization of the North Dakota legislature of 1903. The line is 8,500 ft. long, and its route is from the railroad station to the state capitol. The road will be operated by the state under a franchise granted by the common council, which gives it the right to operate an electric street railroad for 20 years, with a maximum fare charge of five cents. The road was built chiefly to accommodate the legislators, who meet in January and February. It will serve both as a freight and passenger line and will haul coal, mail and express matter for the state house. Bismarck has a population of 4,000 only.

Low Open Cars.

The accompanying illustrations show the partial side and end elevations of a new car patented by Mr. Myron Rounds. This car is designed to furnish a low car without sacrificing seating capacity or making an unusual arrangement of seats necessary. This object is accomplished by raising a part of the floor above the trucks sufficiently to clear the wheels and having the remainder of the floor on a lower level or about 29 in. above the track. Fifteen of the passengers on this car would be on the higher floor level or at the same height as in the ordinary car and the remainder would be on the lower level of the floor. The two seats over the raised portion of the floor are provided with a mechanism for raising them to a height similar to the difference between the floor levels. Fig. 1 is a portion of a cross section showing the seat raised and its operating mechanism. Also the short step A which can be made any convenient height. Fig. 2 is a side elevation showing the raised floor over the truck and motor, also a section of the raised seat and its operating mechanism. The turning or reversing of the seat back raises or lowers the seat as desired so that the height from the floor to the seat always remains the same whichever way the passenger is facing. As the step from the running board to the car floor is the most difficult one, owing to the

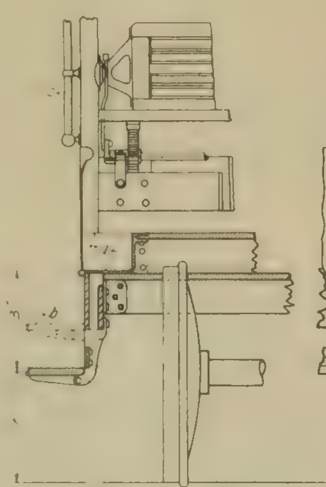


FIG. 1.

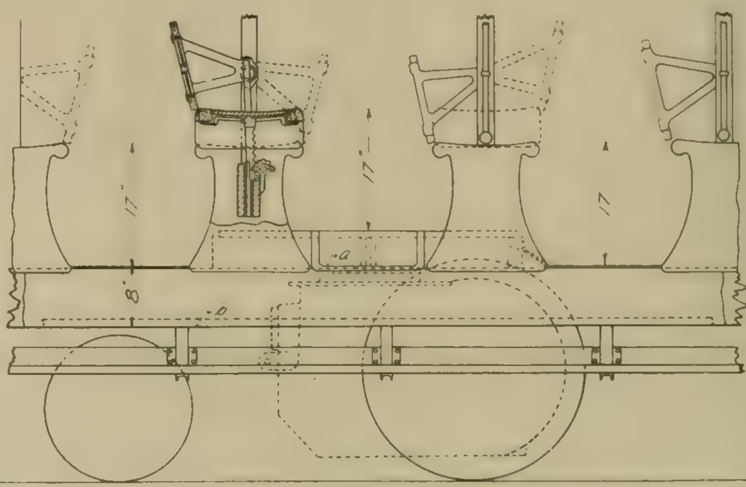


FIG. 2.

absence of the post grab handle, the running board might advantageously be placed at B which would make the last step easy and safe and also more convenient for the conductor to collect his fares and see his passengers. In this case the step A could be dispensed with if desired. With the style of truck shown there would be but five passengers on the elevated part at each end of the car although trucks with wheels all of the same size could be used if desired.

Electric Railways of York, Pa.

The modern industrial and commercial advancement of York, which is the third manufacturing city in Pennsylvania, dates from the inauguration of its street railway system, the later rapid transit facilities especially being a predominant factor in the development of real estate and industries, and the means of attracting outside investors. In 1886, Captain W. H. Lanius, one of York's best-known capitalists, who was the pioneer in street railway enterprises of the city and county, organized the York Street Railway Co., of which he was made president. Horse cars were originally operated upon about two miles of track. From time to time the modest system was extended, until in 1892, when the horse cars were abandoned for electricity, the company's lines reached every quarter of the city.

The York Street Railway Co's. system and the several suburban and rural lines radiating from York are owned and operated by the York County Traction Co., which was incorporated under the laws of New Jersey June 30, 1900, as a consolidation of the York Street Railway Co., York & Dover Electric Railway Co., York & Dallastown Electric Railway Co., York & Manchester Electric Railway Co., Red Lion & Windsorville Street Railway Co., York & Wrightsville Street Railway Co., Colonial Street Railway Co., York Steam Heating Co., York Light, Heat & Power Co., Edison Electric Light Co. and the Westinghouse Electric Light & Power Co. The York County Traction Co. operates under this consolidation over 45 miles of street railways; more than 12 miles of new lines are under construction, while preliminary surveys have been made for more than 30 additional miles of rural trolley roads to be built shortly.

The rolling stock of the consolidated lines comprises 65 cars. Thirty-five Brill cars and three trailers are operated on the city and suburban system and 19 Brill combination cars are used on the rural lines. The company employs about 175 men, of whom 65 are carmen.

The York Street Railway Co. operates 12 miles of tracks, extending from Center square, in the heart of the city, to West York, North York, East York, Windsor Park, Norway Park, Highland Park, Violet Hill and the grounds of the York Country Club.

The York & Dallastown Electric Railway Co. system was put in operation July 27, 1901, with six miles of track; the Red Lion & Windsorville line was opened July 15, 1902, with four miles of track; the York & Dover electric railway was opened November 27, 1901, with seven miles of track; the York & Manchester road was opened in July, 1903, with six miles of track, and will be com-

INTERIOR OF STATION AT YORK, PA.

pleted to York Haven, nine miles from York, within a few months. The York & Wrightsville line has been constructed as far as Hellam, a village nine miles east of York, and when completed will have over 12 miles of track.

Since the opening of the several rural lines, with the promise of additional lines to be opened, York has entered upon a new era of industrial expansion and suburban development. Many tracts of land environing the city have been acquired for building purposes, new suburbs have sprung up and all sort of industrial plant have been established. The populous towns reached have benefited by being placed in more rapid communication with the county capital, and many towns not so favored are urging the extension of the traction company's system. The freight traffic upon the rural lines has become so heavy that special freight cars have been placed in service and a central freight station has been established at York, in a handsome three-story building on West Market St., a few doors from Center square. The passenger station is also in

NEW PAVILION AT FARQUHAR PARK.

the same building. The company's car barns are located in the extreme west end of the city.

The company reaps the benefit of a fine park system, the principal points of interest on its lines being Highland Park, near York; Brookside Park, near Dover; Cool Spring Park, near Manchester; Lake View Park, near Red Lion; grounds of the York Country Club; park and plant of the York water company, south of York; Farquhar and Penn Parks; the Penn Park Athletic Association grounds; the York Athletic Association grounds; the York Agricultural Society's grounds, and the grounds of the Out Door Club, all within the city limits.

Highland Park is a delightful elevation on the banks of Codorus Creek. It is shaded by giant forest trees and contains many romantic promenades and sylvan nooks. A spacious theatre, a broad dancing pavilion, observatories and restaurant are among the park buildings. Brookside Park was established by the company last summer and was liberally patronized by picknickers and pleasure seekers. The park possesses great natural beauty, and is an ideal outing resort. Buildings were reared and the grounds otherwise improved last season, and this spring additional improvements, which will include an athletic field, will be made. Cool Spring Park is a recent acquisition which will be exploited next summer. The other parks named are either public, or are controlled by individuals. The company has secured several sites for parks which will be opened as the development of the system demands.

In the early part of 1904 the immense plant of the York Haven Water & Power Co., at York Haven, will supply power for the York Traction Co's. lines. Provision for this innovation has already been made. A sub-station has been built a quarter of a mile outside the city from which the power will be transmitted to the traction company's power house, situated in the north end of the city. This power house is a commodious structure and its equipment, consisting of boilers of a combined capacity of 1,500 h. p., engines and generators of a total capacity of 2,000 h. p., and all the modern electrical machinery, is being reconstructed. It is expected that the almost inexhaustible source of power (the Susquehanna River), will so augment the possibilities of electric traction in York County that before the end of 1904 the system of the York County Traction Co. may embrace 100 or more miles of track, placing all the towns of consequence within a raduis of 30 miles in trolley communication with York, while eventually all the large inland towns of southeastern Pennsylvania and central Maryland will become accessible.

In accordance with this prediction the York Traction Co., on December 30th, consummated negotiations which had been under

[illegible] the purchase of the Hanover & McSherrystown Street Railway Co., together with the Hanover Light & Power Co.'s property. The merging of the two lines will form one system, reaching almost every important point in York County. The principal places are [illegible]. Hanover has a population of 10,000, and there are numerous smaller towns along the line which will be brought in proximity to York. It is believed that the next move will be to connect Gettysburg and Littlestown, thus forming a complete link between York, Baltimore and Washington, D. C.

The officers of the York County Traction Co. are: President, William H. Lanius; vice-president, Grier Hersh; secretary, George S. Schmidt; treasurer, Ellis S. Lewis; general manager, S. M. Manifold.

To Keep the Bell Cord in Place.

One of the most common sources of annoyance to the conductor, and one which causes him to be reprimanded often, is the bell rope. Frequently, in essaying to give the two-bell signal from the car platform of a long car, the second bell does not ring, owing to the fact that the cord, having been pulled once, remains taut inside the car, while it is slack over the platform. Occasionally, too, the conductor is unable to signal the motorman to stop, for the same reason, and if it is necessary to send in three or more bells quickly it is sometimes impossible to do so. In order to obviate this difficulty, Mr. William I. Kelly, of Jersey City, N. J., offers a simple suggestion which looks feasible. His idea is to allow the cord to run over a four-inch, grooved iron roller placed in front of and a little higher than the hole through which the bell rope runs. It is reasoned that the rope would slide over the roller when pulled, and being higher than the hole, much of the slack would slip back through the hole into the car, thus insuring proper action each time the cord is pulled.

Canadian Notes.

Last year for the first time in its history the gross earnings of the Toronto Railway Co. exceeded $2,000,000. Under an agreement, the city receives 8 per cent of the gross up to $1,000,000; 10 per cent on from $1,000,000 to $1,500,000; 12 per cent on from $1,500,000 to $2,000,000, and 15 per cent on all over $2,000,000

During the past year the Hamilton Street Railway Co. netted for the civic treasury $23,083, an increase of $3,536 over 1902. The Hamilton Radial Electric Railway Co. paid the city $592.

Mr. W. T. Jennings, right-of-way engineer for the Electrical Development Co., Niagara Falls, reported that 85 per cent of the right of way has been secured from Niagara Falls to Scarlett's Road, Lambton, 75½ miles. The minimum width is 80 ft. About 60 acres of land has been acquired at Lambton for terminal facilities. The company has also acquired about 530 acres adjacent to the Chippewa River to be transferred to manufacturers who use its power.

On behalf of street railway employes representatives of the Trades and Labor Congress recently waited upon the premier of the Ontario government and asked for a measure for the establishment of a passageway through open cars to enable conductors to collect fares without being in danger of falling from the side steps. It was advanced that the Hamilton and Ottawa companies are now building cars of that character.

Because the Kingston city council refused a request to extend a switch 800 ft. on the main street, the street railway company served notice that it would suspend operation for the time being. The company claims that by its agreement it need only to run a car once in six months to retain its franchise.

The Ottawa & New York Ry., which operates between Ottawa and Tupper Lake, N. Y., is to be converted to electricity this year. Estimates are being prepared. The present cars and equipment will be retained. Power will be generated at Ottawa and Cornwall, Ont., and at Massena Springs, N. Y.

Messrs. Gilman Brothers & Burden, of Pokirk, and Mr. H. W. Shaw, of the Shaw-Cassells Co., of Hawska, are projecting an electric railway from Fredericton to Woodstock, N. B. Power will be obtained at Pokirk Falls.

The city of Chatham, Ont., has granted a loan of $50,000 to the Chatham, Wallaceburg & Lake Erie Railway Co., which will build an electric railway from Chatham to Wallaceburg, and from Chatham to Rondeau.

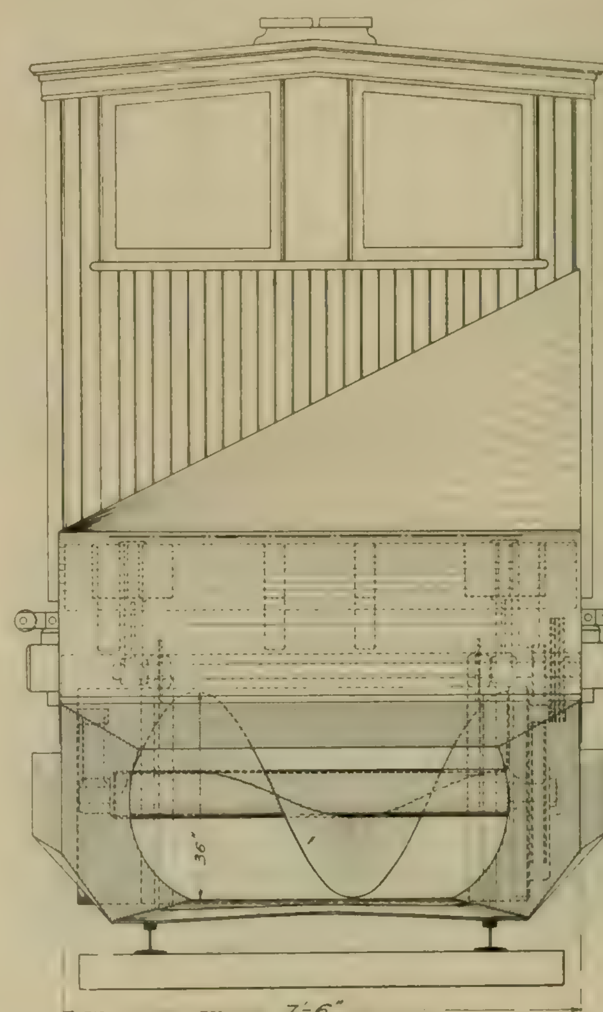
The Ottawa River Railway Co., which was incorporated to build from Grenville to Montreal, is seeking entrance into Montreal. The company agrees to sell 10 tickets for 25 cents good over the line in Montreal and Ville St. Louis for all persons on all days between 5:30 a. m. and 11:30 p. m. Between 11:30 p. m. and 5:30 a. m. two tickets will be required for one fare. The company will pave the streets between the tracks and 18 in. outside, will water them in summer and remove the snow in winter.

The new St. James and St. Charles electric railway system has been opened between Winnipeg and Deer Lodge, with a 50-minute service.

The differences which have existed between the Toronto Railway Co. and the city for four years seem likely to be adjusted by a recent offer of the company regarding new routes and extensions and minor operating details.

Novel Rotary Snow Plow.

The accompanying illustrations show a novel type of snow plow designed by Mr. M. J. O'Donnell, roadmaster of the Seattle Electric Co. The superstructure is a cab mounted upon a turn-table which



ROTARY SNOW PLOW.

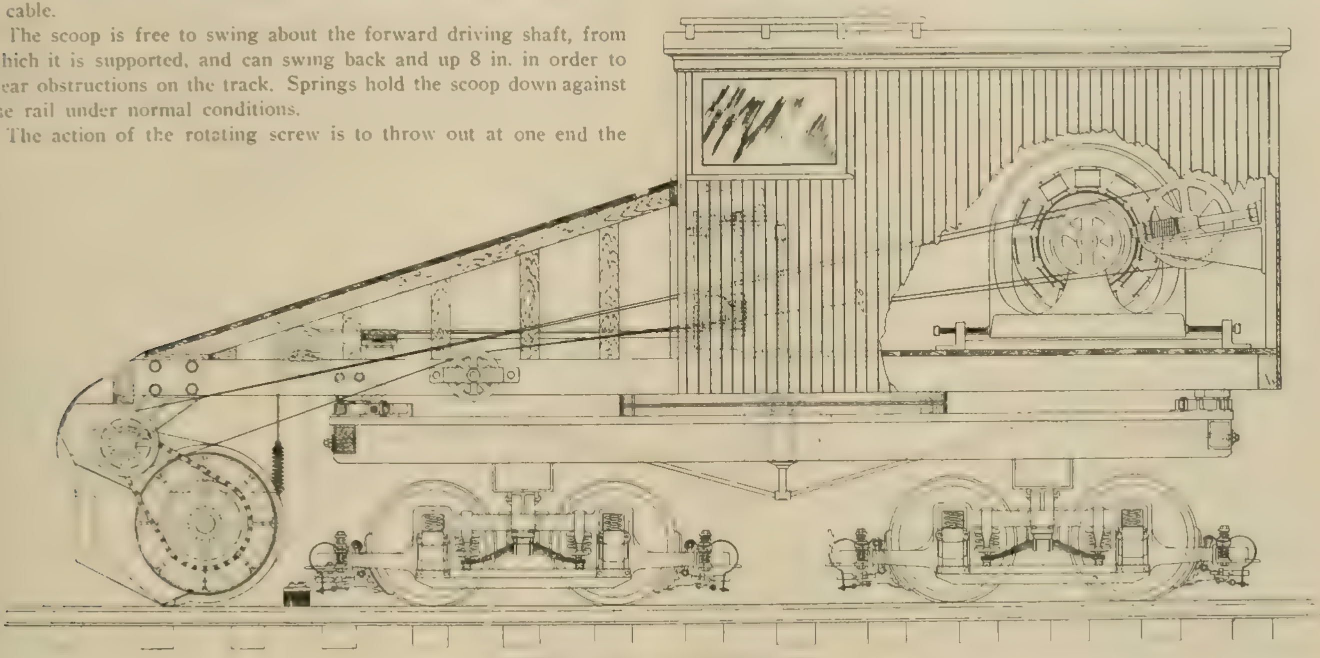
is carried on a platform car mounted on double trucks. The king pin is hollow and through it the wiring for the truck motors is carried, this wiring being sufficiently flexible to permit the cab to swing through 180°. In the cab are the controller for the car motors, and a motor for driving the snow cutting apparatus, with its controller. The snow is removed from the track by a screw 36 in. in diameter and 7 ft. long, which is mounted at the front end of

the plow in a scoop that is suspended from the front of the superstructure, and normally rests upon shoes sliding upon the rails. The screw has a pitch of 48 in. and is driven at a speed of about 300 r. p. m. by sprockets and chain gearing from a driving shaft in the nose of the plow; this driving shaft is driven by the motor through a cable.

The scoop is free to swing about the forward driving shaft, from which it is supported, and can swing back and up 8 in. in order to clear obstructions on the track. Springs hold the scoop down against the rail under normal conditions.

The action of the rotating screw is to throw out at one end the snow which is gathered into the scoop by reason of the forward motion of the plow, the snow when taken from the track being thrown entirely to one side. The need for the turn-table and reversible cab is readily apparent.

Letters patent were granted to M. J. O'Donnell and Otis Cutting on Oct. 5, 1903, the claims allowed being for a rotary snow plow in combination with a reversible or rotating car body, and for the hollow king pin.



SPECIAL ROTARY SNOW PLOW.

Freight Business on Electric Railways.

We reprint herewith excerpts from an article entitled, "Freight Business on Electric Railways," which was prepared by Mr. James D. Hawks, president of the Detroit, Ypsilanti, Ann Arbor & Jackson Ry., and which originally appeared in The Gateway:

For the purpose of this discussion it is advisable to dismiss from consideration electrified steam roads as having no bearing and also to eliminate electric roads running through a country not already supplied with steam road facilities. This narrows the problem down to the consideration of the class which includes the majority of electric railroads which have been built, practically in competition to steam roads between populous cities and villages, and through thickly settled country. It is true that many of these roads carry what is called freight, but this is a misnomer, as they carry what should more properly be classified as express matter or package freight. The usual practice is to adopt the same classification as the steam railroad, down to and including fifth-class, with some special commodity rates, and to charge about the same rate as the steam road.

The commanding advantage which suburban electric roads have constitutes the fact that their main business is done on city roads, with no expense to them for terminals. A new condition confronts them as soon as they depart from their original purpose, for the moment electric roads undertake to haul cheap freight they will have to provide terminals. This would be practically an impossibility in the larger cities. If there were only a few freight cars a day to move there is still the initial expense of providing a freight locomotive to move them and a power house to furnish current, that would be out of all proportion to the revenue, and, on the other hand, if many cars are to be moved the electric road must become a competitor and take freight away from the steam road.

The situation in the passenger department is entirely different. Electric roads carry an immense number of passengers, only a small proportion of which are taken from the steam road, as the great bulk of this travel originates by reason of the frequency of trains and cheap service on the electric road. While passenger travel can be increased immensely, freight movement practically cannot be increased at all. It would be impossible to go into the market to-day and get money to build steam roads paralleling existing lines; they why should it be any easier to get money to build electric lines paralleling steam roads if it is known that the electric roads are expected to get the freight away from the steam roads? There is also a grave question as to whether electricity is a cheaper motive power for hauling freight than a steam locomotive, and it certainly has not been proved so far.

Instances are not wanting to prove that passengers on electric roads are willing to pay the same fare that steam roads charge, the best evidence being that steam roads have reduced their fares in an unsuccessful effort to compete with the electric roads. The fact is, other things being equal, passengers prefer electric roads, and this preference is shown many times where other things are not equal. No one ever heard of a person asking visitors to take a ride on a steam road for fun, but thousands of dollars are spent every year by people riding on electric roads for pleasure. But these advantages of an electric road in passenger transportation do not extend to hauling low-class freight, and besides there are specific arguments against the latter business. The very life of an electric road depends on the cars going through the busy parts of the cities and villages on its line, and it is almost the universal custom for the councils in cities and villages to insist on a girder tram rail or a girder groove rail where streets are paved. This makes the adoption of a special wheel necessary, and suburban roads are driven to use a small flange and a narrow tread. Most of the suburban roads are laid with T-rail outside of the cities, but there would be very little freight to be hauled between the outskirts of one city and the outskirts of the next one.

While it is believed that the package freight has gone to the electric road to stay, it can be readily seen that if there was enough of it to produce congestion the great advantage of quick handling might be lost. It will be many years before the well-located suburban roads can work up the legitimate passenger business that is in sight. Most of them have so far been contented with such business as comes to them, but by proper effort this business can be increased many fold, especially in the summer time. It will require, however, undivided attention to the needs of the people and attractions in the way of parks and resorts. The quicker the suburban roads quit talking about hauling low-class freight the better for them.

Personal.

MESSRS. A. C. ARMSTRONG AND J. M. ATKINSON were recently appointed representatives of the Continuous Rail Joint Co. of America.

MR. JOHN L. BUSHNELL has been elected president of the Springfield, Troy & Piqua Railway Co., to succeed his father, the late Asa S. Bushnell.

MR. S. J. COTSWORTH has been appointed secretary and treasurer of the North American Railway Construction Co., to succeed Mr. D. J. Evans, resigned.

MR. JOHN S. GRAYBILL, JR., has been appointed secretary and treasurer of the Lancaster County Railway & Light Co., vice Mr. Oscar M. Hoffman, resigned.

MR. F. G. DANIELL has resigned as superintendent of the Cleveland, Painesville & Ashtabula Railroad Co., of Cleveland, O., the resignation taking effect February 1st.

MR. G. J. SMITH has resigned the position of assistant superintendent of the St. Louis Car Co., to become master mechanic of the Metropolitan Street Railway Co., Kansas City, Mo.

MR. JOHN H. GLADE has resigned as secretary and treasurer of the South Side Elevated Railroad Co., of Chicago, on account of ill health. He had been connected with the company 15 years.

MR. THOMAS B. REDMOND has been appointed general manager of the Mississippi Valley Traction Co., of Moline, Ill. He was until January 1st assistant superintendent of the Saginaw Valley Traction Co.

MR. C. P. TOLMAN has been appointed chief engineer of the sales department of the National Electric Co., Milwaukee, to succeed Mr. James H. Denton, who has been appointed general superintendent of the works.

MR. S. P. M'GOUGH, heretofore western agent of the Continuous Rail Joint Co. of America, has been appointed assistant to Mr. A. S. Littlefield, western sales agent of the Lorain Steel Co., vice Mr. D. J. Evans, resigned.

MR. WILLIAM GUTHRIE has been appointed superintendent of the power house of the Cumberland Valley Traction Co., Harrisburg, Pa. He was formerly superintendent of the electric light plant at Chambersburg, Pa.

MR. J. P. CLARK, who has been superintending the construction of a branch line for the Indiana Union Traction Co., between Marion and Huntington, Ind., has resigned to accept a street railway position in New York City.

MR. CHARLES A. ATKINSON, formerly master mechanic of the Richmond (Ind.) Street & Interurban Railway Co., has been appointed superintendent of the Medway power house of the Dayton, Springfield & Urbana Electric Railway Co., of Springfield, O.

MR. J. R. BLACKHALL, who has been acting as superintendent of construction for the Chicago & Joliet Electric Railway Co., will succeed Mr. F. E. Fisher as general manager of the company, and will assume his new duties April 1st, when Mr. Fisher's resignation becomes effective.

AT A MEETING OF THE DIRECTORS of the Toledo, Bowling Green & Southern Traction Co., January 19th, Mr. Henry Burkhold resigned as vice-president and treasurer. Mr. John Kilgour was elected vice-president, and Mr. A. J. Becht was elected treasurer of the company.

MR. H. C. HARTLEY has resigned as superintendent and purchasing agent of the Lincoln (Neb.) Traction Co., to enter business in Lincoln. He entered the employ of the company in February, 1894, as consulting engineer, and in June, 1894, was appointed superintendent.

MR. L. TRUDEAU has been appointed superintendent of the Montreal Street Railway Co., to succeed Mr. Luke Robinson, resigned. Recently Mr. Trudeau, who is an ex-official of the company, returned from Alexandria, Egypt, where he was connected with the tramway service.

MR. E. C. FOLSOM has been appointed superintendent of the Logansport & Wabash Valley Traction Co., and the city lines of Logansport, Wabash and Peru, Ind., to succeed Mr. Joseph T. McNary, resigned. Mr. Folsom was formerly manager of the Logansport City Railway Co.

MR. GEORGE A. STANLEY has been elected president of the New York & Long Island Traction Co., vice Mr. John E. Ensign, resigned. Mr. Stanley was formerly vice-president of the company. He formerly lived in Cleveland, O., where he was also purchasing agent of the Cleveland Electric Railway Co.

MR. ROBERT M'AFEE has been chosen president of the Youngstown (O.) Park & Falls Street Railway Co., to succeed the late Samuel C. Grier. Mr. McAfee, who was formerly director of the bureau of public works at Pittsburg, Pa., is at present state banking commissioner, with headquarters at Harrisburg, Pa.

MR. J. B. M'CLARY, who a few weeks ago resigned the position of manager of the railway department of the Birmingham (Ala.) Railway, Light & Power Co., has organized the firm of J. B. McClary & Co., with headquarters in the First National Bank Building, Birmingham, to act as manufacturers' agents for electric railway, railroad, mill, mine and furnace supplies.

MR. E. D. ARNOLD, consulting engineer for the Council Bluffs, Tabor & Southern Electric Ry., who has been in California this winter inspecting railroad construction as carried on in the West, and securing data for his road, will return to Creston, Ia., about March 1st. Upon his return he will take up the matter of the electrical and mechanical equipment of the new road.

MR. HOWARD E. HUNTINGTON has been appointed general manager of the Los Angeles Railway Co., to succeed the late John A. Muir. Mr. Huntington is the son of Mr. Henry E. Huntington, president of the Los Angeles Railway Co. and the Pacific Electric Railway Co. He is 27 years old. Until his recent appointment he has been assistant to the general manager of the Pacific Electric Railway Co.

MR. S. W. WISE has resigned the position of manager of the Mississippi Valley Traction Co., which recently leased the Moline, East Moline & Watertown Railway Co., and has gone to Boston, Mass., to enter upon work at his profession of electrical engineer. Before leaving Moline, Ill., his former headquarters, the employes of the company presented him a gold watch fob embellished with a Masonic design.

MR. C. A. AVANT has been appointed claim attorney for the Birmingham Railway, Light & Power Co., the claim department having been recently detached from the railway department. Mr. Avant was formerly claim agent for the Southern Ry. at Birmingham, and previous to that was claim agent of the East Tennessee, Virginia & Georgia Ry. He has been connected with the claim department of the Birmingham company two years.

MR. PUTNAM A. BATES, assistant secretary and sales manager of the Crocker-Wheeler Co., announces that he has resigned that position and will retire from the company March 1st. He has formed a partnership with Mr. John Neilson, who was until recently assistant secretary and assistant treasurer of the New York & Stamford Railway Co., and under the firm name of Bates & Neilson will conduct a general practice of consulting electrical engineering, with offices in New York City.

MR. T. H. BAILEY WHIPPLE, who last summer resigned a position with the Sawyer-Man Electric Co., in order to participate in the reorganization of the sales department of the Nernst Lamp Co., has returned to his former position with the Sawyer-Man company. Previous to 1903, when he became connected with the Sawyer-Man interests, Mr. Whipple had been general sales agent of the Buckeye Electric Co., of Cleveland, and the Jandus Electric Co., and established most of the agencies of these two companies in the United States.

MR. WILLIAM H. BLOSS, who has been chief engineer of the Indiana Union Traction Co. since July, 1899, and chief engineer and roadmaster since 1901, resigned Feb. 15, 1904, to become traveling engineer for the Paige Iron Works, of Chicago. Mr. Bloss has been with the Indiana Union Traction Co. and its predecessor, the Union Traction Co. of Indiana, during the time which has witnessed the growth of the system from a comparatively small one to one with over 200 miles of track in operation and at the present over 100 miles under construction.

MR. T. E. MITTEN, general manager of the International Traction Co., Buffalo, N. Y., sailed on the Kaiser Wilhelm der Grosse February 9th for Amsterdam, Holland. He accompanied Mr. Henry J. Pierce, also of Buffalo, who is president of the Netherlands Tramway Co., in which Mr. Mitten, Mr. W. Caryl Ely and other Buffalo men are interested, and the object of the trip is to make a tour of inspection of the properties of the tramway company. The company has just completed building about 17 miles of electric railway from Amsterdam to Haarlem. Mr. Mitten also purposes to visit France. He will return home about the middle of March.

MR LUKE ROBINSON has resigned as superintendent of the Montreal Street Railway Co., on account of ill health, and will rest three or four months. He was appointed assistant superintendent in February, 1903, and in March was appointed to the senior office. Prior to going to Montreal he was in Paris, France, and before that was assistant superintendent of the London (Ont.) Street Railway Co., and later general superintendent of the Montreal Park & Island Ry., of Montreal. Mr. Robinson was particularly active during the recent street railway strikes in Montreal and made many friends because of his uniform courtesy and executive ability.

THE PUBLIC SERVICE CORPORATION OF NEW JERSEY on January 28th announced the following changes: Mr. Walter W. Wheatly resigned as general manager of the railway department, the resignation becoming effective February 1st. Col. Edwin W. Hine, formerly executive agent of the company, appointed assistant to the president and designated to represent the president in all matters pertaining to the railway department. His headquarters will be for the present in Jersey City. Mr. Albert H. Stanley appointed general superintendent in charge of the practical operation of the street railway service. Previous to going with the Public Service Corporation a few months ago, Mr. Stanley was general superintendent of the Detroit United Ry.

MR. F. E. FISHER, who has for six years been general manager of the Chicago & Joliet Electric Railway Co., has resigned that position and will devote his time to the completion and the business interests of the Joliet, Plainfield & Aurora Ry., of which he is the president. The resignation will become effective April 1st. When Mr. Fisher, who is also general manager of the Fisher Construction Co., went to Joliet, the Chicago & Joliet system comprised but 22 miles of track, while now it has more than 100 miles, several new lines having been built under his supervision. Mr. Fisher's brother, Mr. H. A. Fisher, is manager of the Joliet, Plainfield & Aurora Ry., and president of the Fisher Construction Co., and a nephew, Mr. L. D. Fisher, is chief engineer.

MR. GEORGE G. MULHERN recently resigned as general superintendent of the Cleveland Electric Railway Co. He spent 41 years in the street railway business in Cleveland, during which time he rose from the position of driver of a mule car to that of general superintendent of the Cleveland City Railway Co., of which Senator M. A. Hanna was president. Since the consolidation Mr. Mulhern has been general superintendent of the present company. On the day of his retirement 150 of the former employes of the Cleveland City Ry. surprised him at his home and presented him a gold watch chain and a diamond-studded charm. The "boys" went to the house in four special cars, accompanied by the "Little Consolidated" Band, which was organized by Mr. Mulhern four years ago.

Obituary.

MR. GEORGE STEWART JOHNSON, vice-president and general manager of the Grand Rapids Railway Co., died at his home in Grand Rapids, Mich., Sunday morning, January 31st. His death, which was entirely unexpected, followed an operation for a growth in the throat which was performed the preceding Wednesday. Mr. Johnson was born at Pontiac, Mich., Dec. 8, 1850, and removed to Grand Rapids with his parents when a child. His early education was received at Grand Rapids and was supplemented by engineering courses at Philadelphia and Ann Arbor. He was graduated from the University of Michigan in 1873. After preliminary work at Ludington, Mich., and in Canada, he entered the engineering department of the Grand Rapids & Indiana Railroad Co., as assistant. Rising to the position of chief, he remained there until he resigned to go with the Grand Rapids Railway Co. He was general manager of the company nine years.

SEN. MARCUS A. HANNA died February 15th at Washington, D. C., of typhoid fever. He was born at New Lisbon, O., Sept. 27, 1837, and removed to Cleveland with the family in 1852. Mr. Hanna was first engaged in the wholesale grocery business, and next iron and coal, and his firm became a factor in lake carrying. By 1877 he had become the leading financial man of Cleveland. He was owner and president of the Cleveland City Railway Co. and was a director in the Union Pacific Ry. He became United States Senator in 1897.

New Publications.

STANDARD FORM OF REPORT FOR ELECTRIC RAILWAYS. Prepared by a committee of the Street Railway Accountants' Association of America, and approved by that Association at Detroit, Mich., Oct. 10, 1902. Adopted as standard by the National Association of Railroad Commissioners at Portland, Me., July 16, 1903; subject to such modifications as the requirements of individual states may make advisable. Bristol board covers, 16 pages, 9 x 14 in. Printed and distributed in accordance with a resolution of the Street Railway Accountants' Association of America, Sept. 4, 1903.

The report first sets forth the general divisions for accounting practice, followed by the subdivisions under each head, the whole being shown so clearly that there need be no hesitation concerning the proper entry of an item. Full-size schedule blanks are given to cover the following accounts: Income Account, Gross Earnings from Operation, Operating Expenses, Detailed Statement of Rentals of Leased Lines, Comparative General Balance Sheet, Construction and Equipment, Construction and Equipment for Leased Lines, Capital Stock and Funded Debt, Description of Road and Equipment, Mileage, Traffic and Miscellaneous Statistics, General Information. On the last page is a blank deposition.

This report has been mailed to each of the commissioners of the various state boards, there being about 140 in all; to the Interstate Commerce Commissioners, and to the Census Bureau, and to each member of the Street Railway Accountants' Association. Copies may be secured of the secretary-treasurer, Mr. W. B. Brockway, No. 40 Morris St., Yonkers, N. Y., or of Mr. Elmer M. White, representing the committee, cashier of the Hartford Street Railway Co., Hartford, Conn.

THE BOSTON TRANSIT COMMISSION'S NINTH ANNUAL REPORT for the year ending June 30, 1903. Cloth, 93 pages, with maps and illustrations. Published by the Commissioners, L. Leighton Beal, secretary. his report deals largely with the East Boston tunnel, and also the proposed new tunnel and subway in Boston for the Boston Elevated Railway Co., giving all the correspondence that has passed between the commission and the railway company in regard to the latter. The report of the chief engineer describes in detail the work on the East Boston tunnel and is illustrated by full-page half-tone engravings showing the main features of the work to date. It shows that the longitudinal division of the tunnel, which is the East Boston end, known as Section A, was substantially completed in November, 1900. Section B has been advanced from the East Boston side nearly to Atlantic Ave., on the Boston side. Section D, which extends under State St., in Boston, is practically completed, while Sections E and F, which comprise the station under the east end of the old State House, and the most westerly division of the tunnel, respectively, are progressing, although it will take some months to complete them. The report contains also a plate showing the studies for the additional subway and tunnel provided for in the legislative statutes of 1902, and it also shows the old subway and part of the East Boston tunnel and elevated road. The financial part of the report shows that since the beginning the total cost of the subway has been $4,158,735, exclusive of alterations and interest, which amount to $243,438. The total expenditure on account of the East Boston tunnel, including interest, has been $2,123,607, of which amount $1,252,796 was spent during the year ending June 30, 1903. An expenditure of $25,241 is charged to "Boston tunnel and subway" for 1903. For bridge work since the beginning there has been expended $1,570,191, making the grand total for all work in which the commission is interested $8,121,214 to date.

The motormen and conductors employed by the Stark Electric Railway Co., of Alliance, O., were surprised January 20th by the announcement that their wages would be increased two cents an hour, to take effect immediately.

January 19th 28 financiers and engineers, guests of Mr. August Belmont, president of the Interborough Rapid Transit Co., inspected the New York subway as far as 120th St., the trip being made in hand cars. Mr. John B. McDonald, the contractor, and Mr. Belmont were congratulated upon the appearance of the nearly completed way.

Annual Report of Twin City Rapid Transit Co.

The annual report of the Twin City Rapid Transit Co. has just been received. It is exceptionally interesting both on account of the general matter which shows 1903 to have been the most successful year in the company's history and because of its typographical excellence. The report comprises the report of the president, Mr. Thomas Lowry, followed by detailed statements by the auditor, Mr. E. S. Pattee; these are supplemented by half-tone views of the company's steam and water power plants, the new Minneapolis and St. Paul sub-stations, interior and exterior views of cars, and a map of the system showing present lines and proposed extensions, etc. The operating statistics for 1903 will be found in the Financial Department of this issue of the "Review."

In his report President Lowry states that the work on the new steam power plant is rapidly nearing completion. It is 156 ft. x 255 ft., and 86 ft. high, with heavy limestone foundations and brick superstructure. The floors, roof and coal bunkers are a combination of steel and concrete and the building is entirely fire proof. It will contain three engine and generator units of 27,000 h. p. maximum capacity; boilers and stokers of 30,000 h. p. maximum capacity; coal conveyors and crushers of 75 tons per hour capacity; coal bunkers of 3,000 tons capacity, with complete equipment of condensers, heaters, pumps and auxiliaries. The plans allow an increase to five engine and generator units of 45,000 h. p. capacity and 24 boiler units of 40,000 h. p. maximum total capacity.

Work on the two sub-stations and office buildings in Minneapolis and St. Paul has almost reached completion. The Minneapolis building is three stories, 80 x 150 ft., and the St. Paul building two stories, 80 x 150 ft. Both are of pressed brick, terra cotta trimmings, roofs and floors of steel and concrete, and fire proof. Each sub-station will contain three rotary converters of 9,600 h. p. capacity, and the buildings will allow for an increase of 100 per cent. The present equipment of rotaries will be re-arranged, four of the units being installed in the present water power station, two in a sub-station in the Midway district and two in a sub-station on the Stillwater interurban line. The steam power house will be connected with these sub-stations by a system of underground conduits, cables and overhead lines.

The company builds its own cars and the report deals in part with the excellent results obtained since the adoption of a 45-ft. semi-convertible car, the earnings between winter and summer months being more nearly equal since the larger cars were adopted in the spring of 1897.

Many new extensions and improvements are outlined in the report, among them being the completion of third and fourth interurban lines between St. Paul and Minneapolis; an extension to South St. Paul; one to White Bear Village; one to South Stillwater and another to Lake Phalen in St. Paul.

The report shows that the gross and net earnings more than doubled between 1897 and 1903, the gross for 1897 being $2,009,121 and the net $1,007,041, while the gross for 1903 was $4,063,938 and the net $2,185,888. The report also states that former reports have shown a large surplus, such as that of 1901, which was $2,700,284, and that of 1902, which was $2,991,346. This is in a sense misleading, it is explained, as it does not represent actual cash surplus on hand, but shows surplus over operating expenses, charges and dividends, but expended in betterments and improvements. The company has, therefore, transferred former "surplus" to "roadway," "equipment", etc., and surplus appearing in future reports will mean cash in hand or its equivalent.

The Columbus, Delaware & Marion Electric Railway Co. recently purchased the rights of way of the Columbus, Delaware & Northern Ry. for $5,064.50. The latter company was a rival that gave way to the former.

The Arnold Electric Power Station Co., of Chicago, has been retained by the Detroit, Flint & Saginaw Ry. to design its power house and equipment and also the electric distribution system for the proposed trolley line between Saginaw and Flint.

The Wichita (Kan.) Railroad & Light Co. distributed among 58 employes last month $665.37 as a reward for faithful service. The amount was determined by the earnings of the road for the last six months, which amounted to $12,968. This is the fourth dividend thus distributed.

Malleable Flanges for Piping.

The Crane Co., Chicago, has mailed us a circular letter discussing this subject, which we reproduce here, believing that the matter will interest power plant managers and engineers:

"For all practical purposes, malleable flanges are equal to steel; they cost less and can be furnished more promptly. The following claims are made for them:

"1. Extra heavy malleable flanges are stronger than card weight pipe to which they may be attached. This has been demonstrated by screwing malleable flanges on pipe and then bursting the pipe under hydraulic pressure. The flanges were not affected by a pressure which ruptured the pipe.

"2. Extra heavy malleable flanges are stronger than the bolts. This has been demonstrated by hydraulic tests and also by bolting two flanges together with an iron ring ⅜ in. thick between them, inside the bolt holes. We find in every instance we can break the bolts without injuring the flanges.

"3. Malleable flanges are stronger than the cast iron flanged fittings, cast iron valves, or separators used in connection with them on every power plant.

"4. By improved methods in casting and annealing we are enabled to produce flanges very uniform in solidity and strength. Much more uniform than any steel flange castings we have yet seen.

"5. Malleable flanges will stand a great deal of hammering or abuse and can not be injured by carelessness in erecting.

"There can be nothing gained by using a stronger material for flanges than malleable iron, for the reason that when a plant is fitted up with malleable flanges, they are the strongest part of the system. Stronger than the pipe, fittings, valves, boilers or engines. If they had ten times the strength it would be of no benefit. The fact that steel has a greater ultimate strength does not make it more desirable because that ultimate strength is not, nor never can be, utilized in practice. The limit of a joint is reached the moment the bolts commence to stretch, and the limit, using the recognized high pressure bolting, is arrived at long before an extra heavy malleable or steel flange will give out.

"When we consider the thousands of cast iron flanges which are turned out of our shops every week, to say nothing of those made elsewhere, and the small number of breakages, we must necessarily conclude that cast iron for this purpose is a fairly reliable metal.

"When a line with cast iron flanges has been erected and warmed up without trouble, the chances are that the flanges will never crack, as serious accidents arising from the failure of cast iron flanges in a going plant are exceedingly rare. Now and then we hear of a cast iron flange giving away while being bolted up, or as the line is being warmed up for the first time. This may result from any of the following causes:

"1. Careless bolting such as drawing all the bolts tight on one side and then following with the bolts on the opposite side, or if the flanges have raised faces with a gasket between so that the outer edges stand about ¼ in. apart then, unless the bolting is very carefully done, the flanges will be broken through the great leverage exerted by the bolts. We have found that if a 6-in. cast iron flange is deflected at the outer edge 1-16 in. the flange will break. The large sizes will probably stand a little more but not much.

"2. Internal stress set up in the flange by forcing it on a piece of pipe on which the diameter and length of thread does not correspond accurately with the flange.

"3. Improper provision for expansion in the piping system.

"Malleable flanges are proof against destruction by the bolting or internal thread stress referred to in paragraphs 1 and 2 and practically proof against expansion strains, because should such strains be set up, other parts of the system would probably be destroyed before the flanges.

"It is evident that malleable flanges may with advantage be used on any piping system, either high pressure or standard, but they are especially valuable on pipe bends where such bends are used to take up expansion and on high pressure piping which must be operated continuously, such as electric light or street railway stations.

"Standard and extra heavy malleable flanges are exactly similar to our cast iron flanges in diameter and thickness of metal."

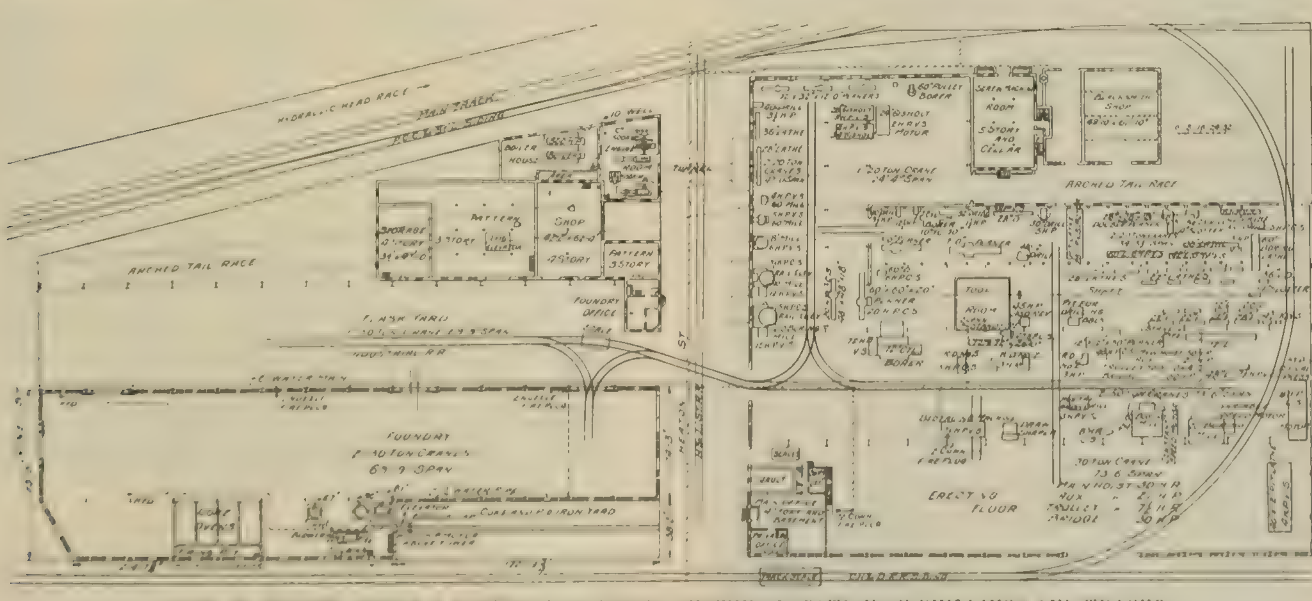
The Brooklyn Rapid Transit Co. recently closed a contract with the Bush Terminal Co. for the distribution by trolley of packages and miscellaneous freight to be furnished by the latter company.

New Shops of Hooven, Owens, Rentschler Co.

The Hooven, Owens Rentschler Co., of Hamilton, O., which is the largest concern engaged in building engines of the Corliss type exclusively, was incorporated in 1901 is a reorganization of

BIRD'S-EYE VIEW OF BUILDINGS, HOOVEN, OWENS & RENTSCHLER WORKS.

the Hooven, Owens & Rentschler Co., incorporated in 1881, when the company took over the business of the Owens, Lane & Dyer Co., established about 1840. The plant of the company, always lo-



PLAN OF HOOVEN, OWENS & RENTSCHLER WORKS, SHOWING LOCATION OF BUILDINGS AND TRACKS.

cated at Hamilton, has been extended from time to time to meet the demands of increasing business, but about three years ago it was decided to replace the old machine and erecting shops by new buildings having four times the then capacity. This work was commenced in February, 1902, and the new building completed in July last, since which time the new machine equipment has been installed and with the exception of one or two large tools is now in full operation.

The half tone illustrations show a general view of the works, and views of the erecting floor, of the central aisle parallel to the erecting bay in which are located the cylinder borers and other heavy tools, of the section containing the small tools, and of the en-

MACHINE SHOP BAY FOR HEAVY MACHINERY 30 FT LONG

MACHINE SHOP BAY WITH COUNTERSHAFT

gine and generator room in the power plant. These illustrations give an excellent idea of the equipment and size of the amount of work that is now being done at the plant.

The general arrangement of the new shops, which is well shown by the line drawing, whereon are located the principal tools, is that of Col. J. C. Hooven, president of the company, and was worked out in detail by the architect, Mr. George Barkman, of Hamilton. The new buildings have steel frames with brick walls and are excellently lighted.

The plant covers two blocks bounded on the east by 5th St. and the hydraulic headrace indicated on the diagram, and on the west by 4th St. An intermediate thoroughfare, Lowell St., was vacated by the city and this space is occupied by a portion of the machine shop. The foundry, pattern storehouse and power plant lie at the north end between Vine and Heaton Sts., and the machine and forge shops at the south end of the works between Heaton and Buckeye Sts.

The plant is surrounded on three sides by the P. C. C. & St. L. and the C. H. & D. railroads, the latter having a loading switch into the southern end of the machine shop as indicated on the plan drawing. Within the buildings are other standard gage tracks as indicated, but for the transportation of material within the walls traveling cranes are most used.

The foundry is a building 406 ft. long; the main portion of this building is 73½ ft. wide and 39 ft. 8 in. to the chords of the roof trusses. At the west side is a lean-to for the cupolas and core ovens; this portion is 233 ft. long and 38½ ft. wide. The three cupolas are 67, 81 and 90 in. in diameter, respectively. In the foundry are three wheel casting pits. The room is served by two 30-ton electric traveling cranes of 69 ft. 9 in. span. The foundry yard is served by a lattice girder crane of the same capacity and length of span.

Opposite the foundry is the pattern storage house, a four-story building, 34 ft. x 47 ft. 10 in. The pattern shop adjoins the power house.

The machine shop extends for 370 ft. along 4th St. and 316 ft. along Heaton St. A portion of the building fronting on Heaton St. was rebuilt from what was formerly the foundry; this contains two machine bays, parallel, and 49 ft. and 26 ft. in width, respectively. In these bays, which are under a gable roof, it is 33½ ft. from floor to roof trusses.

Parallel to 4th St. are the erecting and heavy machinery bays, 57 ft. high from floor to roof trusses. In the rectangular space lying east of the north and south bays and south of the east and west bays are two bays with low roofs. These are on the site of part of the old machine shop and are used as a fitting department for smaller engine parts.

At the southeast corner of the plant are the forge shop, a one-story building 49 x 61 ft., and a five-story building used for the lighter machinery. The screw cutting department occupies the ground floor.

In the erecting bay are two parallel sections 27 x 102 ft. each with flooring of 6-in. cast iron T slot rails embedded in concrete, for the assembling floors. The crane in this bay is of 30 tons' capacity. There is only one non-portable tool in this section of the plant, it being a 40 x 12-ft. pit lathe located at the extreme south end.

In the second bay are located the heaviest machine tools, prominent among which are a 12 x 12 x 30-ft. planer with four heads, a 20-ft. boring and turning mill, a cylinder borer with capacity for cylinders up to 72 in. diameter and which has independently driven port boring bars so that a cylinder can be bored and faced and the ports bored simultaneously, and a bed facing machine with two boring bars at right angles for simultaneously boring the guides and facing the bearings. In this bay are two 50-ton cranes.

The shop is electrically driven throughout, current being furnished by a 500-kw. Ft. Wayne generator direct connected to a 20 and 36 x 42-in. Hamilton-Corliss engine. The speed is 100 r. p. m. and the voltage 220 to 250 volts. The large machines all have independent motors, while the small machines are driven from shafting. The Bullock Electric Co's. four-wire multiple voltage system is used for the variable speed motors. The balancing set, consisting of three 17½-kw. machines is located centrally in the shop. Near this is the constant speed motor of 45-h. p. capacity which drives the line shaft for small tools.

Besides the unit mentioned the power plant contains a 150-kw. 220-250-volt Ft. Wayne generator belt driven from a simple Hamilton-Corliss engine, and used for lighting.

The boiler installation consists of two Franklin water-tube boilers. A Baragwanath condenser is used in connection with the engines when the exhaust is not required for heating purposes. The shops are heated by steam distributed on the Webster system, the engine exhaust being supplemented by live steam in cold weather.

MACHINE SHOP ERECTING BAY, 320 FT. LONG.

ENGINE ROOM

The company's offices are in the northwest corner of the shop building at the north end of the erecting bay. This section is three stories high, the first floor being occupied by the general offices and the clerical force and the second and third floors by the drafting department.

Among the engines now in the shop are the following: Scioto Valley Traction Co., Columbus, O.; two 26 and 52 x 48 cross compound d. c. 1,000-kw. "Bullock" generators. Museum of Natural History, New York; two 15 and 2[illegible] x 30 tandem compound d. c. 200-kw. generators. Louisiana Purchase Exposition, St. Louis; one 34 and 68 x 54 vertical cross compound d. c. 1,500-kw. Citizens Light, Heat & Power Co., Montgomery, Ala.; one 18 and 36 x 42 cross compound d. c. 375 kw. generator. Delaware & Hudson Co., Scranton, Pa.; two 16 and 26 x 42 cross compound d. c. 300-kw. generators. Townsend, Reed & Co., Indianapolis, Ind., for Indianapolis & Northwestern Ry.; one 24 and 48 x 48 cross compound d. c. 800-kw. generator. Texarkana Gas & Electric Co., Texarkana, Tex.; one 15 x 36 heavy duty engine. Johnstown Passenger Ry. Co., Johnstown, Pa.; one 22 and 38 x 48 cross compound d. c. 550-kw. generator. Shreveport Traction Co., Shreveport, La.; twin 22 x 42 engines, d. c. 500-kw. generator. Indianapolis & Eastern Ry. Co., Indianapolis, Ind.; one 26 and 52 x 48 cross compound d. c. 1,000-kw. generator. Decatur, Springfield & St. Louis Ry. Co., Decatur, Ill.; one 28 and 56 x 48 cross compound d. c. 1,000-kw. generator. Saginaw Valley Traction Co., Saginaw, Mich.; one 28 and 56 x 48 cross compound d. c. 1,000-kw. generator. Westchester & Pottstown Ry., Philadelphia; two 22 and 44 x 48 heavy duty cross compound engines. Macon Railway & Light Co., Macon, Ga.; one 20 and 40 x 42 cross compound.

The officers of the company are: President, J. C. Hooven; vice-president, G. A. Rentschler; secretary, C. O. Richter; treasurer, H. Sohn. These, together with G. H. Helvey, J. G. Schmidlapp and Charles H. Kellogg, constitute the directors. The capital stock is $1,000,000, preferred (of which $750,000 is issued), and $1,000,000 common.

The Pittsburg, McKeesport & Connellsville Railway Co. has adopted annual examinations of employes for sight and hearing, including color blindness.

January 25th the McLean-place car barns of the Indianapolis Traction & Terminal Co. were partially destroyed by fire and 26 large winter cars were destroyed and several others badly scorched, the total loss being estimated at $100,000, which was practically covered by insurance.

Damage Caused by Flood, Ice and Snow.

The present winter has been notably vigorous throughout the country and has worked unusual hardships for the street railway interests. The most disastrous reports come from Wheeling, W. Va., where the "January thaw," which set in January 24th, caused an exceptionally heavy flood, and was followed by a severe cold spell that caused ice to form on the tracks as the water receded, and did a great deal of damage. The Wheeling Traction Co. was the worst sufferer, it being necessary to abandon every one of its lines for from one to three days. When the water receded it left ice from 2 in. to 4 ft. thick on portions of all lines. The accompanying views will give an excellent idea of the situation. At Mingo, O., on the Steubenville line, the water was at one time 20 in. above the track at one point, and on the Bellaire division, for a distance of two miles, the ice covering the tracks was from 2 ft. to 4 ft. thick.

The Milwaukee Electric Railway & Light Co. reported difficulty on its Kenosha and Racine line January 16th, when a car and passengers were snow bound 13 hours, and again on February 3rd travel on the same line was completely blocked by snow.

The Auburn & Syracuse Electric Railroad Co. had to abandon traffic on the greater part of its line from January 19th until January 22nd, on account of snow, although it ran cars between Auburn and Skaneateles more or less often. Again on February 3rd the line was tied up.

For two days the Canton-Akron Railway Co. suffered from a flooded power house and its system was tied up. There were also

WHEELING, W. VA., STREET AFTER FLOOD.

washouts along its line between Massillon and New Philadelphia, and, in addition, the ice and snow on the city streets made it almost impossible to run the cars. The melting snow short-circuited the current and caused the motors to be burned out.

Through traffic between Dayton and Cincinnati, O., was abandoned on account of damages to the trestle work and the tracks of the Cincinnati, Dayton & Toledo Traction Co. It was believed that it would be two or three days before traffic could be resumed.

High water on January 22nd caused the abandonment of the Cleveland, Painesville & Eastern R. R. shore-line branch, but the main line had little trouble. February 2nd drifting snows caused much delay on all the lines.

Traffic on the Logansport & Wabash Valley Traction Co's. line between Peru and Wabash, Ind., was suspended January 21st on account of high water near Boyd Park, and on January 23rd the water had entered the power station and had reached the large engine, threatening to cripple the plant. January 25th traffic was resumed.

The Detroit United Ry. suffered considerable damage on account of water and slush, followed by a blizzard, and it was with difficulty that cars were run at all. At one time there were 154 damaged motors in the repair shops.

Because of a flood at Fremont, O., the Lake Shore Electric Railway Co., which operates between Cleveland and Toledo, was unable to operate cars for several days between Norwalk and Ceylon, which section of the road depends upon the power house at Fremont for power. There was nearly 3 ft. of water in the boiler house of the power plant during the weeks of February 1-12. The Sandusky division of the road was operated with power from

WHEELING, W. VA., CAR BARN BLOCKED BY ICE.

Sandusky, which only permitted the company to run small cars. The company was similarly inconvenienced January 23rd, but traffic was resumed the next day.

On account of drifting snow the Detroit, Ypsilanti, Ann Arbor & Jackson Railway Co. was unable to keep the cars running on part of its system for the greater part of two days.

January 25th a blizzard disabled the Indianapolis Traction & Terminal Co's. lines. Haughville, West and North Indianapolis were without car service because the snow sweepers could not cross the bridges, which had been weakened by a flood a few days previous. Other lines were more or less cripled, also, and this state continued until January 28th, when cars began running across the bridges regularly.

The Indianapolis & Northwestern Traction Co. had to suspend operations for a few days over the Northwestern Ave. bridge which crosses Fall creek. Passengers were transferred at the bridge.

The Terre Haute Electric Co's. lines were abandoned January 26th, owing to a blizzard, and it was reported that an interurban car which left Terre Haute January 25th was lost in the snow for

CLEARING THE TRACKS IN WHEELING, W. VA.

three days, the passengers deserting it near Brazil. In order to carry out its mail contract, the company sent the mail pouches to Seelyville and Brazil in a sleigh. February 2nd another storm caused serious damage on the interurban line.

January 21st the Indiana Union Traction Co's. bridge over the

Mississinewa River between Jonesboro and Gas City, Ind., was swept away when the ice went out of the river. The company was also obliged to abandon service on its interurban line into Kokomo for one week, by the washing away of the bridge in Union St. during high water.

From January 23rd to January 26th 60 cars of the Springfield (Mass.) Street Railway Co. were disabled on account of heavy snow storms. The line to Holyoke was closed three days.

On account of the power being shut off at the plant of the Youngstown Consolidated Gas & Electric Co., because of the cold, January 23rd, no cars were run on the Youngstown Park & Falls Street Railway Co's. lines, or the lines of the Youngstown-Sharon Street Railway Co., for 24 hours. To furnish light the electric company had to tap a sewer to get water for its boilers.

February 2nd the Chicago & South Shore Street Railway Co., of La Porte Ind., suspended operations, largely on account of the weather. It was announced, however, that the company would probably not resume until certain financial difficulties had been adjusted and the company reorganized. One of the company's cars was stalled near Waterford January 23rd and the passengers remained in the car all night, until the snow drifts could be shoveled out.

The Chippewa Valley Electric Railway Co's. system, which includes the lines in Eau Claire and Chippewa Falls, Wis., and an

CONESTOGA AND YORK FURNACE TROLLEY BRIDGE

interurban line, shut down January 27th on account of the stoppage of the water wheels at Chippewa Falls, due to extreme cold.

The business of the Erie, Cambridge, Union & Corry Railway Co., of Erie, Pa., was at a standstill for a week during the latter part of January, owing to bad weather.

Nearly 4 ft. of snow covered part of the tracks of the Illinois Valley Traction Co. February 2nd, making it impossible to run cars between La Salle and Ladd, Ill.

January 26th and 27th the Salem division of the Boston & Northern Street Railway Co. was tied up on account of snow, rain and cold. Six inches of ice formed on some of the tracks and the municipal authorities would not allow the company to use an ice cutter to remove it.

For 36 hours beginning February 1st snow drifts prevented cars from being run on the Lebanon Valley Street Railway Co's. line between Annville and Palmyra. In some places the snow was 7 ft. deep.

On the morning of January 23rd the bridge over the big Conestoga Creek, Lancaster County, Pa., used by the Conestoga & York Furnace electric interurban was carried away by an ice jam. This bridge, which was 207 ft. long, was opened for traffic in December, 1902.

Conference of Branch Office Managers.

The annual conference of the branch office managers of the Standard Underground Cable Co., together with the general sales, manufacturing, construction and executive departments of the company, was held recently in the general offices of the company in the Westinghouse Building, Pittsburg, Pa., the session lasting three days. The report of each manager for 1903, and the prospects for 1904, was issued, together with a ways and means for rendering more efficient service to the upwards of 1,000 customers on the company's books. A pleasant social feature of the gathering was a theater party given in honor of the visiting managers by Mr. J. W. Marsh, the vice president and general manager.

The branch office managers in attendance were: Mr. Charles J. Marsh and Mr. George L. Wiley, New York; Mr. Frank Clark Cosby, Boston; Mr. T. E. Hughes, Philadelphia; Mr. J. R. Wiley and Mr. E. J. Pietzeker, Chicago.

British Johns-Manville Co., Ltd.

The British Johns-Manville Co., Ltd., has been incorporated in England, with offices and warerooms at 81 Fenchurch St., London, E. C., and will handle a complete line of ovearhead line material, "Vulcabeston," moulded mica and "Monarch" insulations, specially adapted for insulating railway motors, generators, controllers, arc lamps, switchboards, switch handles, switch boxes and various other parts of apparatus requiring a high-grade insulating material; a full and complete line of electric heaters, rail bonds and Sachs "Noark" enclosed fuse protective devices. The new company will carry a full and complete stock of supplies at the London office, which will enable it to make prompt deliveries and give good service at all times.

Mr. Henry J. Joseph is the managing director of the new company, as well as manager of the London branch of the H. W. Johns-Manville Co., which has offices at the same address.

"Deltabeston" Magnet Wire.

The D. & W. Fuse Co., of Providence, R. I., makes what is known as "Deltabeston," an insulated wire which is said to be practically indestructible and is especially adapted for insulating armature, field and magnet coils. "Deltabeston" wire has been insulated with practically pure asbestos which has been treated in such a manner that its insulating properties are exceptionally good. It is claimed for it that its resistance to heat renders it absolutely indestructible so far as any temperature rise to which it may be subjected in commercial service is concerned. "Deltabeston" wire has been run at a dull red heat representing a temperature in the neighborhood of 600° C. without its insulation being destroyed. The company has given "Deltabeston" wire exhaustive tests, having had a large number of motors equipped in railway service, with such satisfactory results to the managements that entire equipments of motors are being gradually rewound with it. The company is prepared to furnish this wire in any size from No. 4 to No. 18 B. & S. gage and will submit samples.

The Central Electric Co., 264-70 Fifth Ave., Chicago, Ill., is sales agent for "Deltabeston" magnet wire and communications addressed to it will receive prompt and careful attention. The company will also gladly furnish bulletins and samples upon request.

The Affleck Cement Cross-Tie.

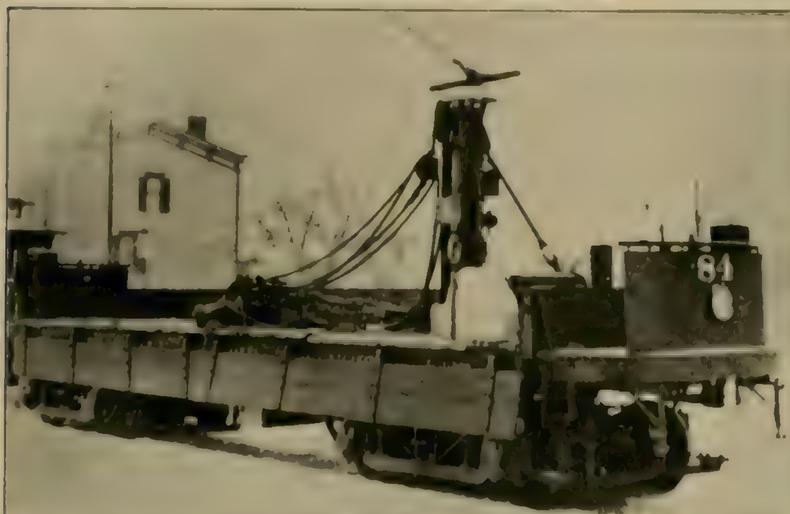
The Affleck cement railway tie, which was patented last fall, has been attracting the attention of steam railroad men for several months, and now the inventor, Mr. David S. Affleck, of Chesterton, Ind., desires to interest electric railway operators in it. The invention is very simple. It consists chiefly of a longitudinal angle bar of iron or steel which has been imbedded in a cement tie near the center, the ends of the bar being bent in a short curve to hold it securely in place and prevent the rails spreading. The rails are fastened to the tie by means of plates, bolts and nuts, the bottom nuts being countersunk in the tie to prevent turning. If preferred, a side fastening may be used to bolt the rail to the tie. A thin wooden shim is placed between the rail and tie to relieve the concussion.

One of the Affleck cement cross-ties has been in use on the Lake Shore & Michigan Southern Railroad Co's. side track at Dune Park since early in 1903, and it is stated that neither wear nor weather has affected it in the least. Two of the ties were placed on one of the Illinois Central Railroad Co's. tracks at Grand Crossing, Chicago, January 15th, also. These ties are 6 x 8 in. x 8 ft. and weigh 400 lb.

Brooklyn Heights R. R. Co. Crane Car.

The accompanying illustrations show a new work car which has been built for the Brooklyn Heights Railroad Co. by the Middletown Car Works, Inc., of Middletown, Pa., and also the details of construction of the crane which accompanies the car. The [illegible] lb. The length of the car over all is 38 ft. 6 in. and the width, 7 ft. 10 in. The capacity of the crane is [illegible] tons.

The work car is equipped with four Westinghouse 68 motors of



BROOKLYN HEIGHTS R. R. WORK CAR MIDDLETOWN CAR CO.

60 h. p. each and with a K-6 controller. It is further equipped with Neal electric headlights, the Sachs "Noark" fuse and Christensen straight air brakes with 10-in. cylinder. For operating the crane the car is provided with a G. E. 800 motor.

The trucks are the Peckham standard M. C. B. No. 40, with 31-in. wheels. This truck is equipped with Peckham's (patent) combination side frames, double roller side bearings, flexible motor suspension, Taylor's (patent) non-chattering brake hanger, "triple elliptic" all steel swing bolster, and standard M. C. B. journals, journal boxes and brasses. The new work car was built in accordance with a design furnished by Messrs. R. C. Taylor and A. J. Wilson, of the Brooklyn Heights road.

The Cleveland Electric Railway Co. will equip all its city cars with power brakes during this year.

Central Yards for Ties.

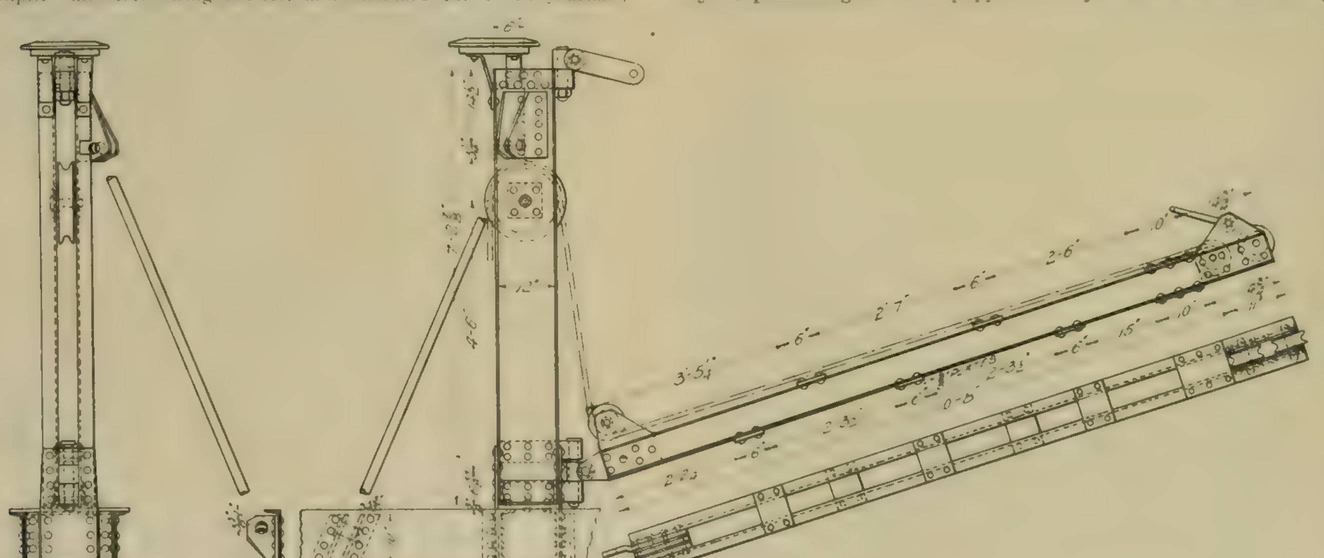
With cedar companies in Michigan, it is the custom to ship the poles which are brought from small producers and also those cut on the company's own lands, into different convenient storage yards. There the poles are assorted into their different sizes, receiving usually a second careful inspection, the first being made in the woods. Some companies still endeavor to ship the greater portion of their stock direct from the woods, but this is so apt to cause delay in getting cars and confusion in filling "straight" carloads of some one size from a small stock, that the more experienced companies have abandoned it almost entirely. The small margin in poles, and the keen competition among the buyers of the different companies in the woods has led to the adoption of every economy possible, but this yard expense is something that must be borne, if orders are to be filled promptly and accurately, especially the larger orders.

However far this reform, if it may be so called, has progressed in the pole business, it has not as yet been very extensively introduced in the cedar tie business. The Maltby Lumber Co., of Bay City, Mich., is one of the few firms that have applied the reasoning and experience of the pole business to ties. Nevertheless it has proven a very attractive feature in securing orders and will doubtless be followed by other tie companies as time goes on.

A railway company is very apt to find itself short a few thousand ties, or possibly but a carload or two. Then the advantage of calling on a section of the country where ties can be, and are shipped every month in the year, is readily appreciated. High water, poor roads, lack of water, have no effect on the shipment of ties that are concentrated in lots of ten to fifteen thousand, especially when piled in yards located in the same favorable position as regards competing railroads, as are the best pole yards.

Progress of New Sturtevant Plant.

The boiler plant of the B. F. Sturtevant Co's. new works at Hyde Park, Mass., is in full operation. The plant comprises three 250-h. p. Stirling boilers equipped with Jones under-feed stokers, air for which is furnished by a Sturtevant steam fan, a Sturtevant induced draft steam fan and a Sturtevant economizer to be installed later. The company has in process of construction a 400-h. p. vertical compound engine with direct-connected 250-kw. generating sets, which will be the first of several units to be installed in the engine room.

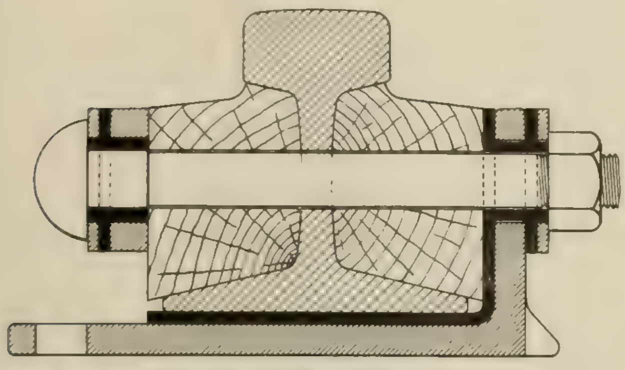


DETAIL OF CRANE ON WORK CAR

Insulated Joints for 500-Volt Circuits.

One of the serious objections which the steam railroad men have urged against the adoption of electric traction on existing steam lines is that such a change would require that the signal systems already installed and operated by low voltage track circuits be abandoned. The installation of block signals on a portion of the subway tracks operated by the Interborough Rapid Transit Co. shows that this objection is not a valid one at the present time, whatever may have been the fact when it was first advanced.

The Interborough company, on that portion of the line where



INSULATED TRACK JOINT

block signals are used, uses one track rail only for the return circuit while the other track rail is used for the signal circuit. The track has Weber rail joints and on the signal track the insulated joints made by the Weber Railway Joint Manufacturing Co. and illustrated in the accompanying sectional drawing, are used. This joint is, we understand, successfully insulating the 500-volt current which is used for railway operation. The rail is insulated from the shoe angle by a fiber angle plate and the bolt is insulated from the shoe angle on the one side, and the splice bar on the other, by fiber bolt bushings, the outer surfaces of these bushings being covered by metal washers.

An insulated joint of similar type is used by a number of steam railroads in connection with signal track circuits, but we believe this is the first application to electric railway work.

Standard Underground Cable Co.

The annual meeting of the stockholders of the Standard Underground Cable Co. was held January 26th at the company's general offices in the Westinghouse Building, Pittsburg, Pa. The statement of the company's operations for 1903 showed a gross business of nearly $9,000,000; dividends aggregating 12 per cent were paid. The assets amount to $3,604,457; liabilities, exclusive of capital, $375,344. The company has no outstanding notes, mortgages, bonds or preferred stock. Directors were elected as follows: Messrs. Mark W. Watson, John B. Jackson, James H. Willock, Robert Pitcairn, J. N. Davidson, John Moorhead, B. F. Jones, jr., Joseph W. Marsh, W. A. Conner. Mr. Conner, a new director, has been at the head of the manufacturing department [illegible]

The directors organized January 29th and re-elected officers as follows: President, Mr. Mark W. Watson; vice-president and general manager, Mr. Joseph W. Marsh; treasurer, Mr. Frank A. Rinehart; auditor, Mr. C. M. Hagen.

The Standard Underground Cable Co. was organized in January, 1882, although prior to that time its founder, Mr. Richard S. Waring, had done much experimental work. It has factories at Perth Amboy, N. J., Pittsburg, Pa., and Oakland, Cal. Its reputation for high class manufacture, its strong financial condition and the favorable location of its factories place it in a favorable position to com- [illegible]

[illegible]

and 43 in the mechanical engineering department.

Fresh's Emergency Car Brake.

The Emergency Car Brake Co., of Cumberland, Md., has been organized to build and sell the well-known Fresh's emergency car brake, which has hitherto been made and sold by Messrs. Fresh & Speicher. The change went into effect January 14th last. During the past few months the Fresh brake has been materially improved by the adoption of compressed wool felt to prevent slipping on wet rails. For a long time the makers had experimented with different kinds of iron and steel, and had also tried rubber, emery and wood, in combination and separately, but the desired results were not obtained until the compressed wool felt was tried. That being an absorbent, it was found to be most efficient on wet or icy rails, and it has been severely tested with eminently satisfactory results.

The felt is made in sheets ¾ in. thick, very solid, and then compressed into a malleable iron plate under a heavy pressure, which makes it hard and durable. These malleable iron plates are attached to the main brake shoe by means of a trunnion ball, instead of using heavy screws, which gives the plate freedom of adjustment on the rails, thereby permitting all the surface of the rail to be utilized to obtain friction. This felt device is quickly and easily attached.

The new company will build these brakes on a large scale as soon as the weather will permit, and it is willing to give tests to any railway company interested. The officers of the Emergency Car Brake Co. are: President, Henry Fresh; vice-president, Frank A. Buckholtz; secretary, Henry A. Hensey; treasurer, Conrad G. Smith.

The "O. K." Sleet Cutter.

The accompanying illustrations present two views of the "O. K." sleet cutter which is made by Porter & Berg, Incorporated, of Chicago, the patentee. One view shows the cutter in position and the other as it appears when it is detached from the trolley harp. This sleet cutter, which has met with very flattering success during the three years it has been on the market, consists of a practically indestructible malleable iron casting, the shank of which bolts securely into the harp and is fitted with a lock washer to prevent its working loose, and of a brass contact device, which, being soft, assumes the most of the wear, thus saving the trolley wire. When this brass contact is worn out it may be easily replaced at small cost.

The "O. K." sleet cutter fits snugly into the harp and is designed to offer no projection which can possibly catch on the span

SLEET CUTTER ON TROLLEY

SLEET CUTTER DETACHED

wire or any part of the overhead construction in event of the trolley leaving the wire. It is so easily attached to the harp that it is suggested that if each car is provided with one the motorman can quickly attach it whenever the necessity arises, without loss of time. The fact that the device may be attached directly to the harp without disturbing the wheel is also a feature the value of which is self-evident. Many of the electric railways in the middle West use "O. K." sleet cutters and they are also in use in other parts of the country.

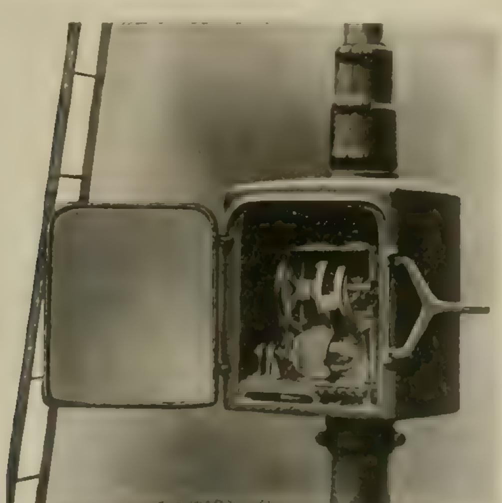
The Chicago city council proposes to license street railway companies to do [illegible] in the cars.

The Young Block Signal System.

We [illegible] the Young automatic block signal system which was designed by Mr. S. Marsh Young, and which has been placed on the market by the Pneumatic Signal Co., 25 Broad St., New York City, with works at Rochester, N. Y. The designers claim that in order to reduce to the minimum the liability of accident on electric interurban roads steam road practice must be strictly adhered to, and that any signal system to receive consideration must show the presence of a pair of wheels on the traffic rails at all times and at any point on the block, in precisely the same manner as the track circuit controls the signals on steam railroads. The working out of a method by which a track circuit could be furnished to govern signals on an electric line forms the basis of the Young system.

CONTINUOUS TRACK CIRCUIT

On a direct current road an alternating current is impressed on the d. c. line for signaling. The track is divided into blocks as on steam roads, although but one of the traffic rails is broken for signaling purposes, the other rail being used for the return of both the direct and the alternating currents. Cross bonding between two rails or between the block rail and the feeder return is accomplished in the same manner and by the same apparatus as is used between the ends of the blocks. Although the two traffic rails are of the same d. c. potential, they are of different potential for the a. c. It will thus be seen that the signal system in no way interferes with the arrangement or the operation of the motor circuits. To one end of each block is fed the alternating current transformed from 100 volts to about 1 volt. At the other end of the block a relay is connected across the two track rails. Between the relay and the track is interposed a piece of special apparatus to prevent the relay from being affected by the direct current.


INTERIOR VIEW OF CASE OF MOTOR SIGNAL.

One of the accompanying illustrations shows the arrangement of apparatus employed to provide a continuous track circuit to govern the signals. In the station, or sub-stations, there is placed a small a. c. generator of a special characteristic. A No. 10 copper wire is carried along the entire length of the road (at say 300 volts) for the alternating current. The a. c. line furnishes current to the primaries of 100 to 1 transformers in each block, shown as T and T'. The secondaries of these transformers are connected directly across the rail at the ends of each block, and this furnishes the track circuit to operate the relays R and R'. Direct current does not in any way affect the relay. When there is no car in the block the track circuit holds the relay points closed, and closes the local signal circuit, which holds the signal to clear. The entrance of a car into the block short circuits the transformer, thereby de-energizing the relay and opening the signal circuit, causing the signal to go to danger. Any interruption to the track circuit from any cause will rob the relay of its current and will result in a danger signal.


TWO-ARM HOME AND DISTANT SIGNAL.

I J and I J are insulated joints dividing the rail X into blocks corresponding to the signal locations. The rail Y is continuous. The rail X is made electrically continuous for the direct current return by means of devices shown as B 1 and B 2 placed across the ends of the blocks. Their arrangement and construction are such that they perform the reverse functions in the presence of alternating current and maintain the requisite difference of potential between the two traffic rails of the blocks to operate the signal relays.

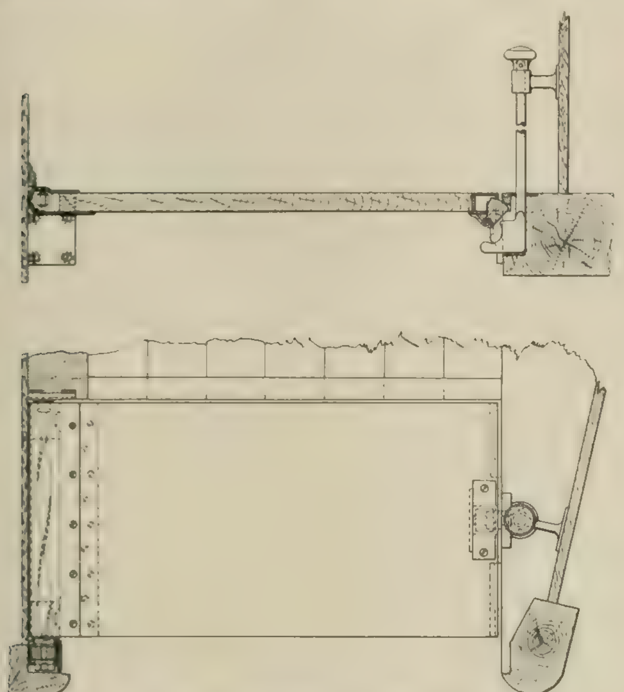
Aside from one a. c. generator for the entire road and the signal mechanism, which may be of any desired form, the complete apparatus for each block consists of one 50-watt energy transformer and a relay, which is the only apparatus containing any moving parts or contacts. It is claimed that there is no possible combination or failure of parts that can produce a clear signal

when a danger signal should be shown, and no amount of current from a foreign source can affect the operation of the system.

Where electric motor semaphore signals are used six small cells of storage battery are connected through a resistance to operate the signal motor. The battery is charged with about ¼ ampere continuously. Incandescent lamps are used as a resistance to cut down the 500-volt trolley circuit to charge the battery, and these lamps may also be used in the signal lantern and to outline the semaphore arm.

Edwards Vestibule Trap Door.

The O. M. Edwards Co., of Syracuse, N. Y., has designed and placed on the market a vestibule trap door for use on electric railway cars. The details of the new device are shown in the accompanying illustration. As will be noted, the hinge of the door is



PLAN AND ELEVATION OF TRAP DOOR.

pivoted at its ends by brackets or journal bearings, one being attached to the step timber and the other to the end of the car. When closed the door is supported at the edge opposite the hinge by a bar held in brackets, openings being left back of the bar to allow snow or other material to fall through, thus giving freedom to close.

The hinge is designed to contain either two or three flat spring bars, as the weight of the door may demand, these bars extending the entire length of the hinge, being firmly held at one end in the hinge and at the other in a ratchet wheel located in the bearing which is attached to the end of the car.

The ratchet wheel is normally held by a wedge piece inserted through an opening in the bracket case to engage the teeth of the wheel, and also has a nut extending through the bracket case by means of which the torsion of the spring bars can be adjusted as desired, it being intended that the springs shall be adjusted to open the door automatically when released.

A lock in the front edge of the door has a pivoted bolt designed to engage with a keeper plate in the platform end sill to lock the door in a closed position. The operating mechanism to release the door consists of a gravity handle rod held at its upper end by a bracket attached to the vestibule side wall, and having its lower end received in a recess in the platform end sill, the arrangement being such that by an upward movement of the handle the lock bolt is first forced back by the inclined surface of the handle rod, and then if the door should stick the knocker end of the handle rod is brought into contact with the bottom of the door to loosen it and start it sufficiently to insure its opening automatically.

The new device avoids the necessity for a hand lift in the top [illegible] of the door.

Christensen Air Brakes Abroad.

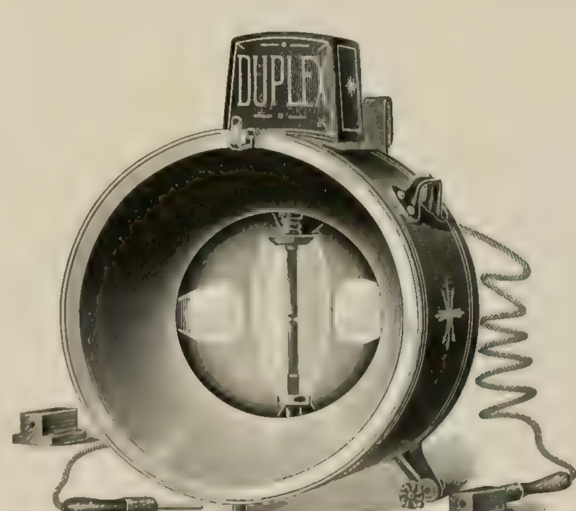
The National Electric Co., of Milwaukee, successor to the Christensen Engineering Co., received a number of foreign orders for Christensen air-brake equipments during January, among which was one from the Underground Electric Ry., London, for 200 automatic equipments for motor cars, the contract calling for air compressors with a capacity of 50 cu. ft. of free air per minute. This is a much larger capacity than that of the compressors furnished by the same company for the New York subway, which have a capacity of 20 cu. ft. of free air per minute.

An order was received from the Metropolitan Underground Ry., of Paris, for 90 automatic equipments, the air compressors to have a capacity of 35 cu. ft. of free air per minute, and an order for 64 equipments for the Vesuvius Electric Railway Co., of Naples, calls for compressors with a similar capacity to those of the New York subway. Orders were also received for 34 straight air-brake equipments for electric tramways in Amsterdam, Holland; for 37 straight air-brake equipments for the government tramways of Sydney, Australia, and for 19 air-brake equipments for the Hanshin Ry., of Japan. These last call for the company's standard No. 1 compressors, having a capacity of 11 cu. ft. of free air per minute.

An Improved Headlight.

The Duplex Headlight Co., of Cleveland, O., has placed on the market an improved headlight for electric cars, a view of which is shown herewith. This headlight will be known as the "Duplex," and it combines both arc and incandescent lamps. The change from arc to incandescent, or vice versa, is accomplished by throwing a two-point switch in the car vestibule, or by inserting an arc or incandescent plug in the receptacle provided for the purpose. The lamp mechanism is very simple, and it is declared that handling or jarring will not derange it. There are but two incandescent lamps used, and they may be removed and replaced without removing the casing or front reflector. This reflector is of peculiar design and is intended to produce more reflected light than is obtained from three ordinary incandescent headlights.

The case of the "Duplex" is made in two parts, having a substantial cast iron back on which the lamp is built, and a steel casing which is neatly finished and can be removed in a few seconds, thereby exposing the entire mechanism. There are no solder or rivets. For the arc light ⅜-in. carbons are used, which limits



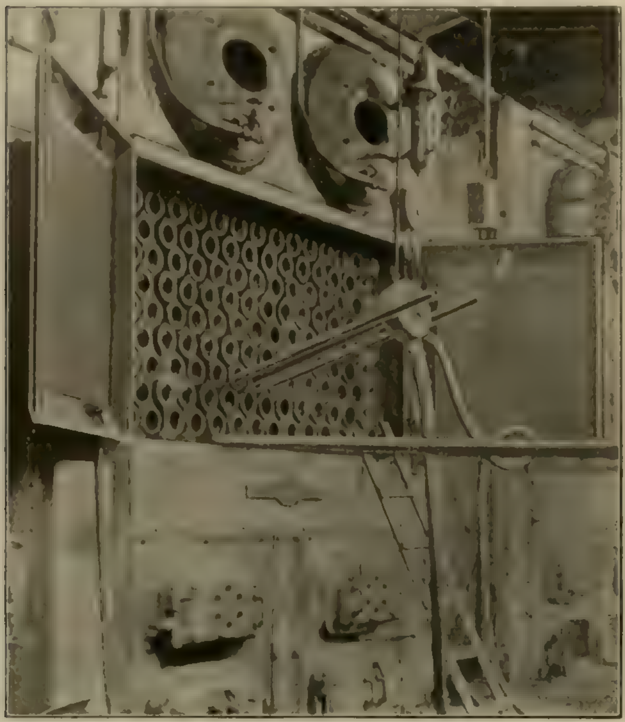
"DUPLEX" HEADLIGHT

the travel of the arc to the minimum, and by the arrangement of the reflectors no shadow is thrown. The lamp is adjusted to operate under from 1½ to 3 amperes. The lamps are easily cleaned and trimmed. The headlight is 19 in. high and 14 in. in diameter. It weighs 25 lb.

February 15th an Indianapolis, Columbus & Southern Traction Co. car ran 45 miles in 1 h. 35 min., including 28 stops.

"Weinland" Boiler Tube Cleaner.

We present herewith two views illustrating the "Weinland" direct water-driven tube cleaner, which is made by the Lagonda Manufacturing Co., of Springfield, O., one view showing the cleaner head, with its different lengths of shafting, and the other showing the cleaner at work in the boiler room of the power plant of the



"WEINLAND" CLEANER IN OPERATION.

Dayton, Springfield & Urbana Electric Railway Co., at Medway, O. Aside from showing the operating and discharge hose, it will be noticed that for supporting the motor a weight is used attached to a rope which is carried over a sheave pulley suspended to a point directly overhead and midway of the bank of tubes to be cleaned. The operator has little to do but to change the machine from tube to tube as the cleaning is done, there being but little lifting required.

The "Weinland" cleaner is a 12-in. water wheel of latest design attached directly to a shaft which carries the company's well-known cleaner head, and is provided with three lengths of shafting to suit the different lengths of boiler tubes. It is driven by water through 1½-in. hose under at least 150-lb. pressure, and develops not less than 5 h. p. It is made for any size straight tube from ¾ in. up, and is guaranteed to remove any condition of scale. All exhaust water can be saved. It is handled easily and takes no

"WEINLAND" CLEANER HEAD.

more water than the ordinary turbine cleaner, and is sold with the company's guarantee to outlast any 10 turbine cleaners.

A Northwestern Elevated Railroad Co. car caught fire at Fifty-second Ave., Chicago, January 27th and was damaged to the extent of $4,000

Wilson Trolley Retriever.

The Wilson Trolley Catcher Co., of Boston, Mass., announces that it has combined a retrieving device with the well-known Wilson trolley catcher and that the new device will instantly reel up the cord and pull the pole down below the wire as soon as the wheel leaves it; also, that this retriever, after it has operated and pulled the pole down, permits the instant replacement of the wheel upon the wire by simply taking hold of the trolley rope and releasing the tension, as is the case with the Wilson trolley catcher. This feature enables the conductor to get his car under way without delay, whereas if, as in the case of some devices, the retriever had to be

WILSON TROLLEY RETRIEVER

pulled back to a certain point before it could be released and the wheel placed on the wire, delay would ensue which might lead to serious consequences, especially if it happened at a railroad crossing

This new retrieving device, which is illustrated herewith, cannot be added to the ordinary Wilson catcher now in such general use; but the retriever is similar in form, although slightly thicker, and contains an extra spring which, properly wound, causes it to act in the manner stated. The new retriever has been in service for several months, and the companies using it report that it is giving the greatest satisfaction, it having been shown during the present severe winter that the device will run successfully through sleet and snow storms, as well as in pleasant weather. The company offers to make an allowance to purchasers of the new retriever for returned Wilson catchers now in use, and it is also willing to furnish retrievers for trial. All the Wilson devices are made of malleable iron and finished with care. They are compact and neat and do not take up an excessive amount of room on the car dasher. The Wilson Trolley Catcher Co. is the successor to Wilson & Co., the pioneers in trolley-catcher making.

Boilers for St. Louis Exposition.

The Aultman & Taylor Machinery Co., of Mansfield, O., has secured through the Cahall Sales Department, W. W. Darley, general western sales agent, the largest installation of boilers for the Louisiana Purchase Exposition. The installation consists of 16 Cahall horizontal water-tube boilers, eight of 508 h. p. each and eight of 400 h. p. each, the aggregate being 7,264 h. p. Four of the 508-h. p. boilers are built to cary 225 lb. pressure, and the other 12 will carry 175 lb. working pressure each. The boilers will be equipped with the Mansfield chain-grate stokers, and with the Buffalo Forge Co.'s induced draft. These 16 boilers will constitute practically two-thirds of the entire exhibit in the steam, gas and fuel building, and all the boilers are to be in operation by April 15th. The total value of the installation, including the foundations and brick work, which will be done by the Aultman & Taylor company, exceeds $165,000. The weight is approximately 3,500 tons and it will require 125 freight cars to transport it

Three masked men robbed the ticket seller at the Fullerton Ave station of the Northwestern Elevated Railroad Co., Chicago, February 2nd. They secured $8 and a watch and chain.

STREET RAILWAY REVIEW

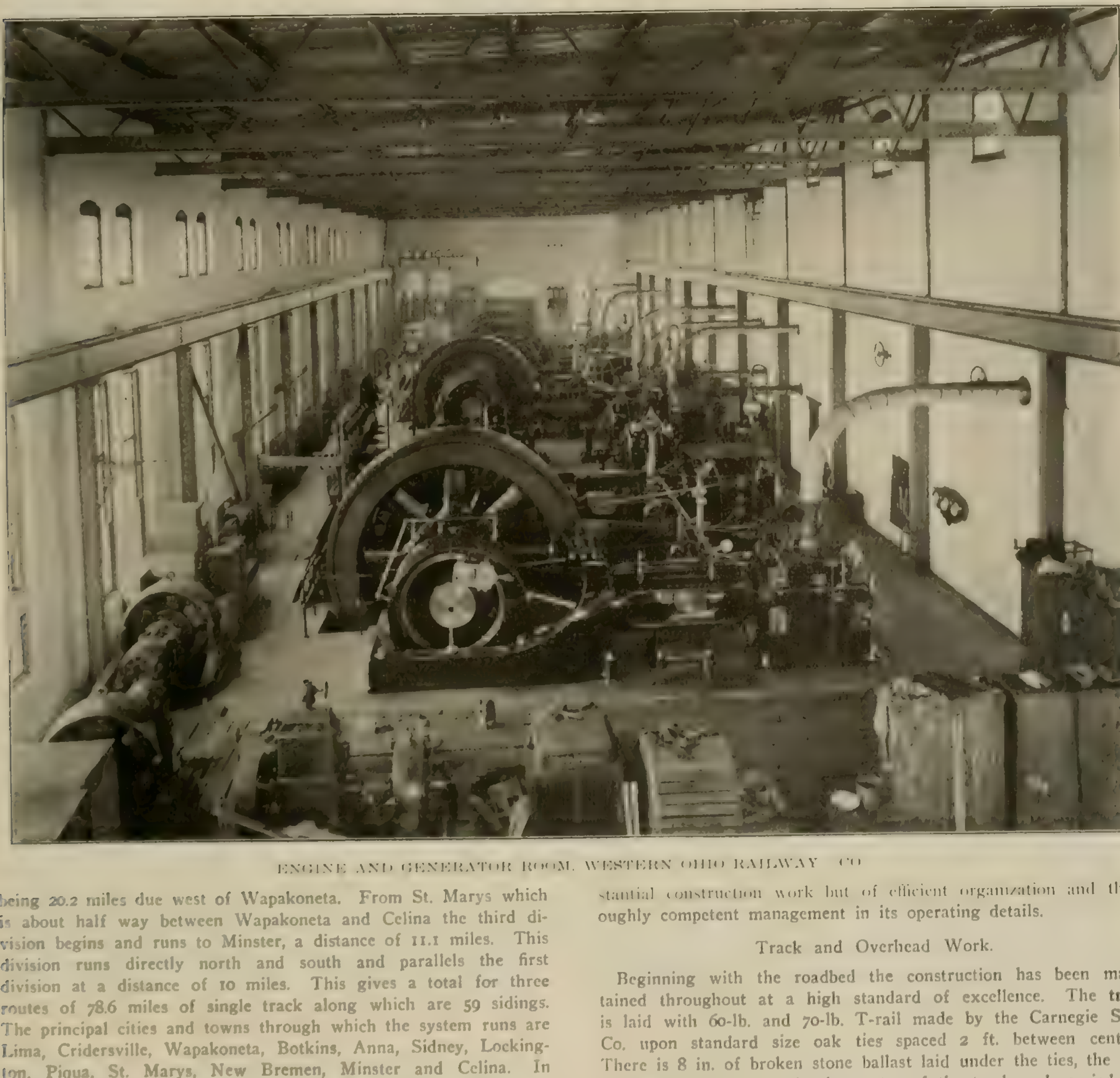
Vol. XIV — MARCH 20, 1904 — No. 3

The Western Ohio Railway Co.

Describing the Company's Lines, Power House, Sub-Stations, Etc., with a Review of Some Operating Details.

The Western Ohio Railway Co. in December, 1903, completed the southern division of its road from Wapakoneta to Piqua, which has since been operating on a regular schedule. As at present completed the road consists of three main divisions. The first division extends from Lima to Piqua, which is an almost directly north and south route, measuring 47.3 miles in length. The second division extends from Wapakoneta to Celina, the latter city being 20.2 miles due west of Wapakoneta. From St. Marys which is about half way between Wapakoneta and Celina the third division begins and runs to Minster, a distance of 11.1 miles. This division runs directly north and south and parallels the first division at a distance of 10 miles. This gives a total for three routes of 78.6 miles of single track along which are 59 sidings. The principal cities and towns through which the system runs are Lima, Cridersville, Wapakoneta, Botkins, Anna, Sidney, Lockington, Piqua, St. Marys, New Bremen, Minster and Celina. In addition to the routes already mentioned the company plans to complete a branch running from Lima in a northeasterly direction to Findlay, O., passing through Bluffton, which will be 32.4 miles long. With this extension completed the total length of route to be operated by the company will amount to 111 miles.

A brief description of the portion of this road which was first completed was given in the "Street Railway Review" for December, 1902, in an article by Mr. D. W. Pell, then electrician of the company. At that time, however, only about half of the present mileage was in operation, and but a small part of the power house machinery had been installed. As the system stands today it presents a gratifying example not only of excellent and substantial construction work but of efficient organization and thoroughly competent management in its operating details.



ENGINE AND GENERATOR ROOM, WESTERN OHIO RAILWAY CO.

Track and Overhead Work.

Beginning with the roadbed the construction has been maintained throughout at a high standard of excellence. The track is laid with 60-lb. and 70-lb. T-rail made by the Carnegie Steel Co. upon standard size oak ties spaced 2 ft. between centers. There is 8 in. of broken stone ballast laid under the ties, the ballast being crowned up in the center of the track and carried out well beyond the ends of the ties. The entire length of the road is ballasted with broken stone except a short distance at the end of the first division, which is ballasted with gravel taken from a pit upon the right of way owned by the company. The entire length

of the road with the exception of the right of way through cities is built upon private right of way averaging about 50 ft. in width and having a maximum width in various places of 60 ft. One of the illustrations shown herewith gives a general view of the track on a tangent between Lima and Wapakoneta. This shows the right of way fenced in on both sides and the general character of the roadbed construction. Outside of the cities the road has been built with a view to high speeds, as the regular schedule under which the company operates requires maximum speeds of from 50 to 60 miles an hour at times. For this reason the grades have been kept down to maximum of 1.8 per cent on the right of way and the shortest curve outside of the cities is of 12°.

VIEW OF TRACK BETWEEN LIMA AND WAPAKONETA

CONCRETE CULVERT AND 42-FT. FILL AT WOLF CREEK

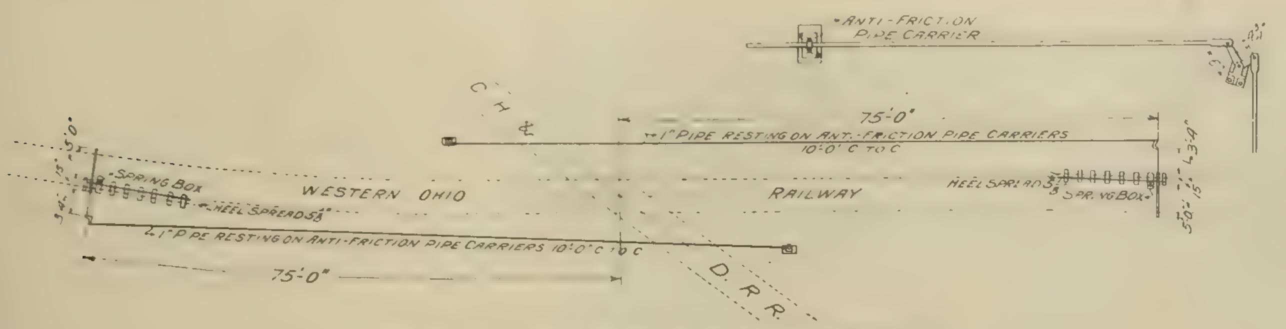
In the construction of the roadbed large amounts of earth were moved in making the various cuts and fills. The maximum cut was 22 ft. deep, while the maximum fill was 42 ft. high. A view of this fill is shown herewith above the concrete culvert at Wolf Creek. This is typical of all the culverts along the line, being solidly constructed of concrete. Several long trestles are also to be found along the line, one of which is shown herewith crossing the tracks of the Lake Erie & Western Railroad. Another trestle, which is the longest on the line, is built at Lockington at the crossing of the Loramie River. This trestle is 2,270 ft. long and is 57 ft. above the high water line. The work of filling in this trestle has been commenced and this fill when completed will contain 160,000 cu. yd. of earth.

CROSSING OVER TRACKS OF LAKE ERIE & WESTERN R. R.

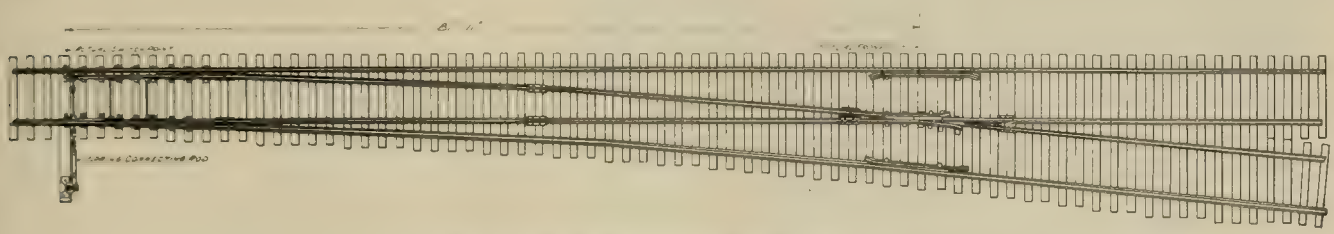
There are 13 railroad crossings along the route of the Western Ohio Railway, 10 of which are at grade, 2 are overhead and 1 undergrade. All of the grade crossings are provided with derailers, most of which are of the style illustrated in the accompanying diagram and which are made in the company's shops. These derailers consist of 15-ft. switch points which are normally held open by spring boxes. The switch stands through which these derailers are operated are located in each case on the further side of the track to be crossed, the connection between the switch point and stand being made by suitable lengths of 1-in. gas pipes connected through a bell crank as shown. Another commendable feature in the track construction is the adoption of a standard turnout which is adhered to in every case. A plan of this turnout is shown in one of the accompanying illustrations from which it will be seen the switch has a lead of 81 ft. 11 in. The ties under this special work are spaced 20 in. between centers and split switches and frogs, each 15 ft. long, are used. The guard rails are 10 ft. in length and the switch stands are provided with spring connecting rods. All of the rail bonds were supplied by the American Steel & Wire Co. There are seven bridges along the route, all of which are built of steel and rest upon concrete piers. These bridges were designed to be loaded with a 40-ton car and a 40-ton trailer and were calculated with a factor of safety of four.

The overhead construction has been built in the same substantial style which characterizes the track work. The overhead material was furnished by the Ohio Brass Co., the trolley wires and copper feeders by the John A. Roebling's Sons Co., and the aluminum high tension transmission lines by the Pittsburg Reduction Co. The poles for the overhead work are all of Michigan cedar, 7 in. in diameter at the top and 35 and 45 ft. long. On curves the poles have been set unusually close together and are thoroughly braced and guyed where necessary with a view to making the overhead lines very substantial so as to meet all the

requirements of high speed service of heavy cars. The trolley wire is No. 00 round wire and is double throughout the entire length of the road. The trolley wire hangers are rigidly fastened to the brackets, the flexibility of the line being obtained through the brackets, which are of the Christy flexible type in which the arm is pivoted at the pole which permits a small amount of motion in a vertical direction. The cross arms are set in deep gains and fastened by means of bolts and nuts instead of lag screws. The low tension feed wires are carried on a short cross arm placed a little above the trolley wire brackets and the telephone wires are carried on the same cross arm. The telephone booths at which the crews may report to the dispatcher's office are located at every siding. The telephone line is equipped with Kellogg Switchboard & Supply Co. instruments, of which there are about 50 in use. Where the high tension lines run parallel with the track they are carried on cross arms near the top of the 45-ft. poles. Cross country lines have been built in some places to avoid carrying the high tension circuit through cities. The lines are protected by lightning arresters of both the Wurtz and the Garton-Daniels types placed approximately half a mile apart.



STANDARD DERAILER MADE BY WESTERN OHIO RY



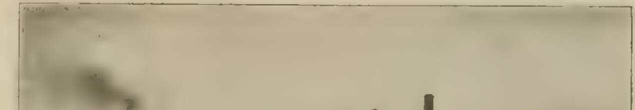
STANDARD TURNOUT WESTERN OHIO RY

Power House.

The power house is located at St. Marys about a mile distant from the company's tracks and is a long brick building 245 ft. by 97½ ft. in area. The building is neat and substantial in general exterior appearance, but no attempts at architectural ornamentation were made. A general view of the exterior is shown herewith. The interior is divided into two rooms extending the full length of the building by means of a brick partition wall, in front of which is the engine room, 50 ft. wide, and to the rear the boiler room.

The engine room, which is illustrated herewith, contains two 500-h. p. Cooper-Corliss engines with cylinder dimensions of 24 x 42 in. and two cross compound Cooper-Corliss engines, each of 1,000 h. p. capacity, with cylinder dimensions of 24 and 44 x 48 in. There are also two Westinghouse vertical compound engines with cylinder dimensions of 13 and 22 x 13 in., each of which drives a 100-kw. exciter generator. The two large engines are direct connected to two 750-kw. Westinghouse generators and the two smaller engines to two 400-kw. Westinghouse generators. These generators are of the multipolar a. c. type and generate at 400 volts pressure. In the basement are located seven 400-kw. transformers of the Westinghouse make, by means of which the 400-volt current is stepped up to 33,000 volts, at which pressure it is transmitted to the different sub-stations along the line.

In addition to the alternating current machinery this station also includes a sub-station equipment, consisting of two 400-kw. rotaries and a direct current switchboard by means of which the section of the road adjacent to the power house receives its direct current supply. The sub-station switchboard contains two rotary transformer panels, two direct current panels and two line panels. The low tension alternating current switchboard which is illustrated herewith, contains four generator panels, one totalizing panel, three 400-volt panels for the low tension side of the transformers, two exciter panels and one lighting panel for the lighting of the building. The high tension alternating current switchboard, which is shown in the further end of the building in the general view of the engine room contains seven panels equipped with static interrupters and low equipment lightning arresters. There is sufficient space remaining in the engine room for the installation of another of the 1,000-h. p. generating units whenever it may be required, but at the present time the capacity of



POWER HOUSE AT ST. MARYS, OHIO.

the station is more than double what is needed for the requirements of the road. The engine room is served throughout its entire length by an overhead traveling crane, built by Chisholm & Moore. As will be seen in the general view of the engine room the vacant portion of this room is temporarily devoted to the storage of two sub-station equipments which have already been purchased for

that portion of the road between Lima and Findlay which [illegible] remains to be built.

The boiler room, part of which is shown in one of the accompanying illustrations, is equipped with eight Stirling boilers each of 375 h. p. capacity set in batteries of two, each battery being surmounted by a steel stack 48 in. in diameter and 80 ft. high.

BOILER ROOM AT ST. MARYS POWER HOUSE.

These boilers are operated at a pressure of 150 lb. and are hand fired. A small industrial railway is provided along the front of the boilers and from the small cars shown in the illustration coal is shoveled into the furnace doors. The pumps for this plant are all located in the center of the boiler room. They consist of two feed pumps, two heater pumps and two 14 x 22 x 15 injection pumps for the condensers. The condenser is of the elevated injector type.

Sub-Stations.

There are six sub-stations at present constructed along the route, including the one at the power house, and there will be two others on the northern branch of the road which is to be built. The present sub-station buildings are located in Lima, Wapakoneta, Anna, Sidney and Lockington, and the equipment of all of these buildings is identical, although the buildings themselves vary somewhat in design. A general exterior view of the sub-station at Wapakoneta is given herewith, and in this case the building is provided with a passenger waiting room, this being the general transfer point between the first and second divisions of the road. All of the buildings are of brick and are of a neat design, and they are all provided with living rooms for the attendant and his family. An important detail in connection with the economical management of these sub-stations is the use of but a single attendant at each station. When this was first proposed by the management the idea was criticised as being impracticable, but since this road has been in operation the management has proved its practicability, at least in this case. There is in reality but little work to be done in connection with the sub-stations. After the machinery shuts down each night about midnight the machines have to be inspected and cleaned ready for operation next morning, and this is practically all of the real labor which devolves upon the sub-station attendant. During the day, while his presence at the sub-station all the time is necessary, yet in general he has practically nothing to do except perhaps to close a circuit breaker occasionally when it comes out, so that in spite of the long hours of attendance the sub-station attendant has but little work to perform and there has been no difficulty found in filling this position with an entirely satisfactory class of employes.

Car Shops.

The company has recently completed a new car shop which is located at its car storage yard in Wapakoneta about a mile south of the sub-station and the transfer point in that city. A diagram shown herewith gives the general layout of the car storage yard which lies between the tracks of the Western Ohio Ry. and those of the Cincinnati, Hamilton & Dayton Ry. A spur track connects the two roads at this point by means of which interchange of freight and cars is made. As will be seen by the illustration there are seven tracks within the storage yard, two of which pass through the repair shops and the remainder being uncovered. It is the policy of the company to store most of its rolling stock on the open tracks and the car house seldom contains more than three or four cars which may be undergoing repairs. It may be mentioned in passing that the overhead and special track work in the storage yards has been built in the same substantial style which characterizes the construction of the company's lines throughout.

The repair shops, an exterior view of which is shown herewith, are neatly and substantially built of brick, and contain in addition to the shops proper the dispatcher's office, motormen and conductors' room, and a locker room and toilet room for the trainmen. The general arrangement of the repair shops and the location of the various rooms and machine tools is shown in the accompanying diagram. The building is 229 ft. long by 125 ft. 3 in. wide and the dispatcher's office and trainmen's room are located in one corner of the front of the building facing the company's track. In the basement under the trainmen's room is located a boiler which provides heat for the building and the remainder of the front portion of the building is used as a large storeroom. Along one side of the shop, beginning at the south end, is a blacksmith shop, with one forge; next to this come locker and wash rooms for the shop employes and beyond this the office of the master mechanic. A passage between the main shop and the storeroom separates the master mechanic's office from the armature room and toilet rooms. The remainder of the building is divided by brick partition walls into two main

SWITCHBOARD AT ST. MARYS POWER HOUSE.

rooms, one of which is the machine shop proper and the other the carpenter shop, general interior views of each of which are shown herewith. The machine shop is equipped with one 26-in. and 48-in. double spindle McCabe lathe; one 18-in. Bradford lathe; one 150-ton Shafer wheel press; one Fosdick & Holloway radial drill; one Woodward and Rogers 13-in. speed drill; one No. 4 power hack saw; one diverter winding machine made in the company's shops; one emery wheel; one grindstone, and

one transfer table for removing trucks from under cars. The armature room is equipped with a 1,000-lb. swinging crane, and

SUB-STATION AND WAITING-ROOM AT WAPAKONETA.

a 3,000-lb. swinging crane is provided for mounting wheels and axles in the lathe and on the wheel press. The company makes considerable use of compressed air in cleaning cars and motors and for hoisting, and there is now being installed in the shop a Christensen type L continuous running stationary compressor and a 75-ft. air tank to provide compressed air for these purposes. There is also being built in the shop at present a 5-ton traveling crane with a span of 30 ft. and a travel of 64 ft. A drop section of the pit tracks is also being installed to facilitate the removal of wheels and axles from under the cars.

The carpenter shop is equipped with a 30-in. Oliver hand planer and jointer, an Oliver saw bench and one wood lathe. The shop is driven by a 10-h. p. Westinghouse shunt wound motor and is lighted by means of arc lamps. The company has been boring wheels on a lathe and getting good results, and saving the investment of a boring mill

Rolling Stock.

The company's rolling stock consists of 19 passenger cars, three express cars, one line car and one work car. Ten of the passenger cars are combination passenger and smoking cars, 45 ft. long, built by the Niles Car & Manufacturing Co., mounted on Peckham 14-A-XX trucks. Eight cars were built by the Kuhlman Car Co., and are 44 ft. long, three of these being combination passenger and baggage cars and five combination passenger and smoking cars. These are mounted on 14-A Peckham trucks. One combination passenger and smoking car 54 ft. long was built by the Jewett Car Co., and is mounted on 14-A-XX Peckham trucks. All of the cars are uniformly equipped with four Westinghouse No. 56 motors, K-14 controllers mounted on both platforms, Christensen air brakes and Knutson trolley retrievers. Almost all of the cars are equipped with pilots, although a few Providence fenders are used. It will be noticed that all of the car equipments are entirely uniform and this was decided upon in order to reduce the number of repair parts to a minimum and to facilitate the inspection and work in the repair shops. The cars are in use every alternate day only, and are thoroughly inspected during the day following each day's run, and it may be stated here that the thoroughness with which the inspection is made and the time which is devoted to it has proved to be time and money well spent, as during more than a year that the company has been operating there has never been an armature burned out on the road, although much heavy work has been done by the cars, especially during the last season in removing the snow. There are no snow plows, sweepers or track scrapers used on this road, yet in spite of the severity of the winter and the fact that almost all of the interurban lines in Ohio and Indiana were more or less crippled during the past winter and had their schedules badly deranged at times, the Western Ohio Railway Co. lost but a single trip throughout the whole winter and the cars were but very rarely off the schedule time. This was accomplished by following the advice which is frequently quoted to "keep the cars moving." The schedule is arranged so that two cars pass every point on the road every hour and while snow storms were in progress the

REPAIR SHOPS AT WAPAKONETA.

CARPENTER SHOP AT WAPAKONETA.

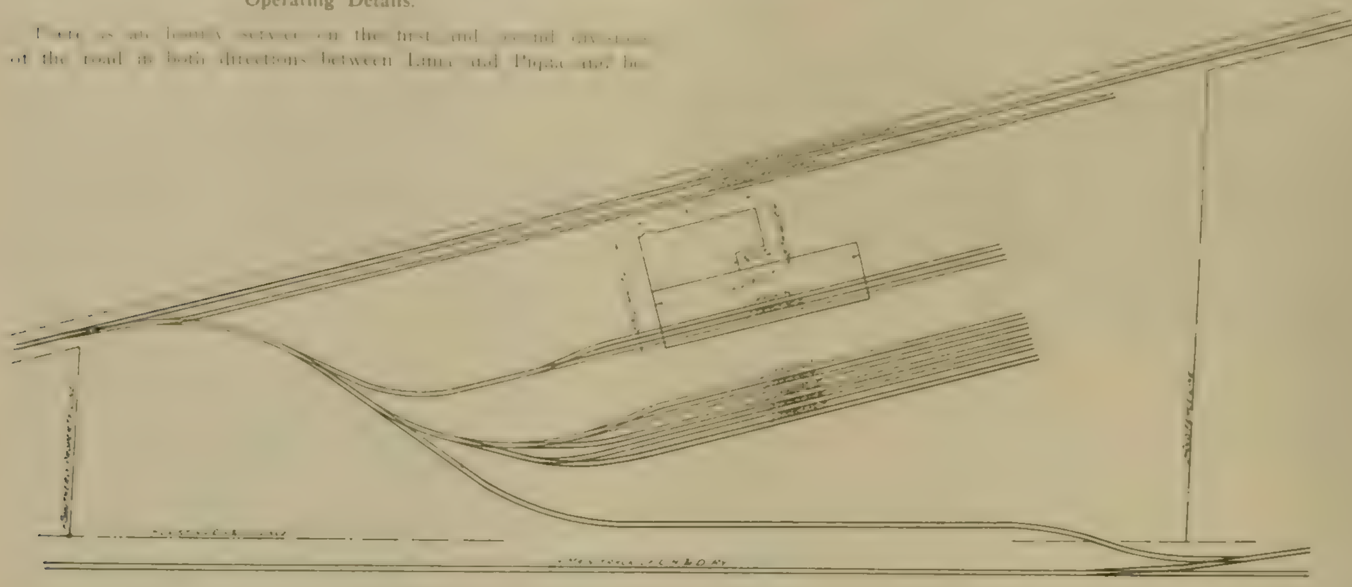
cars been kept running at night so as to prevent any accumulation of snow on the tracks. The point of the cars [illegible] were fitted with a [illegible] which took the place of a plow. When the usual frequency of service over the tracks was not sufficient to keep them clear, as was sometimes the case in the long cuts, extra cars were sent out which operated continuously back and forth over these troublesome places.

Operating Details.

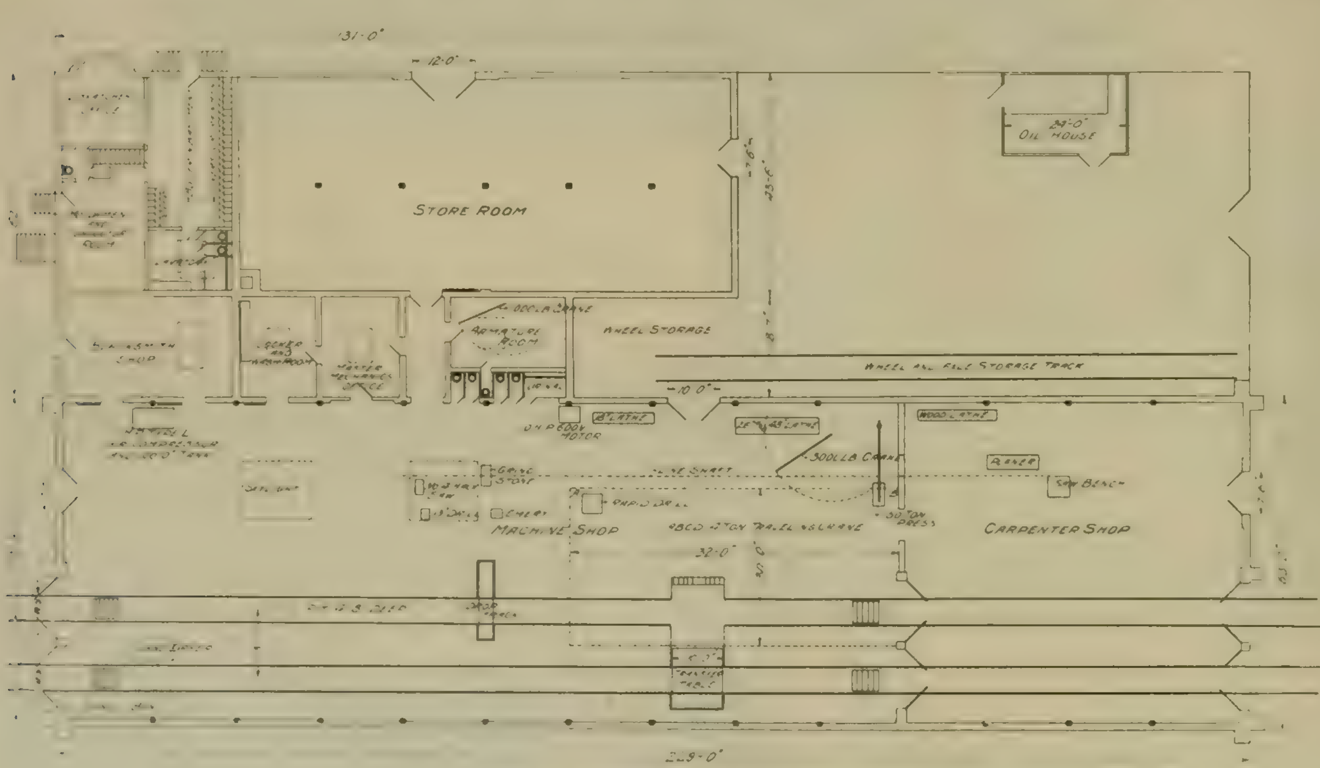
There is an hourly service on the first and second divisions of the road in both directions between Lima and Piqua and between Wapakoneta and Celina. On the third division between St. Marys and Minster there is a 1½ hourly service in both directions.

The company publishes a very complete time-table for the use of trainmen which is supplemented by five pages of rules. It is the theory of the management that the schedule and rules are made to be adhered to and consequently the trainmen are held to remarkably strict observance of them. If a car is found to be off its schedule at any time its crew must either have an excellent excuse for it or suffer the penalty therefor.

All cars are run under dispatcher's orders, although no special orders are given as long as the trains adhere to the schedule time or, in other words, the schedule is the crew's authority for running as long as the schedule is maintained. Each car or train has its train number, and its time at every station and siding is given on the schedule. The time is generally printed in light face type on the time-table except at such siding where two trains are to meet. The time at these points is printed in heavy black face type and just above the time is a small figure indicating the number of the train which is to be met at this siding. This arrangement of the time-table is an excellent one as it shows each motorman at a glance just what sidings are meeting points, by



CAR STORAGE YARD AND REPAIR SHOP AT WAPAKONETA



FLOOR PLAN OF REPAIR SHOPS AT WAPAKONETA

means of the prominent type, and also the number of the train which he is to meet. Telephone booths are provided at each siding, but crews do not report to the dispatcher when they are on time except at meeting points. In this case the first crew to stop at the meeting point calls up the dispatcher and reports "Train No. —— at siding No. ——. Train No. —— in sight," or

MACHINE SHOP AT WAPAKONETA.

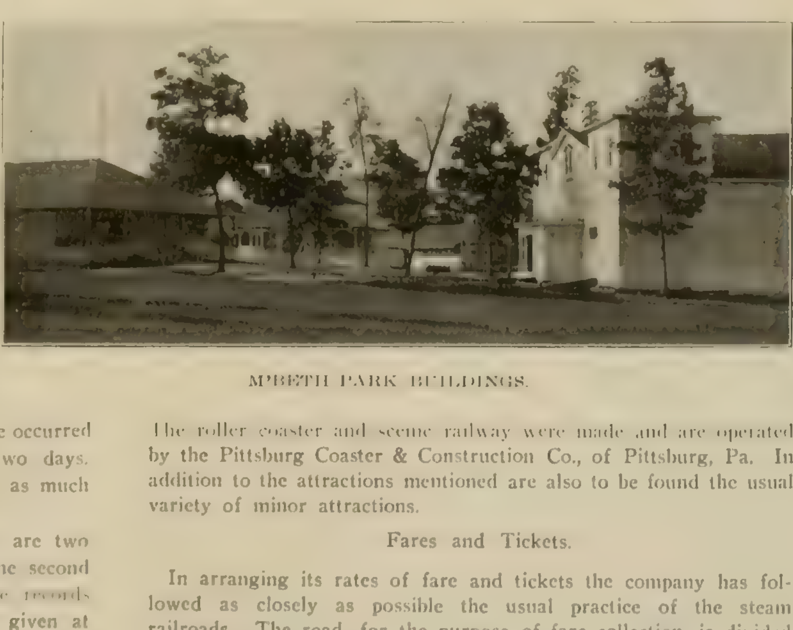
"Train No. —— not in sight" as the case may be. If the cars are about on time the dispatcher answers back "All right, make your schedule," or if one of the cars is late the first crew reporting will be told to call up the dispatcher again in two or three minutes. If one of the cars is more than five minutes late it loses its schedule right and operates thereafter under special orders from the dispatcher. Each of the trainmen is provided with train order blanks which are used in case special orders are given out by the train dispatcher. The order given by the dispatcher is received by the motorman and written by the conductor on the form provided and when the writing is finished the motorman repeats the order back to the dispatcher who, if he finds it correct, will answer "Complete." The order must be signed by both the motorman and conductor before the train leaves the siding and in case the telephone connection should fail before "complete" is received the order is not effective. In case a train is unable to make schedule time its crew is obliged to report to the train dispatcher at the first telephone booth after becoming five minutes late. When a large number of people are to be handled for any special occasion the trains are run in sections, as many extra cars as may be needed being put into service, but these trains follow the regular schedule from which no deviations are made. When special trains are run they have no rights other than those conferred upon them by the train dispatcher and they are usually run under orders to clear all regular trains by five minutes. It is worthy of notice that so closely is the schedule adhered to on this road that very few train orders are found necessary and instances have occurred where not a single train order has been issued for two days. This means that for two days' operation no car has been as much as five minutes off its schedule.

The train sheets that are filled out by the dispatcher are two in number, one for the first division and the other for the second and third divisions. Each train sheet contains complete records of all the runs each day, including the weather report given at midnight, noon and six o'clock p. m., the time at which every car reported at the different sidings, and a memorandum of the special orders issued. At the bottom of the train sheet is space to be filled out by the dispatcher containing a summary of the day's mileage, divided into regular passenger mileage, special passenger mileage, special mileage, express mileage, foreign mileage and work train mileage. Spaces are also left for reporting the time in case the power is off, reporting the movements of work trains and for reporting detentions and their causes.

The time sheet for the crews operating each day are made out to show the motorman and conductor operating on each run, the time they are on and off and the total time for the day. Another useful form is the daily car mileage report, showing the number of each car in service, the mileage, both regular and special, for passenger and express service and also the construction service mileage. The construction mileage is entered under the heads of "Ballast," "Overhead," "Dirt," and "Special."

Parks.

The company operates one park called McBeth Park, which is located a short distance outside of the city of Lima, and covers an area of 40 acres. This park contains an artificial lake which is well stocked with fish and the company has a number of row boats which are rented at 25 cents per hour. The lake is lighted around its border by incandescent lamps and is three acres in area. A general view of the lake is shown in one of the accompanying illustrations. The park also contains a group of buildings and other amusement features, some of which are shown in the accompanying engraving. On the right-hand side of the illustration is shown the theater which has a seating capacity for 700 people and which was built at a cost of $8,000. In the center is the building containing a roller coaster, which cost $4,000, and to the left is a dancing pavilion and restaurant. The park buildings together were erected at a cost of $15,000. The theater entertainments are given by a stock company and the price of admission is 15 and 20 cents, and 25 cents for box seats. The dancing pavilion has an excellent polished hardwood floor, 60 x 100 ft., and dancing at the rate of five cents each per dance has proved an attractive feature of the park entertainment. Connected with the dancing pavilion is a restaurant that seats 60 people and that is in charge of a competent caterer. The park also contains a scenic railway which is considerable of a novelty, the scenes consisting of all kinds of mines, such as gold, silver, copper, salt mines, etc.



M'BETH PARK BUILDINGS.

The roller coaster and scenic railway were made and are operated by the Pittsburg Coaster & Construction Co., of Pittsburg, Pa. In addition to the attractions mentioned are also to be found the usual variety of minor attractions.

Fares and Tickets.

In arranging its rates of fare and tickets the company has followed as closely as possible the usual practice of the steam railroads. The road, for the purpose of fare collection, is divided into several divisions and card tickets both one way and return are issued bearing a coupon for each division. The general fare is based on a rate of two cents per mile with a deduction of 10 per cent on round trip tickets. One way cash fares are

the [illegible] tickets [illegible] car passengers intending to return the same way almost always purchase tickets in order to avail themselves of the 10 per cent discount. The company also issues regular strip tickets such as are used by steam railroads in which the destination is filled in in ink by the agent. Mileage books of 500 miles are sold, good for three people for $7.50. School tickets are also sold at the rate of one fare for the round trip, one of these tickets being a 46-ride commutation ticket and the other a 54-ride commutation ticket. Party tickets for 20 or more people are sold at any time desired for a rate of one and one-third fares and special rate tickets for all points on the road to Dayton via the Dayton Covington & Piqua Traction Co. are sold good going on Saturday, Sunday or Monday and returning Monday night for one and one-third fares. No transfers are issued except to the local street railways in Wapakoneta and St. Marys to points inside of the town. These transfers were required by terms in the company's franchise.

The company formerly supplied duplex tickets which were issued by the conductors as receipts for cash fares but this system has been abandoned and all of the company's cars are being equipped with the Ohmer fare register system and hereafter no cash fare receipts will be used. As there are not enough dial points on the registers of these machines to include all of the

M'BETH PARK LAKE

cash fares if collected for the full length of the road at one time, the road has been divided into several sections, as previously mentioned, and the conductor must collect a fare every time the car enters a new section. He is also prohibited from collecting a through cash fare, but can only collect the amount of fare which would carry the passenger to the end of the section on which the fare is collected. In case the passenger buys a ticket between through points he is provided with a hat check and not disturbed until he reaches his destination. Employes or others entitled to ride free are provided with tickets or passes so that the conductor is required to ring up some fare for every passenger on the car.

Arrangements have been completed with a connecting road by means of which a fast service will be maintained between Lima and Dayton, a distance of 79 miles. Two trains will be run in each direction daily which will cover the distance in two hours and thirty minutes. This schedule will take effect early this spring.

Power is to be supplied from the power house of the Western Ohio Railway Co. for operating the cars of the Ft. Wayne, Van Wert & Lima Traction Co's. system which is now under construction.

Personnel.

The officers and board of directors of the Western Ohio Railway Co. are: A. E. Akins, president; L. J. Wolf, first vice-president; H. C. Lang, secretary and assistant treasurer; F. G. Pomeroy; M. J. Mandelbaum, treasurer; F. D. Carpenter, second vice-president and general manager; L. M. Coe; F. L. Fuller and A. E. Feihl. The executive offices of the company are at Cleveland and the general office is at 119 W. Market St., Lima O. The officers and staff directly connected with the operation of the road at Lima are F. D. Carpenter, second vice-president and general manager; J. H. Merrill, auditor; C. N. Wilcoxon, superintendent; R. H. Carpenter, general passenger agent; G. H. Kelsey, master mechanic; Frank Rynn, electrician, and Fred Mason, chief engineer

Roanoke Railway & Electric Co.

In a recently published compilation which is entitled "Roanoke, the Magic City of Virginia," there appears among numerous comprehensive sketches of representative business interests of that city, and also of Salem, Va., an interesting sketch of the Roanoke Railway & Electric Co., which was organized as a horse car line in 1888 and was converted into an electric line in 1893. It was first known as the Roanoke Street Railway Co. In 1889 it was reorganized and consolidated with the Roanoke Light & Power Co. under the present designation. Its interests were held by local parties until January, 1903, when the present proprietorship obtained control. The company operates 19¼ miles of road extending in all directions from the center of Roanoke, and a 10-mile line from Salem on the west to Vinton on the east. The equipment is modern and includes 30 cars, seven being double-truck convertible cars. It also has a new modern freight car which is used between Salem and Vinton, and a sprinkler car.

Last year the company purchased and laid out Mountain Park, which comprises 36 acres on the west side of Mill Mountain, about a quarter of a mile west of Virginia College. It is laid out in walks, flower beds and groves, and has seats, swings, etc. In season there are attractive entertainments, including vaudeville, opera and comedy. This year a dancing pavilion and other features will be added. The park was very successful last summer, it being especially desirable for Sunday school picnics and lodge and society gatherings. There is no charge, except a small fee for the entertainments. The company maintains frequent car service to the park during the summer and fall.

The company recently made extensive improvements to its power house and the plant will compare favorably with any electric power plant of like capacity. The car barns have also been improved and are commodiously equipped. In regard to the light and power departments, it is stated that the company has in operation in Roanoke 6,000 incandescent lamps and 350 arc lamps for city lighting and in the business houses. It also supplies power for several of the leading industries. The company employs about 85 men in all departments.

The president of the company is R. D. Apperson, of Lynchburg; F. H. Shelton, of Philadelphia, is secretary and treasurer, and J. W. Hancock, of Roanoke, is general manager.

Paying Express Business in Massachusetts.

The Middleboro, Wareham & Buzzard's Bay Street Ry., which has been carrying express on its passenger cars for some time, put a regular express car into service early in February and has found the business profitable from the start. One car only is used and up to this time it has made but one round trip daily between Taunton and Monument Beach, a distance of about 37 miles. On its first trip out of Taunton the car was loaded to its capacity. In warm weather it is purposed to make two or three trips daily, as it is anticipated that large quantities of provisions will be carried to the summer resorts on lower Cape Cod. Besides the transient business, which has been excellent, the company has received assurances of patronage from the wholesale dealers along the line, and others. By utilizing this service shippers save two days in transit and get the same rates as charged by the steam roads. The transportation of cotton from Taunton to two big mills in East Taunton will augment the business, also. An office has been established on Main St., Taunton, in charge of Charles Parris.

The supreme court of New York recently handed down a decision which granted to the city of New York judgment against the Third Ave. Railroad Co. for $25,720, with interest and costs, for car license fees for the years 1894 to 1899, inclusive, at $20 a year for each car used.

Compressed Air in Electric Railway Shop, Power House and Track Work—I.

applied to hand power cranes already in use, in which the hoist

In its application to various phases of electric railway work, compressed air is rapidly coming to be recognized as a most convenient, economical and desirable agency, and it would seem the possibilities in this direction had only been touched upon.

The widespread use of compressed air, and the practical application of air under compression for doing useful work, are of so comparatively recent date that the known data on the subject still remain difficult of access to the lay seeker after specific information. The literature treating on the commercial uses for compressed air has been confined largely to occasional papers presented to engineering societies; to special articles appearing at intervals in the various technical journals of America and Europe; and to a few general treatises upon the subject, all of which are largely technical, and most all of which are theoretical, as distinguished from the practical.

Inasmuch as most of the published information is of interest only to compressed air engineers, the following article has been prepared with the idea of supplying some practical working data and information for those who do not care to study the technical theories of compressed air and its properties, but who are anxious for information that will enable them to make specific applications of air in the shop, power house and other departments of electric railway work.

It is not the intention to discuss the use of compressed air as a propelling force for electric railway cars, as elaborate experiments very definitely evidenced the fact that in the present stage of the science, compressed air is not a mechanical success and certainly is not a commercial success as a propelling motive power for transportation service.

As outlining the scope of this article, it may be in place here to give a list of some of the manifold uses to which air under compression can be applied in connection with electric railway work.

In the Car Shop:

Pneumatic tools for doing various kinds of work.

Pneumatic hoists, cranes, jacks, etc., for lifting and conveying car bodies, trucks and truck parts, armatures and other motor parts, etc.

The air blast for general dusting and cleaning work, including cleaning interior and exterior of cars, dusting seats, blowing dust from controllers, motors, etc., and removing dust and dirt from all inaccessible places.

Compressed air sand blast for cleaning dirt and old paint from trucks, dashers and other metal surfaces prior to repainting, or for securing bright contact surfaces for brazing or welding. The sand blast is also used for grinding and frosting glass in decorative designs for car signs, deck-lights, etc.

Combined compressed air and gas blow torch for burning off car bodies preparatory to repainting; also used for brazing and soldering purposes.

Compressed air for blowing furnaces, forges, tire-heaters, etc.

Compressed air sand screens for screening sand.

Maintaining pressure by compressed air on automatic fire sprinkling systems in car houses, shops, and other buildings.

At the Power House:

The air blast for general cleaning purposes, as blowing dust and dirt from generators, rotary converters, switchboards, etc.

Compressed air oiling systems for piping oil to various parts of the power house for automatically oiling engine bearings, etc.

Compressed air driven coal and ash handling machinery.

Compressed air lift or pump for lifting water from wells for boiler feed water and other purposes.

On the Cars:

Compressed air brakes.

Air whistles.

Compressed air for maintaining pressure on running water where cars are furnished with wash basin and toilet room.

Compressed air track sander.

Operating trolley retriever by compressed air.

Compressed air device for opening and closing doors and platform gates on interurban and elevated railway cars.

In Track Work:

Compressed air tools for punching, drilling, etc., preparatory to attaching bonds to rails.

Compressed air sand blast for securing bright surfaces on rails prior to bonding, welding, etc

Track tamping by compressed air.

Miscellaneous Uses for Compressed Air:

Painting and whitewashing by means of compressed air spray.

Compressed air on special service cars and vehicles, i. e., for raising tower on tower repair wagon or cars; for operating cranes or derricks on service cars; for throwing water over street from sprinkling cars; for feeding sand to track from sanding cars; for operating the plow nose and shears on snow plows, etc.

Pneumatic signal systems for operating signals on electric railways.

Cleaning horses by compressed air.

Cleaning carpets, upholstery, etc., by compressed air.

In connection with the foregoing list of uses to which air under compression can be put it will be in order to speak of some of the methods and devices used for applying the air. After which will be discussed the subject of air compressors and the cost of compressing air.

Pneumatic Tools and Hoists.

Although the economy of portable pneumatic tools and appliances is of course more readily evident in large machine shops where the size of output warrants an elaborate installation of compressing plant and tools, it is nevertheless true that the advances made within the past few years in the art of pneumatic tool manufacture have rendered these ingenious labor-saving devices applicable even to the smallest machine shop. Moreover, if other uses for the compressed air can be found in the same building so as to warrant a piping system and compressing plant of reasonable size, the application of the air to driving various tools becomes a matter the economy of which cannot be questioned.

The many and varied uses to which air can be put in and around electric railway repair shops renders the electric railway machine shop a most promising field for the use of pneumatic tools and appliances. A line of air pipe along the ceiling over the vise benches, with the air hose attached to a pneumatic hammer and pneumatic drill standing upon the bench ready for instant use, forms a combination without which no modern machine shop, however small, can hardly be said to be complete. When the air pipe system is extended to all parts of the shops with branch-offs at convenient intervals, and the list of appliances is made to include pneumatic drills and hammers, riveters, chipping hammers, forge hammers, tire-heaters, air hoists, jacks, gas blow torches, sand blast, sand screen, etc., the arrangement can almost be called the modern exemplification of convenience and economy in machine shop work. Practically all of the larger electric railway shops in the United States as well as many of medium size, and even some of the smaller shops are now fitted with air appliances in this way, among those having notably complete installations being the shops of the St. Louis Transit Co.; the Boston Elevated Railway Co.; the Rhode Island Co., of Providence; the Milwaukee (Wis.) Electric Railway, Light & Power Co., and others too numerous to mention in detail. The apparatus used by the Boston Elevated Ry. was supplied by the Ingersoll-Sergeant Co.

The application of air hoists to cranes and to overhead travelers is now made in an almost endless variety of ways to meet the requirements of machine shop and foundry practice. The most common type is the simple cylinder hoist, either vertical or horizontal, or in combination with an intermediate inelastic fluid, as water or oil. In many instances direct acting hoists may be readily

may be hooked to the gear tackle for adjusting the height, when the air hoist is used for quick work. The air hoists are usually provided with a safety stop or brake attachment for arresting the load automatically at any desired point.

In combination with an overhead track and traveler the single cylinder air hoist makes a very desirable way of handling armatures, small parts and materials of all kinds. The overhead track system usually consists of 8 or 10-in. I-beams suspended from the ceiling and upon the lower flange of which the travelers run. By extending this overhead track system to all parts of the building with branch-offs to the car tracks and machine tools most frequently used, the usefulness of the hoists will be greatly increased.

Car bodies may readily be lifted from the tracks by means of four direct acting simple cylinder hoists supported from the roof girders near the four corners of the car.

Various styles of pneumatic jacks have been devised for service in car pits for removing armatures, axles and wheels, etc. It seems to be the case, however, that although the air hoist is very satisfactory the air jack is not looked upon with so much favor and several master mechanics reports that the air jack cannot be depended upon to hold any considerable weight for any length of time.

Space will not permit description of the various styles of pneumatic tools and hoists upon the market. There are now some dozen or more reliable manufacturers who make appliances operated by compressed air, and who are willing to furnish full information concerning the construction and working of their various devices. The products of any of the leading firms will doubtless be found reliable and satisfactory. For most of the pneumatic tools and hoists a pressure of air ranging from 70 to 80 lb. will be found the most satisfactory. Compressors adapted for pneumatic tools and appliances are a specialty of N. A. Christensen, Milwaukee, Wis.

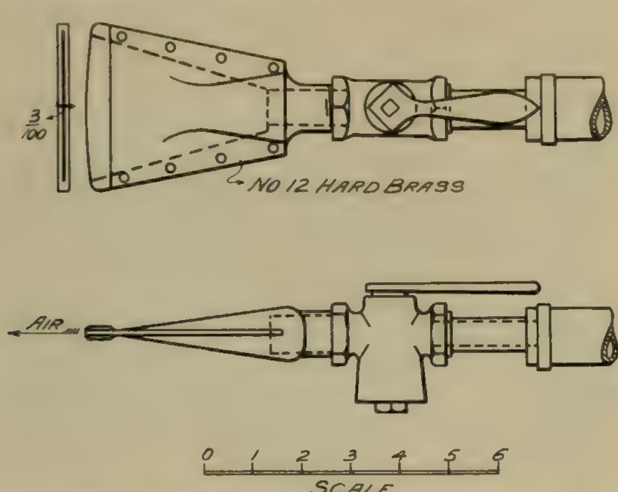


FIG. 1—NOZZLE FOR CLEANING CAR SEATS.

Cleaning and Dusting by Compressed Air.

The use of the compressed air blast for cleaning the interior of cars, for cleaning and renovating cane and plush car seats, and for cleaning and dusting purposes generally, is one of the simplest appliances of compressed air and it is one of the most effective. With a compressed air nozzle and a few feet of flexible hose, for instance, one man can remove the dust from the interior of a car in considerably less than one-half the time required by any other method. Moreover the air blast instantly reaches every crack and corner, and more effectually removes the dirt and dust than any other means that can be employed.

For cleaning car seats the Boston & Maine R. R. uses the form of nozzle shown in Fig. 1. Mr. E. F. Millar, car department superintendent of the Boston & Maine R. R., described this work in an article published in the "Review" for Aug. 20, 1903, as follows:

"The cushions and backs are removed from the cars and placed on wooden horses where all loose dirt and dust are blown out of them with compressed air. The nozzle is made of brass, formed at one end so as to give an opening which can be connected to a pipe having a valve in it. This pipe in turn is attached to a rubber hose, which is connected to the reservoir containing the air supply. The opposite end of the nozzle is so constructed as to give an opening about 3 in. long and 3-100 in. wide; however, the length of the opening can be any dimension desired according to the volume of air at hand, as the air pressure should not be lower than 60 lb. to 80 lb. per sq. in. The latter pressure will do much better work. With a pressure of 80 lb. and a nozzle 3 in. wide, a man can clean a cushion in two minutes. By opening the doors and windows in a car, quite a good job of cleaning backs and cushions can be done without moving either of them. The results from a sweeper's standpoint are very good, as the compressed air will carry ahead of it all the dust and dirt which are in the lattice work of the floor, or in the heaters, or around the seats where they are fastened to the floor, much better than a broom, also much faster."

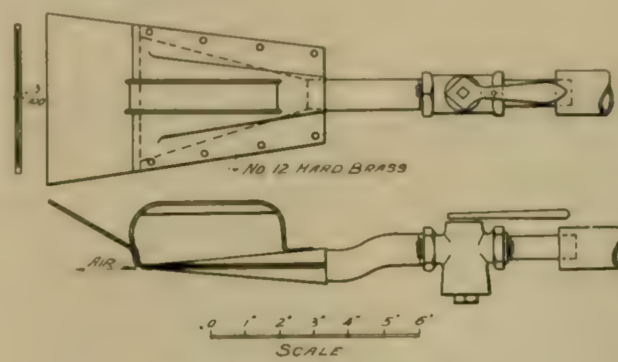


FIG. 2—NOZZLE FOR DRYING.

The same railroad has a system of washing and drying car cushions and in connection with this work uses a nozzle with a shield as shown in Fig. 2, for drying out the fabric after washing. The shield is designed to prevent the water from flying in all directions.

In Fig. 3 is shown a common form of air-spray nozzle for dusting with compressed air. This is a broad, thin nozzle with slightly curved edge. The open slit at the end should vary in width from 1-32 to 1-16 of an inch and in length from 1 to 6 in. depending upon the kind of work to be done. A good form for general car cleaning is 1-16 of an inch wide by 5 to 6 in. long. The straight-edge nozzle shown in Fig 4 is the most suitable for flat work such as car-seat cushions and backs that are dusted out of doors. For general dusting purposes a low pressure from 15 to 25 lb. is best. For cleaning seats, a pressure from 50 to 80 lb. will give good results, but with a pressure exceeding 80 lb. there is danger of injuring the nap of plush seats. Where air is supplied to the piping system at 80 lb., reducing valves can be used for supplying lower pressures when necessary.

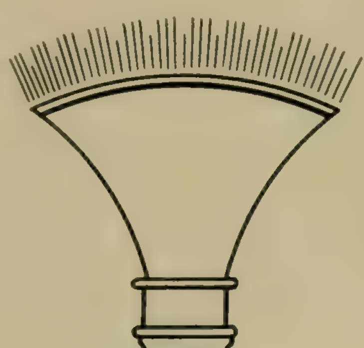


FIG. 3.

Fig. 5 shows a form of suction nozzle applicable for car cleaning work. The compressed air is ejected against the point of the inverted cone, which induces a strong current of air upward and from under the bottom of the inverted funnel, drawing the dust from the fabric of the seats and projecting it through a hose out of the car windows.

The Sand Blast.

The air sand blast is used to advantage for frosting or "grinding" the surface of glass, in either plain or decorative designs, for use as car-route designating signs, car-transom lights, etc.; for cleaning brass, iron, and steel castings and trimmings; for removing old paint and dirt from car trucks, car dashers, etc., preparatory to

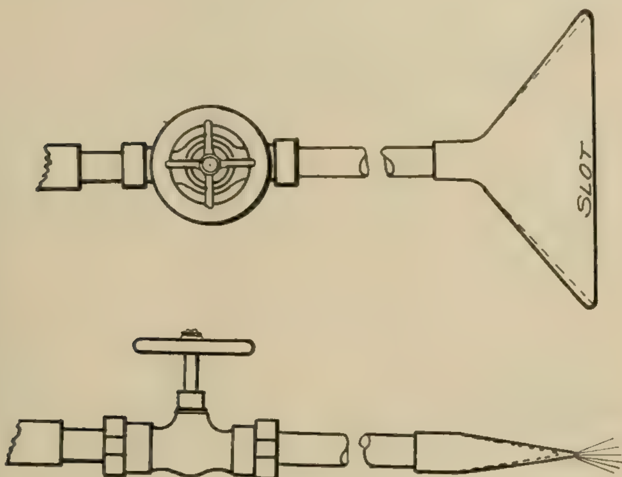


FIG. 4.

repainting; for cleaning metal surfaces and structures in general, such as bridges, viaducts, sides and roofs of buildings, etc., preparatory to painting or repainting; for sanding paint or car roofs and buildings wherever sanded paint is needed for special protection; in bonding work to obtain a clean, bright spot on the rail to which to attach the bond; in rail-welding work for obtaining clean, bright contact surfaces between the metal pieces preparatory to making the weld; for cleaning metal surfaces in general prior to welding, brazing or soldering; and as mentioned elsewhere for applying sand to rails to prevent car wheels from slipping.

To meet all the requirements arising in electric railway work, the simplest form of sand blast will suffice and any one of a half dozen forms of apparatus, such as can be built at slight cost in the shops will meet all ordinary demands. The object is simply to drive a stream of rapidly moving sand against the surface to be operated upon.

In Fig. 6 is shown a form of sand blast tank very commonly used for frosting glass and for cleaning all sorts of metal surfaces. The compressed air enters the lower compartment and issuing through the cross pipe receives its charge of sand graduated by the slide valve which is regulated by the lever as indicated. Just above the air chamber is the feed chamber for sand, the sand being fed in from the top through an inlet valve held in place by a spring. The upper section is the hopper into which the sand is dumped,

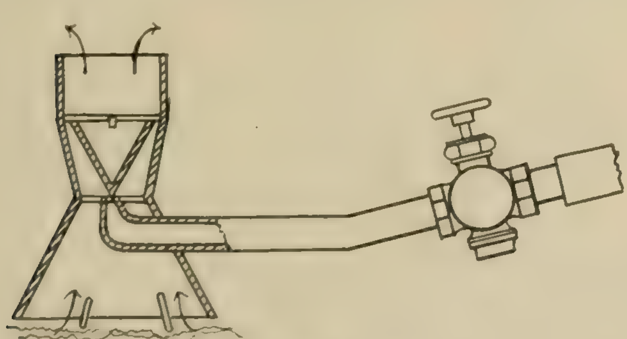


FIG. 7.

when by pulling down the spring with the lower slide valve closed, the sand drops into the feed chambers.

Fig. 7 shows a form of sand blast apparatus used at the shop of the International Ry., of Buffalo, for cleaning dirt and old paint from trucks or dashers, metal signs, etc. The work was formerly accomplished with gasoline blow torches which were inconvenient and dangerous. The entire apparatus consists of a sand tank, a few feet of ¾-in. iron pipe and a nozzle made by flattening out a piece of ¾-in. iron pipe. Compressed air is taken through the iron pipe from an air compressor in the main shops. The sand, which must be of fine quality, is fed from the tank into the air pipe in the manner indicated in the diagram, the force of air combined with gravity being sufficient to draw the sand down the pipe in a good steady stream. By means of the flexible connection and nozzle one man directs the sand against the surface to be cleaned, exactly in the same way as he would handle a blow torch of any kind. The superintendent in charge states that with an air pressure of approximately 90 lb. and a good quality of sand every particle of old paint is removed and a cleaner surface is secured than could be obtained with a blow-pipe flame, and in just one-half the time, inasmuch as one man now does the work formerly requiring the services of two men.

Various styles of nozzles are used in connection with the sand blast. A piece of ½ or ¾-in. iron pipe at the end of a flexible hose will serve for most purposes. The end of the iron pipe may be flattened out, leaving a narrow slit if desired. A more elaborate form of nozzle is illustrated in Fig. 8. With this form the mingling of the air with the sand is postponed until both have issued from the nozzle. The inner straight pipe is the pipe through which

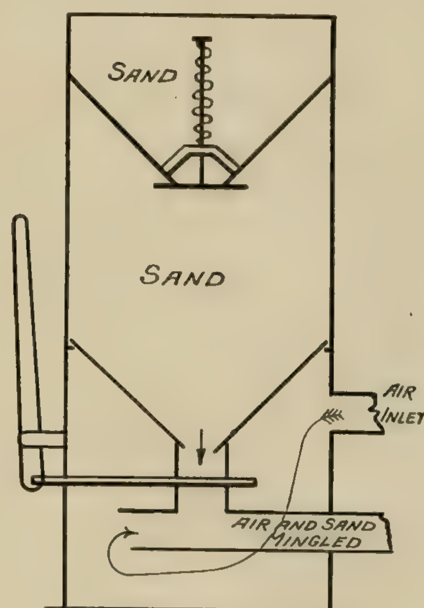


FIG. 6.

the sand arrives by gravity or otherwise; this is surrounded by the enlarged hollow head of the air pipe, the one adjustable lengthwise within the other to determine the extent of the annular space between their open tapering ends; the air rushing up the air pipe issues through this space, and converging, catches up and carries the sand forward, the two only mingling at the point shown by the vertical dotted line, well beyond the end of the nozzle.

The ornamenting of glass for signs, transoms and windows has not been used extensively in electric railway work; but presents attractive possibilities. A momentary application of a sand blast using very fine sand under moderate pressure depolishes glass over any space that can be covered by one stroke of the sand shower, instantly changing the previously bright surface to that known as ground glass. A little longer exposure cuts more deeply, and with further time, apertures are readily pierced through sheet and plate glass. If the surface is partly covered with a template made from heavy manila paper or metal, the action of the sand blast is confined to the unprotected portions of the glass, and designs, letters, ornamentations and even perforations can thus be easily and cheaply obtained. The idea especially lends itself for making illuminated deck and hood signs for designating car routes. The same method is applicable to ornamenting metal signs. Carrying the idea to an extreme, a beautiful translucent variety of glass can be secured, known as chip or crystalline glazing glass, covered with gray filaments and fern and feathery markings on an ice-like

ground. The surface, first uniformly frosted with the sand blast, is then covered with a coat of strong glue, and when this has set, the sheets are placed in horizontal racks in an oven heated to 100 degrees. In the course of ten or twelve hours, the hardening glue audibly cracks and springs off in patches, bringing away thin flakes of the glass with it. The fern-like markings are irregular portions of the original sand-blasted surface which remain on these flat conchoidal fractures. By using templates or overlays prior to frosting and gluing, the crystalline effect is sharply localized and confined to any portion of a design. This scheme of glass ornamentation and lettering is worthy of consideration and a small amount of experimenting will lead to pleasing results.

The best pressures and the best grades of sand to employ in the various uses to which the sand blast can be put are questions best decided by experiment. Where an air-compressor is in operation in the shops giving air compressed to from 75 to 90 lb. per square inch the air for the blast can be taken through a regulating valve and the pressure at the nozzle regulated at will. For cleaning castings, trucks, etc., the full pressure of 80 to 90 lb. can be safely used, providing the blast is not kept on the work long enough to cut into the metal. For frosting glass a pressure of from 15 to 25 lb. is sufficient.

The sand used may be clean silicious sand as builders' sand, sea-beach sand, emery from fine to coarse, chilled iron gratings or steel shot. The heavier materials, as emery and chilled iron, are only used with very high pressure for cutting metal and stone. For cleaning metal surfaces, a medium coarse sand is good. For glass frosting purposes a very fine, clean, sharp sand is best.

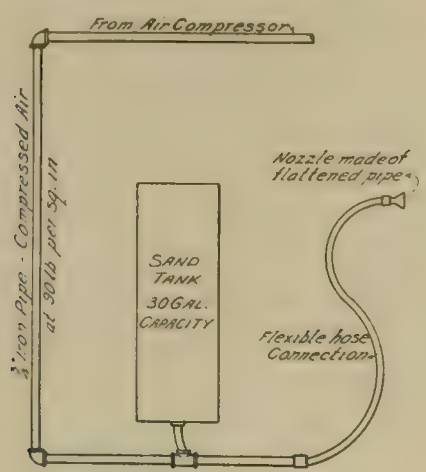


FIG. 7.

Small castings and forgings can be readily cleaned by directing the sand blast against them as they lie in piles on the ground. This will effectually remove all hard scale, rust, dirt, etc., leaving them clean and bright. Metal surfaces to be welded, brazed or soldered can be rendered perfectly clean to give good contact by a few seconds' application of the sand blast.

The thorough work of the sand blast has been demonstrated in the cleaning of old paint and dirt from structural steel work for preparing it for repainting. The viaduct at 155th street, New York, and elevated structures in various cities have been so cleaned, after rusting had taken place under the many coatings of paint, and blistering and peeling had given the work an unsightly appearance with indication of damage to the structure. For this work compressed air was conveyed from 150 to 400 ft. from a compressor to a receiver, and to the portable sand-mixing apparatus near the work. A hose connects the sand mixer and nozzle, which is held close to the surface to be cleaned. A section can be made perfectly clean and immediately painted by the air-blast spray process, thus giving the paint a perfect contact with the metal and by this means obviating the formation of rust or loose scale.

The air blast is useful for sanding paint on car-house roofs and buildings wherever sanded paint is needed for special protection. The sand thus thrown with great force imbeds itself in the paint, and the air blast without the sand is used to blow off the excess.

Brick and stone walls that have been blackened or charred by fire and smoke can be restored to their original appearance by means of the sand blast in practically the same way as described for cleaning structural work. A convenient method for securing compressed air for this purpose is by means of a gas driven air compressor mounted on a car or wagon with a sufficient length of air hose to enable the operator to reach the highest point to be treated.

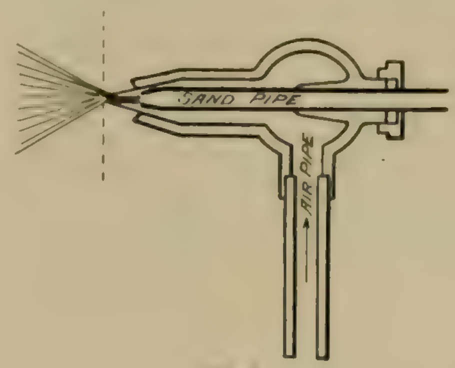


FIG. 8.

For cleaning rails preparatory to attaching bonds, or for welding work, a portable air-compressing outfit is necessary, mounted on a small truck or car. In this work, the sand blast gives as clean and as bright a surface as can be secured with a file or emery wheel, and in considerably shorter time.

The Compressed Air Gas Blow Torch.

The gas blow torch in conjunction with the compressed air blast is a very excellent substitute for the gasoline and other forms of oil blow torch. The use of the air gas blow torch is not urged so much on the question of economy but on the score of cleanliness. It has been used with particularly satisfactory results for burning off cars, preparatory to repainting; also for soldering joints when rewinding motor fields; for brazing band-saws; for heating soldering irons and, in general, for any work that can be done with the ordinary gasoline torch.

The nozzle used is made of brass, and consists of a ¼-in. tube, inside of a ½-in. tube; the smaller pipe being for the gas, and the larger one for the air. The air pressure and the supply of gas are regulated by stop cocks, giving any intensity of flame desired. The one possible objection to the air gas blow torch is the lack of flexibility; the air and gas pipes are necessarily limited in length, and the car to be burned off, or the other work to be done, has to be brought to a point accessible to the nozzle. This is an easily remedied difficulty, however, as in the case of car painting work, one track in the paint room can be reserved for the burning off process, and the flexible hose attached to the nozzle is made a sufficient length to reach any point on this track. For smaller work, it is usual to reserve one cornor of the shop near the main air supply pipe for doing the brazing and other work.

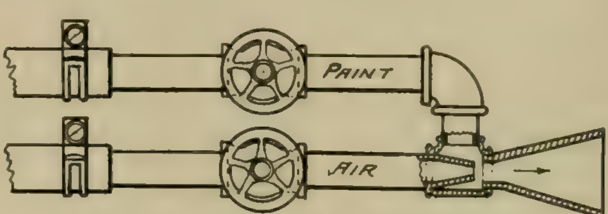


FIG. 9

The Air Blast for Painting, Disinfecting, etc.

The compressed air blast is used for applying paint to structural work, bridges, sides and roofs of buildings, roofs, trucks, and metal parts of electric railway cars, and to the sides and roofs of freight cars. It is also an efficient method of whitewashing and kalsomining walls and fences.

Painting and kalsomining by means of the air spray are rapid, economical and efficient processes. The paint is evenly distributed

over the surface, and the spray carries the paint into corners and crevices that could not be reached with a brush. The method is particularly recommended for painting car trucks.

In painting or kalsomining with the air spray, the essential thing is a suitable nozzle in which the paint is thoroughly atomized as it is blown outward by the air. Such a nozzle is illustrated in Fig. 9. The inner or air nozzle, having a ⅛-in. opening, is made on the best lines for high air velocity, and is fixed central to the larger opening in the inverted conical nosepiece, which is flattened to a thin opening, about 1-32 in. wide, to project the paint spray in a thin sheet. The paint is drawn in at the side inlet of the tee piece, and both air pressure and paint supply are regulated by valves, both pipes being under the same pressure from the paint tank of from 50 to 80 lb. per sq. in. By varying the opening of the valve of the spray nozzle, any density of the spray may be had from a thin cloud to a solid paint stream. The nozzle should be moved slowly broadside over the work; a jerky motion scatters the paint. The nozzle can be used in connection with a main central compressing plant and the air piped to the work, or it can be used with a portable motor-driven compresssing outfit. The paint or whitewash can be drawn from a centrally located tank, or it can be carried in a small hand air-paint pot to which the nozzle is directly attached, or it can be carried in a small tank or reservoir which may be strapped to the back of the operator.

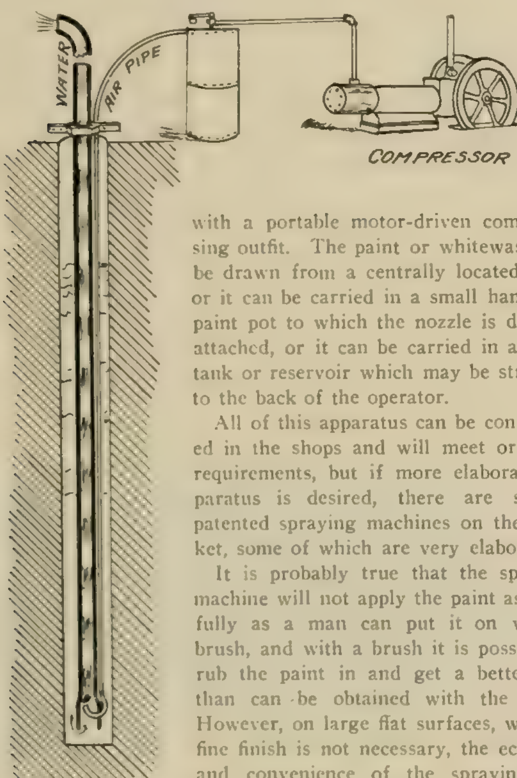


FIG. 10.

All of this apparatus can be constructed in the shops and will meet ordinary requirements, but if more elaborate apparatus is desired, there are several patented spraying machines on the market, some of which are very elaborate.

It is probably true that the spraying machine will not apply the paint as carefully as a man can put it on with a brush, and with a brush it is possible to rub the paint in and get a better film than can be obtained with the spray. However, on large flat surfaces, where a fine finish is not necessary, the economy and convenience of the spraying machine are unquestioned. Where there are rods or similar surfaces, the spray will miss more than it hits and there will be considerable waste. On the other hand the spraying machine reaches corners and places that the average painter does not take the trouble to reach.

Several forms of air sprays are used for spraying the inside of cars, seats, floors, etc., with disinfecting and antiseptic fluids. The form of the nozzle described for painting will answer this purpose although it is better to have smaller openings so as to deliver a very fine spray.

Lifting Water By Compressed Air.

The air lift is a system of pumping water from artesian wells by means of compressed air without the use of any moving parts other than the air compressor. For simplicity, durability, high efficiency, and economy, the air lift system peculiarly commends itself for furnishing water for boiler feed purposes at power houses and for fire protection and other uses at car houses. The system, as indicated in Fig. 10, comprises two properly proportioned pipes, which are placed in the well and go down nearly to the bottom. The larger of the two pipes is for the water and the smaller pipe, which is for the air, leads from the air compressor and is connected into the large pipe at the bottom through what is known as the foot or end piece. The compressed air is forced through the air pipe into the foot of the water pipe, through which it rises, carrying the water with it to the surface or to a tank. There is no moving mechanism below the surface to require attention or get out of order. In addition, sand or grit does not affect the action, the water is purified, and one air compressor will pump from several wells.

Fire Sprinkling System.

The use of compressed air for maintaining the pressure of the automatic fire sprinkling system in car houses and other buildings is particularly desirable, especially where buildings are not heated.

In many cases, if the sprinkler system was kept full of water, the water would be liable to freeze. By connecting the sprinkling system with the water supply, and keeping the pipes in the building filled with air under pressure instead of water, the same results will be secured, for just as soon as an opening in the sprinkling system occurs the air will flow out, and the water immediately rises throughout the entire system.

The air pressure can be maintained from a place of supply, such as a main reservoir tank, or, if desired, a separate motor driven air pump can be placed in the building and the air pressure renewed every two or three days or when necessary.

Other Uses.

The other uses for compressed air as enumerated in the introduction of this article need not be described in detail, as numerous patented devices are made for all the various uses, and methods of application will suggest themselves for each particular case.

In concluding this chapter we give herewith statements sent us by several prominent master mechanics in response to requests for data on the uses of compressed air in electric railway work.

Mr. C. F. Baker, superintendent of motive power and machinery, Boston Elevated Railway Co., Boston, Mass., writes as follows:

"I would say that we are putting compressed air to various uses in our power stations and shops as well as on the elevated structure.

"We have recently installed a motor driven direct connected compressor having a capacity of 587 cu. in. of free air per minute at 125 revolutions. The horse power of the compressor at this rate is 100. The cost per horse power for a compressor of this type and size is approximately $50, exclusive of cost of foundation.

"As to the various uses to which compressed air might be put in electric railway work I would mention the following: Operating pneumatic drills and hammers; sand screens; air hoists; jacks; riveters; chipping hammers; forge hammers; pneumatic hoists (both geared and straight); tire heaters; drills for tie rods, rail bonds, etc.; sand blast for cleaning rails, etc.; also for grinding glass; glass blow torch; signal system, etc. It is also used for cleaning motors, armatures, generators, coal handling machinery, etc.

"We are using compressed air for cleaning controllers and motors with excellent results. We have no apparatus at present for cleaning car seats but have recently made tests on apparatus for this work which gave good results and indicated that air can be used to a very good advantage for this purpose.

"In the power station we use compressed air for blowing out motors, generators, etc., using a pressure from 20 to 80 lb. We find it a large saving over the old way of cleaning.

"We have in use several pneumatic drills for boring holes for tie rods and bonds on track work, etc. We have pneumatic drills and hammers in our shops and we have also used air in the sand blast for cleaning the ends of rails prior to welding. We have also used it in connection with gas as a blow-torch for replacing the ordinary gasoline torch.

"Our experience with air hoists, cranes, jacks, etc., has been very satisfactory, particularly for the first two.

"Compressed air also supplies the motive force for the operation of the signals and switches on our elevated system.

"As to its use in painting, we have used it to some extent in whitewashing, but with hardly economical results unless a large surface was to be covered. The small machines operated by hand hardly give satisfactory results."

Mr. Edwin H. Olds, superintendent rolling stock, Milwaukee Electric Railway & Light Co., Milwaukee, Wis., says:

"Our company uses compressed air for operating hoists, for handling motors, for air drills, riveters, chipping hammers, etc. We also operate a [illegible] steam hammer with it. We have also found air more than satisfactory for cleaning controllers and motors and in fact for cleaning everything from which dirt or dust can be blown.

"We have used it but very little for painting or whitewashing. What little experience we have had with it, however, has been very satisfactory.

"The way department also uses it in connection with sand blast for cleaning rails before cast welding."

Mr. H. J. Lake, master mechanic, the Muncie, Hartford & Fort Wayne Railway Co., Muncie, Ind., states:

"Compressed air can be used for nearly every kind of work around the car barn and repair shop. I use it for cleaning the inside of cars under the seats, behind the heater pipes, cleaning cushions, armatures, controllers, motors, or anything else that needs a pressure to drive the dust out. I have used it for hoisting and for lifting jacks; for hoisting it is very satisfactory, but for jacks it is not to be depended upon to hold, any length of time. For drilling or chipping it is just the thing for any kind of portable work. I have never used it for sand blast, blow torch work, painting or whitewashing, but know it will do the work all right."

Mr. W. D. Wright, superintendent of equipment, the Rhode Island Co., Providence, R. I., writes:

"We use compressed air for cleaning cars both inside and outside before they go to the paint shop. Also, we use it for hoists, and a portable drill, and find compressed air something that we would hardly know how to get along without."

Mr. F. C. Randall, manager, National Electric Co., Milwaukee, Wis., writes:

"In addition to the list of uses for compressed air by electric railways, I would call your attention to the private parlor car recently built for Henry Everett, the head of the Everett-Moore syndicate of railways in Ohio. This car was built by the J. G. Brill Co. and is a fine example of the car builders' art. The car has sleeping, office, dining and toilet compartments. It is equipped with Christensen air brake and the air from the brake compressor is used to keep a pressure for the running water on the car, in the toilet room. The pressure required for the air brakes is about 80 lb., which, of course, is too high for use in toilet room, but this is overcome by the use of a reducing valve which reduces the pressure for the water tanks to about 10 or 15 lb. By this method, it is not necessary to carry a big water tank on the roof of car."

In subsequent chapters will be given data on the cost of producing compressed air and a separate chapter will be devoted to the air brake.

Connecticut Street Railways.

The 51st annual report of the Connecticut Railroad Commissioners shows that, exclusive of mileage located outside of the state, the miles of street railways in operation on June 30, 1903, measured as single track, was 556.577 miles, an increase for the year of 49.123 miles. Including track outside the state, the mileage was 642.383 miles. The Connecticut Railway & Lighting Co. operates 169.894 miles, the Fair Haven & Westville Railway Co. 104.139 miles, and the Hartford Street Railway Co. 85.678 miles.

The authorized capital stock of all the street railway companies is $33,482,000, and the amount actually issued $26,653,548, showing an issue of $45,122.96 per mile of main line. The total bonded debt of the companies is $20,633,500, being $34,931.36 per mile of road owned. The floating indebtedness of the companies is $2,714,030.82, or $4,440.05 per mile, and the total stock, bonds and floating indebtedness per mile of road owned, including sidings, is $71,728.50. The cost of construction and equipment is reported as $41,711,830.14, which is $80,773.45 per mile.

The gross earnings for the year ending June 30, 1903, were $4,503,571.29, or $6,798.45 per mile of road operated and $0.214 per mile run. The largest earnings per mile operated were $9,917.99, by the New London Street Ry. The largest earnings per mile run were $0.402, by the Montville Street Ry. The three companies having the largest earnings were the Fairhaven & Westville Railroad Co., with gross earnings of $1,290,667.21, the Connecticut Railway & Lighting Co., earning $1,110,599.55, and the Hartford Street Railway Co., earning $807,856.53.

The operating expenses for the year were $3,164,599.07, or $4,777.18 per mile of road operated and $0.151 per mile run. The net earnings for the year were $1,338,972.22, being $2,021.27 per mile operated and $0.063 per mile run. Dividends amounting to $369,816.24 were paid by 10 companies upon $6,702,300 of capital stock, while no dividends are reported paid upon $19,951,248 of capital stock. Twenty-two companies paid $860,903.94 for interest upon a total bonded and floating debt of $23,347,530.82. The amount of taxes paid to the state by various companies was $267,708.03.

The total number of miles run was 21,029,889, an increase of 1,654,159 over 1902; the gross earnings were about one cent per mile greater, the operating expenses about two cents per mile more, and the net earnings about one cent per mile run less than the year before. The total number of passengers carried was 96,857,782, as compared with 91,554,021 the previous year, and contrasted with 64,918,472 carried by the steam roads. The number of paying passengers per mile run was 4,606, and the number of paying passengers per mile operated was 146,213. The total number of employes was 3,403, averaging about five for each mile of road operated.

The number of persons injured was 370, compared with 292 in 1902; of this number four were fatally injured, four more than the year before. The number of passengers injured was 206, of whom 2 were killed; the number of employes injured was 20, of whom 3 were killed.

Street railway and steam railroad maps, corrected to Jan. 1, 1904, accompany the commissioners' report.

A Rolling Stock Record Board.

The Los Angeles and Pacific Electric Railway companies have adopted an exceedingly simple and lucid, although unique, method of keeping track of its rolling stock by means of photographs, which are mounted on what are known as record boards. Each car owned by the companies is photographed and on each photograph is clearly marked the length of the car, its seating capacity, weight

ROLLING STOCK RECORD CARD

and equipment. These photographs are afterwards reduced to a uniform size of 1¾ x 3 in. and mounted on a Spanish cedar block ¼ in. thick. These blocks are then inserted into frames which compose the record board, and the status of the rolling stock can be seen at a glance. One of the reduced photographs is shown in the accompanying illustration. Not only are the passenger cars thus photographed, but freight, wrecking, material, oil and mantenance-of-way cars are similarly kept track of.

The Lake Shore Electric Railway Co's. new power plant at Beach Park is nearing completion. Its equipment will include a 1,500-h. p. engine and generator. This will give the company a high tension a. c. service over its line from Lorain to Toledo. Later a sub-station will be installed at Sandusky, superseding the d. c. plant at that place.

The Elgin, Aurora & Southern Traction Co. has established an express service between Elgin and Aurora, with free delivery at each point where the company has an office, express being received at these offices for shipment. At other points the company receives and delivers express at the cars. Offices have been opened in Aurora, Batavia, Geneva, St. Charles and Elgin.

Electric Traction in Italy by Means of Monophase Series Motors.

BY E. GUARINI.

If it is incontestible that the problem of urban electric traction has been definitely solved, and that the electric tramways possess indisputable advantages over horse-drawn omnibuses, the same is not true as regards the problem of electric traction on the railroads as a substitute for steam traction. In this latter case, the distance of the generating station has to be reckoned with; consequently it is necessary, in order to avoid the expense of installations too costly to be remunerative, to have recourse to very high tensions. While we anticipate on the part of the Société de l'Industrie Eléctrique et Mecanique, of Geneva, a development of its program of electric traction by continuous current at very high tension, conveyed directly to the car; at the present moment the advantage rests with the alternating current at high tension. These latter can be conveyed directly to the car or else transformed in sub-stations to currents at low tension, either continuous or alternating. The first solution is generally preferred, as the second solution necessitates a double conductor, one for the low tension and one for the high tension. On the Valtelina railway are to be seen no less than five conductors, three of which are for triphase current at 20,000 volts, and two for the service line at 3,000 volts, the return current being carried by the rails.

Among the experiments which mark an epoch in the history of electric traction, must certainly be ranked those of Zossen-Marienfeld, where the motors have been directly supplied with current at 12,000 volts without the intervention of any process of transformation. Only the triphase current, even when conducted directly to the motors, has the disadvantage of requiring three conductors, or at least two, when the return current is carried by the rails. The monophase current would present, from this point of view, an enormous advantage, since it only requires a single conductor; it is therefore in the same category as the continuous current employed for urban tramways. Professor Finzi now asserts that the solution of this problem, which will never lose its interest until it is solved, is to be found in the system adopted by him.

The main requirements for electric traction is a motor of variable speed, having a high efficiency at all speeds. It is also for many reasons desirable that the normal speed shall be capable of being exceeded on occasion (to regain lost time, etc.), and a further requisite is simplicity of mechanism and control—conditions which are difficult to satisfy.

The induction motor does not offer this advantage and among the continuous current motors, the shunt wound motor only partly satisfies this condition. It is only the series wound motor which, in this respect, approximates in elasticity of function to steam and animal traction. It must, however, be admitted that the continuous current series motor is defective, since, strictly speaking, it would require, in order to be perfect, to be supplied at a variable voltage, and the line supplies it with a constant voltage, hence there is loss in the resistances. This economic defect can only be remedied —and that partially—by the system of multiple units, coupled sometimes in series, sometimes in shunt.

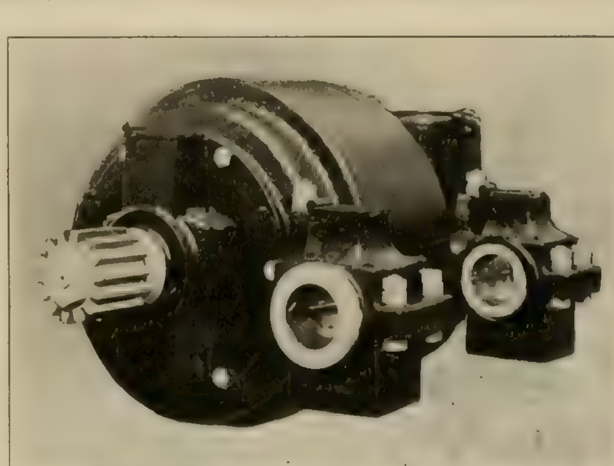
The ideal solution is, therefore, according to M. Finzi, a series motor supplied at variable voltage. But a series motor is also possible a priori with alternating currents, and the supply at a variable voltage is obtained by quite simple means with alternating monophase currents.

Even the most recent works on electrotechnics only devote a small space to the monophase series motor, and if they mention it, it is only in order to disparage it by saying that its efficiency is low, and the sparking at the collector disastrous. On the whole, they do nothing but repeat the conclusions of Steinmetz (1896), derived from theoretical studies. The results obtained with a badly-constructed motor of 4 h. p. have, nevertheless, not prevented numerous investigators from turning their attention to this construction.

The following are characteristic features of Finzi's monophase motor, whose inventor ignores all its disadvantages: Laminated fields and pole pieces; resistances between the armature coils and the commutator bars; a large number of poles; a small angular velocity. The longitudinal division of the poles is the most simple means of carrying off the reaction current of the field coil.

There remains to avoid the sparking due to the short circuit of the armature coils which form the secondaries of transformers under the primary effect of the poles. It is accomplished by the use of resistances of silver wire which unite the armature coils with the collector, all of which pass in turn beneath the brushes in the short circuit of which we have spoken, and limit the current which can circulate in it. We thus obtain a series motor for traction which works well with frequencies of 19 to 20 periods, and at 100 to 300 volts. The monophase series motor, as we have just described it, has been applied to one of the Edison Company's cars for urban service. The central station included a triphase motor of 60 h. p., 3,600 volts, driving by means of a belt an old alternator with eight poles, at the rate of 270 revolutions a minute; the frequency was 18 periods per second, and a pressure of 90 volts was attained by an auto-transformer. The tension of the line was 520 volts during the operation of the motor.

Most of the experiments were made during the night on a line 5 km. long with Vignole rails; the average grade was 2 per cent, but in certain places was as much as 25 per cent. The distance covered in 10 nights was 200 km. No accident happened to the motor; the only difficulties which occasionally arose were due to the sharp fall of potential from 160 to 95 volts. The car weighed 5.848 tons, the motor .8 tons, the controlling transformer .5 tons; total, 7.10 tons. The transformer had a capacity of 40 kw., but a capacity of 14 kw. would have been sufficient. In that case the total weight of the carriage would only have been 6.89 tons.



FINZI A. C. SERIES TRACTION MOTOR.

The motor carried on its shaft a pinion with 14 teeth, gearing with a wheel of 67 teeth placed on the axles of the wheels; the proportion was therefore 4.78. The diameter of the wheels of the car was 77 cm. The speed was measured in various ways.

The line, coming from the trolley, passed through a circuit breaker placed on the first platform, then, reaching the other platform, passed through an ammeter, and a second circuit breaker, and entered the auto-transformer; the other extremity of the latter was grounded, as was also one of the brushes of the motor. The other brush communicated, through the excitation of the motor, with the handle of a rheostat which served to produce a flow of current to various points of the winding of the auto-transformer. The tension was thus varied by 20 volts at a time. The passage from one contact to the other took place without a spark. The stoppage of the car was effected by means of one of the circuit breakers. A definite controlling apparatus would naturally include a dead point for stoppages.

From the time of the first experiment the smoothness of working and absence of sparks on the brushes were obvious. During the experiments the motor behaved better than those with continuous current. A few sparks appeared from time to time, when the motor was receiving the maximum voltage; they seemed from their color to be due to carbon from the brushes. After a journey of 200 km., the commutator was still perfectly smooth. The wear of the brushes was inappreciable.

In addition to generally determining the action of the motor, the experiments also aimed at comparing the energy consumed with that of a series motor with continuous current. In some of the journeys direct readings on the wattmeter were taken in order

to [illegible] the power necessary to maintain the car at [illegible] speeds. In [illegible], attempts were made to investigate the [illegible] by repeated and fairly accurate comparisons with readings relating to a typical journey, etc. The comparison of results showed that the power absorbed is lowest for the monophase motor, although the absolute efficiency is slightly inferior to that of the continuous-current motor. At a speed of 22 km., the energy absorbed was 9.40 watt-hours per ton for the monophase motor and 12.35 for the continuous-current motor. At 23.5 km. the figures become 10.60 watt-hours, and 14.85 watt-hours. On the other hand, an economy of 25 per cent in favor of the monophase motor has been proved for the process of starting, an economy which is by no means insignificant when it is remarked that, in urban service, starting absorbs 50 and sometimes even 65 per cent of the total energy.

Faithful Mule Has Been Retired.

On Washington's Birthday the Nashville Railway & Light Co. retired "Old Kate," a large white mule which has done faithful street-car service for more than 30 years. "Kate" was five years old when the street-car company acquired her, so she is now 35 years of age, but it is said that she was not retired because of infirmity, but as a reward for faithful service. She began street car service on the Jefferson St. line in North Nashville, and Mr. George D. Mills, the present superintendent of transportation, who has driven her a good many miles, says that "Kate" is as good a mule as he ever held the lines over. She helped to haul, in her younger days, children who now have children of their own. Many changes have taken place during her 30 years of service; companies have been organized and reorganized, the heads of departments have changed many times, new lines have been built and the electric current has taken the place of the patient mule.

When the other mules were driven out of service in 1888 "Kate" was retained, as a good mule was needed for the repair and trouble wagon.

LAST MULE AT NASHVILLE, TENN.

She performed her new duties with the fidelity that marked her performance before the car, and Superintendent Mills eloquently praises the good sense she always displayed in getting a car back on the track when it had been derailed. She has been in two fires and came out without a scratch, breaking her halter each time and running out of the stable, while the other animals remained and were burned to death. "Kate" has also been entangled in live wires, but always escaped unharmed. She was never "laid off" a day, and even now the men in charge of the trouble wagon say they would rather have "Kate" than the new animal that has taken her place.

"Kate" will make her home at Glendale Park, which belongs to the company, where she will be one of the attractions with the buffaloes, bears, deer and other animals. When turned loose in the park she hardly knew what to do with herself, it being her first day off in nearly a third of a century; she kicked up her heels vigorously a number of times, and carefully investigated the barbed wire fence, as though to ascertain how many volts it carried.

A photograph of "Old Kate" in harness is shown herewith, from which it will appear that she has not the appearance of an old mule yet, and this photograph was taken at a very recent "sitting." "Kate" has not a spot or blemish on her and has never been sick a day.

Long-Distance Trip of Sleeping Car.

On February 26th was made the initial trip of the Holland palace sleeping car "Francis" from Indianapolis to Richmond, Ind., and return. On board were a number of electric railway officials, bankers and others, who not only thoroughly enjoyed the trip, but were warm in their praise of the magnificence of the car and its appointments. This car, which is one of the two which were described in the "Review" for June, and again in August, 1903, and interior views of which were shown in the "Review" for January, 1904, was named in honor of the son of the general manager of the Holland Palace Car Co., Mr. Joseph W. Selvage. Its interior, finished in green, with chairs and carpets to match, contrasted with unique and brilliant brass trimmings and grille work, and mahogany inlaid panels, produces a very rich effect, especially when the electric lights are turned on. It weighs about 50 tons and runs quite as smoothly as a Pullman.

Notwithstanding that this was the first trip, and the car was not "limbered up," at times a speed of 50 miles an hour was maintained, and although a higher speed was possible, it was not thought best to attempt it. The car was run over the tracks of the Indianapolis & Eastern Railway Co., through the courtesy of the officials of that company, who furnished a special crew for the purpose, and over the tracks of the Richmond Street & Interurban Railway Co., whose officials gave personal attention to the comfort of the guests.

On the trip out dinner was served at Cambridge City, after which the car was run into Richmond, where it was opened to the public for inspection. Leaving Richmond at 4 p. m., supper was enjoyed at Knightstown and the party arrived at Indianapolis at 9 o'clock.

The Indianapolis party which participated in the enjoyable occasion was composed as follows: M. B. Wilson, president of the Columbia National Bank, and treasurer of the Indianapolis & Eastern Railway Co.; H. F. Holland, president of the Holland Palace Car Co.; A. K. Hollowell, vice-president; J. W. Selvage, general manager, and Judge McCullough, general counsel, of the same company; Charles N. Wilson, general manager of the Columbus, Greensburg & Richmond Traction Co.; August M. Kuhn, director of the same company, together with newspaper representatives. These were met at Cambridge City by the following delegation from Richmond: S. S. Stratton, president, and J. F. Reeves, secretary, of the Commercial Club; Samuel Dickinson, president of the Dickinson Trust Co.; Edward H. Gates, cashier of the Union National Bank; Samuel Gaar, cashier of the Second National Bank; Cash Beall, president of the South Side Improvement Association; Charles Du Hadway, cashier of the First National Bank; Walter McConaha, director of the Columbus, Greensburg & Richmond Traction Co.; B. F. Wissler, editor of the Sun-Telegram; George H. Love, proprietor of the Westcott Hotel; C. A. Denman, general superintendent of the Richmond Traction Co.; H. C. Starr, attorney of the Chicago, Cincinnati & Louisville R. R.; John L. Rupe, attorney for the Pennsylvania R. R.; Thomas E. Davidson, general counsel of the Columbus, Greensburg & Richmond Traction Co.; W. W. Zimmerman, mayor of Richmond; Wilfred Jessup, attorney for the Columbus, Greensburg & Richmond Traction Co.; Rev. J. F. Mattingly, and representatives of the local newspapers.

The Interstate Consolidated Street Railway Co. was recently fined $25 by the district court judge of Attleboro, Mass., for neglecting to furnish school children with half-rate tickets. The charges were preferred by the school committee and endorsed by the selectmen. The defendant appealed.

The limited cars which have been running between Indianapolis and Richmond, Ind., have been discontinued, because the service was unsatisfactory. Richmond cars now connect with Indianapolis cars at Dublin. The limited service will not be tried again until the cars can run into the city of Richmond, the Main St. bridge forming an obstruction at present.

Proposed Reorganization of the A. S. R. A.

Milwaukee, Wis., Mar. 5, 1904.

Editor "Review:"

With reference to the movement now on foot looking to the organization of an association of electric railroad "Way" engineers and superintendents, the numerous communications received to date indicate a general appreciation of the necessity for some such society and tender a generous support for the association when formed.

It has been urged, however, that the isolation of this branch of the electric railroad business in another distinct organization is probably not the most effective method of handling the matter and two other schemes have been proposed. The intention of this letter is to lay these propositions before the street railroad presidents, managers and other officials throughout the United States and Canada for their consideration and advice, and with the hope that definite opinions may be arrived at and sufficient interest aroused to guarantee the formation of some plan of action before the next meeting of the American Street Railway Association and the due futherance of such plan at that meeting.

The least radical and least comprehensive of the plans mentioned suggests a reorganization of the American Railway Mechanical and Electrical Association under the name "American Society of Electric Railway Engineers;" that society to include all the mechanical divisions of street railway work. Sub-divisions could then be effected probably as follows: "Rolling Stock and Shops," "Way and Structures," and "Power Houses," sub-committees being appointed to conduct each phase of the work. This plan would save the expense necessary for the formation of another distinct organization and would serve to give the present organization much better support.

However, it has been justly urged that the formation of these various distinct societies is gradually tending to strip the parent body (The American Street Railway Association) of all the functions for which it was organized. This is, of course, due in great measure to the fact that there has not been room, time or method in the meetings of that body permitting a satisfactory or thorough discussion of enough subjects in any one branch of the work. It may not be possible or advisable to extend the length of time of these meetings (that is a moot question), but it certainly does seem both possible and advisable to so change the method of these meetings as to make them thoroughly effective along all the lines embraced in electric railroading. It is therefore respectfully suggested that a reorganization of the American Street Railway Association by the presidents and general managers representing companies therein or who may wish to affiliate with such reorganized association is possibly advisable. The plan indicated and outlined in numerous letters received to date is approximately thus:

The Association's active members to consist of owning or operating companies as represented by their presidents, general managers, or other duly accredited representatives.

These active members to have full control of all executive matters and a general direction of the sub-divisions covering all the phases of the work.

The sub-divisions could be determined only after more thorough discussion, but would be approximately Accounting, Legal and Claims, Transportation, Way and Structures, Rolling Stock and Shops, Power Houses.

Each of the sub-divisions to constitute a sub-society represented in the main body by a vice-president elected by the members of each sub-society. The active members to pay a small fee and consist, as may be afterwards determined, of the persons having charge of that particular class of work on the electric railways affiliated with the main association.

This vice-president to appoint his committees and the sub-association to carry on its work exactly as though it were a distinct organization, except that it will be under the general direction of the presidents and general managers constituting the parent body, at whose will all of the present organizations exist. The present Accountants' Association need not lose its individuality in any manner inconsistent with causes permitting its existence at this time. Sub-association meetings could be made to kept together so that no one representing different departments need suffer. Thus the Accountants and the Way men might meet at the same time, as also the Transportation and the Power House men. The publication of the discussions would be information enough for those not directly interested and methods could be devised within each sub-society that would tend to the maximum benefit derived within the minimum time. Papers should be published and distributed sixty days in advance of the meetings, discussions prepared, boiled down and methodically handled, sub-committee meetings held when necessary during the year, business handled by the various vice-presidents and sub-secretaries, so that each meeting of the reorganized association would be of such value to street railway work that no company could afford to remain unattached thereto.

An expression of opinion as to the above is earnestly solicited in order that a plan of some kind may be decided upon, the necessity for some action which will give the "Way" men, the "Transportation" men and others whose work up to the present time has been neglected a chance to progress along lines similar to the two independent societies now in existence, being widely recognized.

The scheme to reorganize the American Street Railway Association as outlined above has been suggested through letters received and opinions expressed by the following gentlemen, who are absolutely favorable thereto: John I. Beggs, president and general manager, Milwaukee Electric Railway & Light Co.; S. L. Tone, vice-president, Pittsburg Railways Co.; C. D. Wyman, representing Stone & Webster; R. B. Baer, president and general manager, Galveston City Railway Co.; J. F. Vail, general manager, Pueblo & Suburban Traction Co.; C. S. Kimball, chief engineer, Boston Elevated Ry.; C. D. Emmons, general superintendent, Ft. Wayne & Wabash Valley Traction Co.

Yours truly,

Fred G. Simmons.

Supt. Construction and Maintenance of Way, Milwaukee Electric Ry & Lt. Co.

Concrete Railway Ties in France.

The State Railway of France is testing concrete ties on a short length of railroad near Bordeaux. The ties are not made entirely of concrete, but are iron and cement combined. The framework, or skeleton, consists of five metal plates placed vertically and held in position by stout iron wire or thin bars, the interstices being filled with cement. A layer of compressed felt one-fifth in. thick is placed between the tie and the boltheads. These ties were made by a cement manufacturer in the south of France, who sent four samples which were laid in October, 1900. Upon the track overseers reporting that no fault could be found with them, but that it was impossible to correctly judge from such a small number, 96 more sample ties were laid between April 20th and July 1st, 1902, the maker having altered the construction so that the bolts could be replaced without damaging the tie. The greatest weight concentrated upon a single pair of driving wheels on the road in question is about 14 tons. The rails are 11 meters (12 yds.) long and weigh from 77 to 81 lb. per yard, and 14 ties are used for each rail of 12 yds. The ties have rounded corners and are slightly thicker where the shoes are placed, the average thickness being about 4 in. The weight of each tie is about 308 lb. and the cost 14 to 15 francs ($2.70 to $2.90). Mr. John K. Gowdy, the United States consul-general, reports that the experiment is too recent to enable any definite opinion to be formed, as the usual life of a timber tie in France is about 15 years. He is of opinion, however, that the price now charged is a serious obstacle to the employment of the concrete ties.

Mail service has been established on the Elgin, Aurora & Southern Traction Co's. lines between Geneva and St. Charles and St. Charles and Elgin. Two round trips are made on week days and one on Sundays and holidays. Other routes will be established.

The Wheeling Traction Co. inaugurated an express service between Wheeling and Moundsville December 21st, using a car which was built in the company's shops especially for the purpose. Mr. Louis Lipphardt, formerly superintendent of the Steubenville division, and now claim agent, has charge of the express department

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SUMMARY OF CONTENTS.

TO ENCOURAGE URBAN TRAFFIC.

The elements upon which depend urban railway traffic, the relative importance of these elements, and the means by which railway companies can best promote traffic are discussed in a paper by Mr. R. W. Western, which we reprint in this number. Mr. Western's mathematical analysis to determine the relative weight of the considerations affecting the passenger and the value of improving the service is unique in method as well as interesting in results.

The author assigns as the reasons for using tram cars, the pleasure derived, the trouble saved, the time saved. On analysis of these three motives, it is concluded that the third reason, the saving of time effected, is the controlling one in the temperate zones. With assumed average length of ride and average time of stop the condition that the time consumed for a journey should be a minimum, leads to a fixed number of stopping places per mile. Thus 10-second stops and an average length of ride of 6 miles would fix the stopping points at .41 mile apart, a condition closely approximated on some of the interurban lines that have adopted the fixed stopping place principle. An average ride of 2¼ miles would require stops at intervals of .2 mile to give best results. City service in America, where cars stop at each street crossing if desired, and the streets vary from eight to twelve to the mile, according to the Western formula would best serve passengers riding only .8 mile to .36 mile. Such examples as given here are illustrative only, but the application of the formula made after careful investigation on city lines, and noting length and frequency of stops, would doubtless lead to changes in existing ideas, and attempts made to educate the public so it would recognize less frequent stops as being to its own interest as well as to the company's.

Mr. Western's conclusions are that to encourage urban traffic it is wiser to save the passenger's time than to increase his comfort, and to save time the speed of cars should be increased, the regularity of service increased and the number of stopping places reduced.

INTERCHANGEABLE ELECTRIC MILEAGE.

Probably a majority of the electric interurban railways now operating over distances of twenty miles or more have already adopted or are considering the adoption of mileage books. Two objects are apparent, the encouragement of traffic and the elimination of commutation books, and the results in every case where mileage books have been used are reported as eminently satisfactory. From the passenger's standpoint, however, existing conditions are not ideal because electric railway mileage has not yet been made interchangeable, and for this reason travelers who cover a considerable territory are at present debarred from enjoying to the fullest extent the benefits of the low fares on electric lines. Reference to the map of Indiana published in the January "Review" shows no less than eight electric interurbans entering Indianapolis, and assuming that all of these companies issued 250-mile books, as do the Indiana Union Traction and the Indianapolis & Northwestern companies, a man having occasion to patronize all of these roads would be required to invest $26 in transportation available in a comparatively small area. To get the lower rate given by the 1,000-mile books would require an investment of $100, a very large sum when the length of route on which the books can be used is compared with corresponding mileage on steam roads.

The two roads mentioned sell 250-mile books at the rate of 1.3 cents per mile, and 1,000-mile books at the rate of 1.25 cents per mile, the single trip fares being based on 1.5 cents per mile.

It is hard to conceive of any valid objections to interchangeable mileage books, excepting those practical difficulties of administration due to the fact that the lines now operating do not have uniform rates. Some roads base their fares on 2 cents per mile, with a 25 per cent reduction on commutation books. The Union Traction until recently based its rate on 1 cent per mile, but in February this was increased to 1.5 cents; this company also charges an excess fare on its limited trains.

Two schemes suggest themselves as feasible for interchangeable books. One is to issue a book of 250 coupons of the value of 5 cents each, which shall be accepted by all lines in the payment of fare at their face value. The other is to issue mileage books, en-

dorsing on the cover that conductors "will detach one line for each mile except on the A. & B. road, where 20 per cent more mileage will be lifted," etc., to meet varying conditions. This rule is not more awkward than the one now in force on some roads having contracts with local companies in terminal cities, where one line in the mileage book is detached for each mile outside the corporate limits of the terminal city and four lines (1.25 cents per mile) for the ride within the city limits.

The joint bureau for auditing interchangeable tickets would have no trouble in accounting with either of these systems.

LIGHTING ACCOUNTS.

Since the publication in the "Review" for February of Mr. C. L. S. Tingley's "Classification of Lighting Accounts Conforming to the Street Railway Accountants' Association Standard", we have received a number of inquiries as to the accepted standards which indicate a wide interest in the subject. The report of the committee of the National Electric Light Association appointed to draft a standard scheme for lighting accounts was adopted in May, 1901, and by courtesy of that association was submitted to the Street Railway Accountants' Association at its New York meeting and published in the proceedings for 1901. We understand that the Accountants' Association has taken no action as to recommending the use of the Lighting Standard, but merely printed the report for the information of its members.

The disadvantage of having two systems of accounts differing in scheme of classification, especially for small traction and lighting companies, where the same clerks have to handle both accounts, is one of the points made by Mr. Tingley; and his classification shows how easily the two can be brought into harmony without sacrificing the ability to make comparisons easily. By the device of giving an account two numbers (placing one of them in parenthesis) the identity of each is preserved, and reference facilitated.

SUGGESTED REORGANIZATION OF A. S. R. A.

In the "Review" for February we discussed at some length the proposed association of electric railway construction and maintenance of way engineers, and published the tentative scheme of organization that had been compiled by Mr. Fred G. Simmons, of the Milwaukee Railway & Light Co., after an extended correspondence with the heads of the civil engineering departments of other companies. Since our last issue it has been suggested that the most desirable action in the matter of electric railway associations would be to effect a reorganization of the American Street Railway Association on lines that would include the other two existing associations and permit of the development, within the main society, of other subsidiary bodies as the need for them appeared.

This plan is set out in the letter from Mr. Simmons published on another page of this issue, and briefly is as follows:

1. A general association in which the active members are railway companies or individual owners of electric railways.

2. Sub-societies to cover the different fields of work that in a railway organization are represented by the different departments —Accounting, Legal and Claims, Transportation, Way and Structures, Rolling Stock and Shops, Power House—with active membership comprising persons having charge of the corresponding departments.

3. The sub-societies each to have as its executive officer a vice-president of the general association, who would appoint the committees. Each sub-society to conduct its affairs as if it were a separate organization, having its own sub-secretary, and doing its separate work.

As the construction and maintenance of way men are firmly convinced of the need for an association to discuss their problems, and will effect an organization at the next A. S. R. A. convention, the discussion of plans is very desirable at this time and suggestions and criticisms from all interested are invited.

At the present time we are convinced that the radical scheme of reorganization and consolidation of existing associations that has been proposed is not a good one. In the first place, a general association with perhaps six subdivisions within it would be extremely unwieldy, and if the general association took any interest in the affairs of the others it would have but little time for the transaction of its own business. The presidents and managers who are the representatives of their companies in the A. S. R. A. as it is organized today are not men who have either time or inclination to familiarize themselves with the details of the various departments under their general direction; consequently they, with a few exceptions that serve to emphasize the rule, are not the ones who can discuss to advantage the technical questions that interest their subordinate officers. We believe this statement is fully confirmed by the proceedings of recent conventions, and furthermore we believe that this condition is just as it should be to best serve the interests of the companies these men represent. The function of chief executives when they meet in convention is to discuss questions of general policy, not details. If there is any tendency for the new associations to strip the A. S. R. A. of the functions for which the latter was organized, we believe the reason is that the new associations are better fitted for the work they are doing than was the parent body, and that the latter body should now devote itself, as before mentioned, to the broader questions in keeping with the larger railway systems that exist today.

It has been considered that the electric railways might object to contributing to the support of too many separate associations, and perhaps economy of administration is one of the strongest reasons for urging consolidation. This point is of doubtful importance. If the suggested scheme is carried out successfully it will require a competent sub-secretary for each division and each division would have its own papers and reports to print, and its own correspondence to conduct. These constitute the principal items of expense and could not be very materially reduced. For satisfactory results each of the proposed sub-societies would have to be practically independent and with seven associations in fact, there might as well be seven in name.

In the steam railroad field we find separate and independent associations. First, there is the American Railway Association which passes upon recommendations of the other railroad associations. These include the following: Accounting Officers, Master Car Builders, Master Mechanics, Master Painters, Master Blacksmiths, Air Brake Men, Maintenance of Way Men—each of these seven associations is national in scope and holds at least one convention each year.

In addition to these associations, which are most familiar to us on account of their mechanical and engineering affiliations, there are about fifty other railroad associations, most of which hold national conventions.

To make any organization successful requires hard work on the part of the management, which in associations of the character we are discussing means first, the secretary, who is the permanent official, and second, the president, and the other members of the executive committee. By common consent, in most cases, the other members of the committee feel that the work should go with honor, and content themselves with letting all initiative lie with the president and secretary. With the scheme for consolidation under discussion the effect on the associations that would be reduced to the rank of committees must be considered. With both of the existing associations that would be affected, their success has been attained by hard work of the officers and members; and while we are sure that those to whom this success is most due would not urge personal feelings against the best interests of the industry, we fear the effect of consolidation would be a diminution of interest on the part of the most active members that would in the end severely affect the work of the association.

The "Review" would greatly regret to see any action taken that would in the slightest degree impair the well-earned prestige of the Street Railway Accountants' Association. The record of the Accountants' for the seven years of its existence entitles it to autonomy.

The American Railway Mechanical and Electrical Association is only a year old, but its first convention demonstrated that it has a reason for being and can take care of itself, and has accomplished better work than was ever done in this field before. The fact that this association is more distinctively an engineering association suggests that it might enlarge its scope to include civil engineering as well as mechanical and electrical engineering departments, and try the experiment of administering the association

as two or three branches calling itself the Electric Railway Engineering Association, or by an equally descriptive title. This plan is not radical and if a failure but little harm could result.

Another alternative would be for the A. S. R. A. to create departments or sub-societies in accordance with the scheme as outlined in Mr. Simmons' letter, but limit these sub-societies to those departments not already cared for by the Accountants' and Mechanical and Electrical associations.

The question for the railway companies to decide is one of expediency. Existing associations could be amalgamated readily, but if this step were taken against the wishes of the existing independent bodies, the usefulness of the latter would be practically ended.

Terminals for World's Fair Traffic.

The St. Louis Transit Co. and the St. Louis & Suburban Railway Co. have leased sites for their World's Fair terminals near the Administration and De Baliviere gates of the Exposition grounds. Instead of running east and west on the south side of the Colorado R. R., between the Skinker road and De Baliviere Ave., the Transit company will build tracks parallel to the old route and midway between Waterman and De Giverville Aves. The western terminus will be the Skinker road, near the Administration gate, the cars not being allowed to run through the fair grounds. A loop will be built here, and the Suburban company's loop will be built on the opposite side of Skinker road. The Transit company will have another loop near the De Baliviere gate, while the Suburban has secured a site near and back of the Wabash Ry's. new terminal station for its De Baliviere gate terminus. By an agreement between the two companies persons living east and west of Clayton on the Transit line will be transferred to and from the Suburban cars free.

Chicago Union Traction Co.

The long anticipated hearing at Chicago on the validity of the 99-year act, under which the Chicago Union Traction Co. bases its claims for extension of franchises, took place hefore Judge Grosscup, of the United States Circuit Court, and Judge Jenkins, of the United States Court of Appeals, March 1, 2 and 3. The interests of the Traction company were represented by Attorneys J. S. Auerbach and Brainerd Towles, of New York, and W. W. Gurley, Henry C. Crawford and John S. Miller, of Chicago. The city was represented by David T. Watson, of Pittsburg, special counsel; John C. Mathis and Edward Burritt Smith, attorneys for the local transportation committee of the city council, and Corporation Counsel Tolman. The court took the matter under advisement.

The city having petitions for an inquiry into the good faith underlying the application of the Guaranty Trust Co., under a creditor's bill, for the appointment of receivers for the Union Traction Co., Judge Grosscup, of his own volition, instructed a master in chancery to conduct such an inquiry, although the court denied the city's right as an outside party to intervene. The inquiry was begun March 14th.

Amicable Adjustment of Loop Difficulty.

As a result of a recent conference between representatives of the Chicago elevated railroad companies and the city a plan was agreed upon whereby the companies are expected to receive permission to extend the Union loop platforms, provided the extensions be made narrower than the present platforms and that they be not covered. The city will agree to dismiss the cross bill in the platform extension suit brought by property owners, and also waive the demand for track deadening until engineers have solved that problem; the city will further concede that the demand for half fare for children is a legal question to be adjusted by court, if necessary. To pay for these concessions the companies will post their car licenses in all cars, light the street intersections under the elevated structure of the loop, and pay the loop and Northwestern road compensation, which was provided for under an old agreement, without protest. The differences thus amicably settled primarily grew out of a controversy between the Union Loop Co. and the Northwestern Elevated Railroad Co.

Car Barns Burned at Chicago.

During the night of March 13th the Chicago Union Traction Co's. car barns at Leavitt St. and Blue Island Ave., Chicago, and 250 cars were destroyed by fire, caused by an overheated stove. The night superintendent and three employes who were sleeping at the barns were more or less burned and injured. By closing a large fire door 600 summer cars were saved. Service on the 18th St., Blue Island Ave., 26th St. and Canal St. lines was seriously affected by the fire for a time. The structure was 400 ft. long and 300 ft. wide. The loss was estimated at $275,000. This is the second car-barn fire which the company has suffered this winter, the other being at Wrightwood and Lincoln Aves.

Southwestern Associations to Join.

It is anticipated that at a meeting to be held at Dallas, Tex., April 25-27, 1904, the Southwestern Electrical Association and the Southwestern Gas, Electric & Street Railway Association will be consolidated. The membership of both associations is about 200. The territory of the first-named comprises Indian Territory, Oklahoma, Kansas, Arkansas and Texas; of the latter, Indian Territory, Oklahoma, Arkansas, Louisiana, Texas, New Mexico and Mexico. All the membership and all the territory of both organizations will be included in the new association.

At a recent conference in Dallas the following subjects were selected for discussion at the joint meeting in April: "Advantages of the Combination of Gas and Electric Interests," "The Operation of Single Phase Motors from the Central Station Standpoint," "Framing of City Franchises for Public Service Corporations," "Combination of Public Utilities in Small Cities," "Water Purification Processes and Values," "Economics of the Meter," "Benefits and Evils of Telephone Competition," "Accidents on Street Railways and Damage Suits," "Central Station Accounting," "Electric Wiring from the Central Station Standpoint and the Requirements of the National Board of Underwriters," "Developments of Interurban Railways in the Southwest," "The Development of the Modern Gas Plant."

Progress on the Technolexicon.

Up to the present time 363 technical societies and 2,573 firms and individuals have responded to the appeals for contributions to the Technolexicon, or universal technical dictionary for translation purposes, in English, German and French, the compilation of which was begun in 1901 under the auspices of the Society of German Engineers. All outstanding contributions are to be called in by Easter of this year, in order that the printing of the Technolexicon, which is to begin in the middle of 1906, may not be delayed. All contributions should be forwarded at once to the editor-in-chief, Dr. Hubert Jansen, Berlin (N. W. 7) Dorotheenstrasse 49, who will be glad to furnish additional information.

Chicago Elevated Traffic.

The daily average of traffice of the South Side Elevated Railroad Co., Chicago, for February was 90,330, an increase of 1,814, or 2 per cent, over February, 1903. The daily average of the Northwestern Elevated Railway Co. for February was 73,193, an increase of 3,308, or 4.73 per cent. The daily average of the Metropolitan West Side Elevated Railroad Co. was 119,073, an increase of 2,983, or 2.50 per cent. The daily average of the Lake Street Elevated Railroad Co. for February was 42,715, as against 42,917 last year, a decrease of .005 per cent.

The Illinois Telegraph & Telephone Co., of Chicago, has offered to carry the Chicago mail in electric cars in its tunnels for $172,000 a year. The company agrees to put 100 cars into service and build elevator connections costing $300,000.

It is probable that the Brooklyn Bridge and the new Williamsburg Bridge, in New York City, will be connected by an elevated road to be built in Baxter St., which is to be widened to 100 ft., and thence down Delancy St., the widening of which is already provided for.

Zanesville Railway, Light and Power Co.

Description of the Company's New Plant which Comprises a Steam Turbine Equipment and a Water Power Plant, Combined with Storage Battery for Reserve.

The Zanesville Railway, Light & Power Co. has just completed a new power plant which involves a combination of engineering features which, we believe, is unique in the history of electric power plant design and which has no parallel in this country. As is implied in its official title, the company's business includes the operation of a local electric street railway system, furnishing current to the cars of the interurban line within the city limits, the general electric lighting system of the city and the renting of power for manufacturing purposes. The power for these various purposes was formerly supplied from an old steam power station, an interior view of which is shown herewith, but since the reorganization of the company, which was recently effected, a complete reorganization of the generating plant has also been made.

The new power house, a general exterior view of which is shown herewith, together with its surroundings, is located on the Muskingum River just adjacent to the dam, by means of which water is supplied to the Ohio River Canal. A diagram of the building and its surroundings is also shown, which gives a very clear idea of the location of the building and its advantageous position with reference to the water power. As will be seen from this diagram, the building is bounded on the north by the Baltimore & Ohio railroad bridge, on the south by what is known as the concrete Y-bridge, by the Ohio River Canal on the east and by the Muskingum River on the west side. As shown in the diagram, the dam across the Muskingum River is just above the power house, at which point is the entrance to the canal. The Muskingum River is a stream of considerable size which drains about 3,500 sq. miles. The company, by continuous lease, has the use of 13,500 cu. ft. of water per minute and all the surplus above 6-in. of water on the dam. This gives a maximum available head of water of about 14 ft., which, of course, varies considerably at different times.

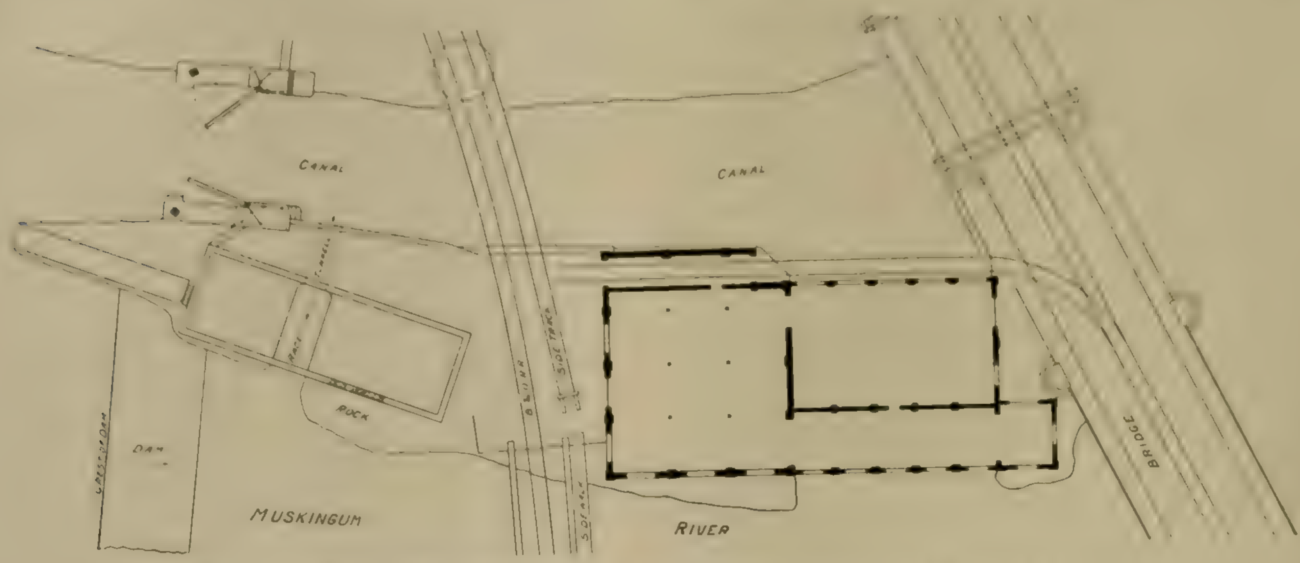
VIEW OF NEW POWER HOUSE, ZANESVILLE RAILWAY, LIGHT & POWER CO.

One of the half-tone illustrations shows the west side of the building at the time of its completion and beneath the water wheel pits are shown a number of arches leading into the river, which form part of the tail race. One of the illustrations shows a transverse section through the building, which will give a clear idea of the hydraulic arrangements. The water passes from the canal under one side of the building, the wheel pits being located at the farther side nearest the river. After passing through the water wheels the water escapes through the arches on the west side of the building previously mentioned.

The building presents an attractive exterior, being made of yellow pressed brick ornamented with stone trimmings. It is divided into two main parts by means of a brick partition wall which extends transversely through it. One part of the building is again subdivided into two rooms, one of which contains the boilers and the other the shaft operated by the water wheel and governors. The other part of the building is devoted to the electrical machinery, steam turbines and the storage battery plant. An idea of the location of the various machines will be obtained by referring to the longitudinal elevation of the building shown herewith. In one end of this elevation are shown the water wheel pits with the wheels in place, the vertical shafts of the wheels carrying large bevel gears which mesh with the bevel pinions upon the shaft in a long room extending through half of the building and having an extension on the front of the building in which is located one of the two alternating current generators operated by the water wheels. The other end of this shaft extends through the partition wall into the rear end of the building, where it is coupled to the other water-wheel driven alternator.

That part of the building situated over the head race to the wheels is supported on iron piers which in turn rest on concrete

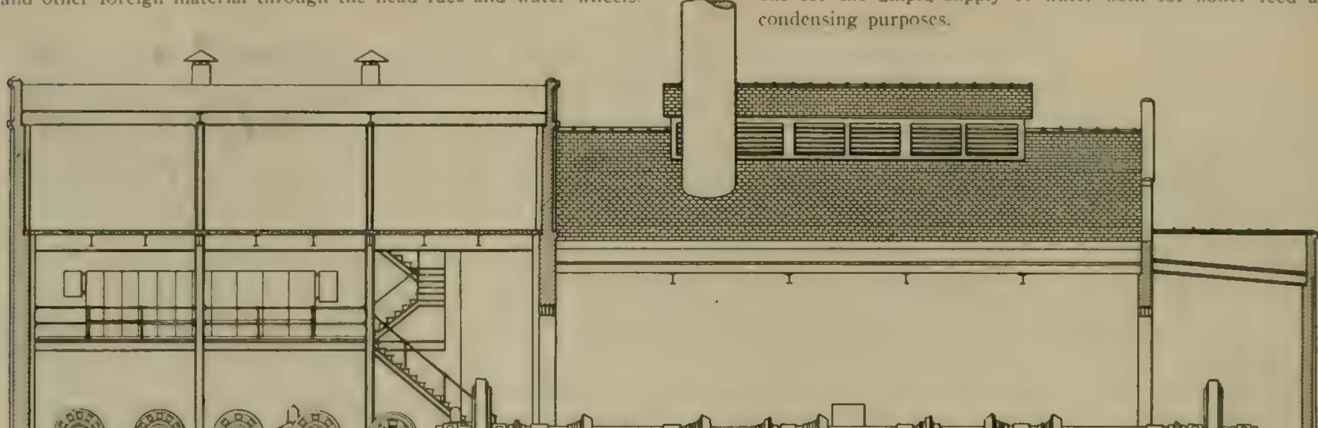
foundations carried well down below the bed of the water. As it would be obviously impossible to have these iron pillars in contact with the water on account of their inevitable destruction by corrosion, the plan of protection was adopted which is shown in one of the illustrations. After the columns were put in place a form was built around them which was filled with concrete, thus providing complete protection against contact with the water of the head race. The illustration shows this work in process of construction, one of the columns being only partly covered with concrete.



SHOWING LOCATION OF NEW POWER HOUSE OF THE ZANESVILLE RAILWAY, LIGHT & POWER CO.

At the edge of the canal where the water leaves to pass under the building is an iron grating to prevent the passage of debris and other foreign material through the head race and water wheels. The bars of this grating, which are of iron, are set about an inch apart.

The rear portion of the building, as will be seen from the longitudinal elevation, is divided into four levels. The basement contains the condensers and foundations for the steam turbines, the latter extending through openings in the floor a short distance above the ground floor level. On the ground floor are located the rotary converters, transformers, low tension switchboard, etc., and in the gallery, extending along one side of this room, is a high tension switchboard. From this gallery stairs lead up to an overhead room in which is the storage battery plant. From the foregoing description it will be seen that the general location of the building is a most advantageous one, not only on account of the water power which can be utilized, but for the ample supply of water both for boiler feed and condensing purposes.



LONGITUDINAL SECTION THROUGH POWER HOUSE, SHOWING LOCATION OF WATER WHEELS AND ELECTRICAL MACHINERY.

The Equipment.

The boiler room contains two Heine water-tube boilers of 380 h. p. each, based on a rating of 10 sq. ft. of heating surface per

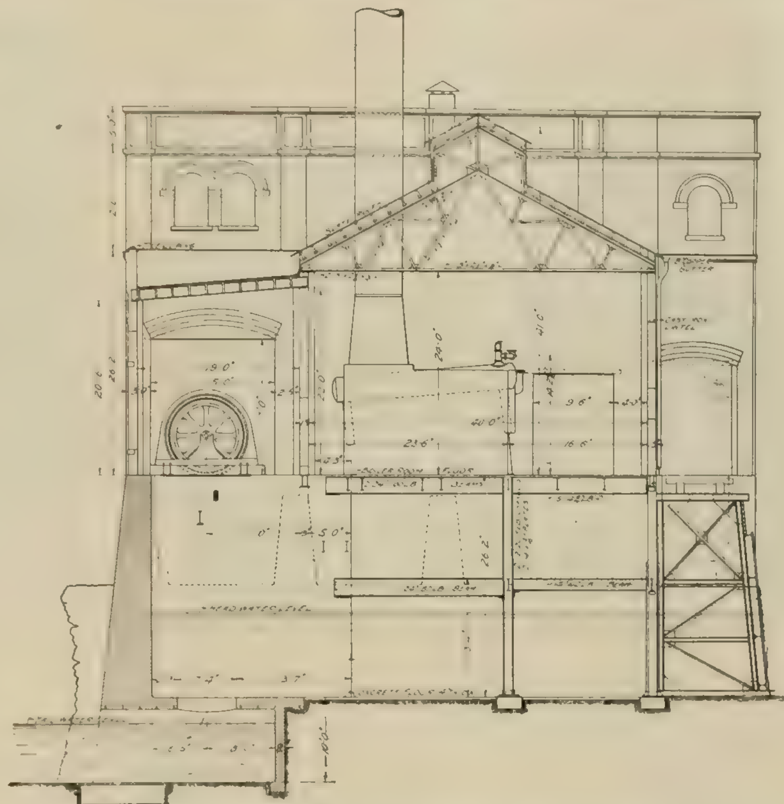
horse power. These are built in one battery and are surmounted by a sheet steel stack. The boilers are designed to carry 175 lb. pressure normally. This boiler plant occupies but half of the available space in the room to allow for duplicating the present equipment with the increase in the company's business. These boilers are fed by Stilwell-Bierce feed pumps located in what will eventually be the space between the two batteries. Coal is delivered on a spur from the railroad track which runs along one side of the building and can be unloaded directly onto the boiler room floor.

Parallel with the boiler room and running along the rear of the boilers is the water wheel shaft and governor room, a general view of which is shown herewith. The wheel pit lies directly underneath this room. The water wheel plant consists of five 51-in. Stilwell-Bierce "Victor" turbines, each capable of developing 278 h. p. and running at a speed of 200 r. p. m. These wheels are connected by bevel gearing to a long countershaft as shown, by means of jaw clutches, and the shaft is divided by couplings into three parts. Both the outer ends of the shaft project through partitions into rooms at each end, in which are located two alternating current machines of 375 kw. each, 36 poles, 7,200 alternations, 60 cycles. This division of the shaft into three sections permits running either of the alternators by any of the water wheels. Along the side of this room, as shown in the illustration, are located the two Lombard governors by means of which the speed of the water wheel is regulated.

The main engine and generator room contains two 500-kw. General Electric turbines of the Curtis type, the general principles of which were fully described in the "Street Railway Review" for April, 1903. Upon the vertical shaft of each turbine is mounted a three-phase, 60-cycle, alternating current generator. The foundations for these machines are laid in the basement, which is 14 ft. above the high water level, and the upper ends of these machines, which extend through an open space in the generator room floor, reach about 4 ft. above the floor level. The most noticeable feature perhaps in connection with these steam turbines is the very small space which they occupy, the entire machine apparently requiring considerably less floor space than one of the rotary converters. The turbines operate at a speed of 1,800 r. p. m. and the oiling system for these machines is worthy of notice.

FOUNDATION PILLARS PROTECTED WITH CONCRETE

The oil is supplied to the bearings by means of an oil pump driven by a direct connected 110-volt d. c. motor. This oil pump supplies oil to the bearings under a pressure of 300 lb., which is necessary to counteract the end thrust on the shaft and to provide the necessary clearance. From these generators the current is carried to three General Electric air blast transformers of 330 kw. capacity, the primary voltage being 2,300 and the secondary 430 and 180 volts. These transformers are located on one side of the room over an air chamber built in the basement. The air pressure is supplied by two blowers built by the Buffalo Forge Co., direct connected to two 7-h. p. induction motors, operating at 220 volts. All of the high tension wiring is contained within this air chamber.



TRANSVERSE SECTION THROUGH POWER HOUSE.

On the opposite side of the room from the transformers are the rotary converters and the low tension switchboard. A view of this side of the room is shown herewith and in the rear of this view will be seen one of the alternators connected to the end of the water wheel shaft. There are three rotary converters at present installed. One of these is a 300-kw., 550-volt machine which furnishes current for the railway circuit. On one end of this machine is mounted a direct connected 20 h. p. induction motor used for starting. The other two rotaries are 300-kw., 240-volt machines which supply current for the three-wire lighting system. This room also contains a 150-kw. differential booster for charging and discharging the batteries, which is capable of raising the pressure through a range of 150 volts.

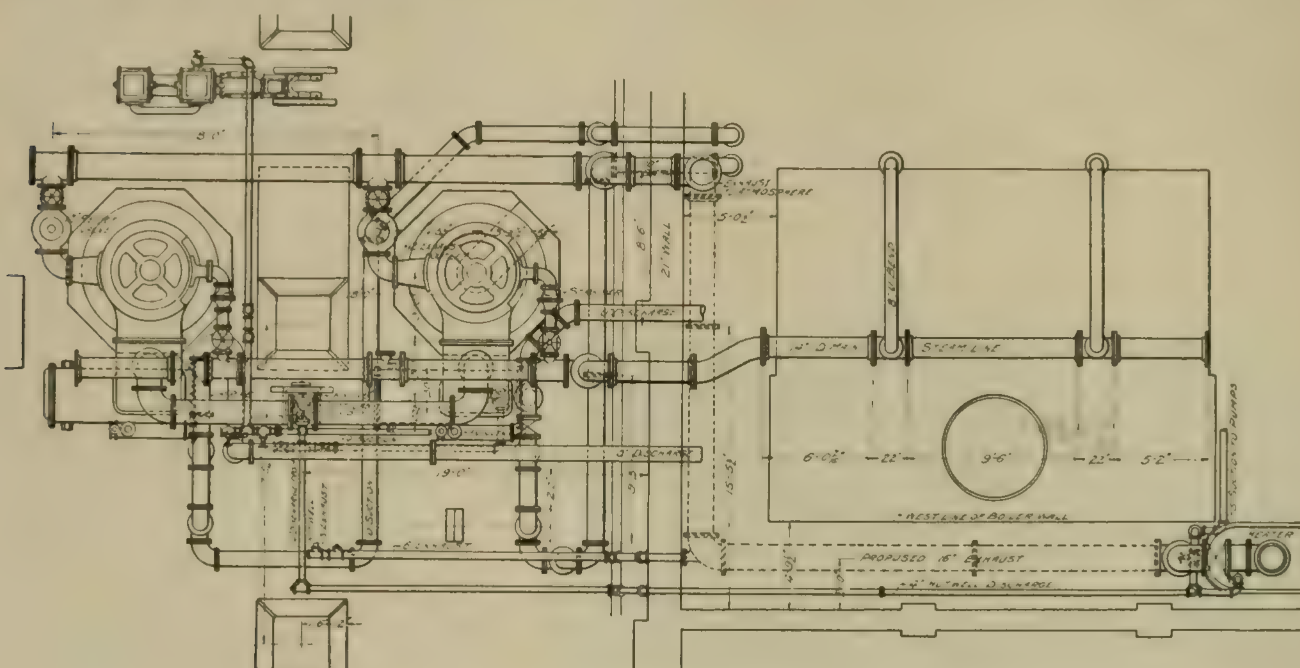
The basement under this floor contains in addition to the steam turbine foundations, the condensers and the feed water heater. Each condenser is a Stilwell-Bierce surface condenser with 1,200 sq. ft. of cooling surface. The arrangement of the piping for the turbines and condensers is shown both in plan and elevation in accompanying illustrations. Practically all of the steam piping in the power house is beneath the floor of the engine room.

The direct current switchboard, opposite the rotary converters,

contains one 600-volt rotary panel, two storage battery panels, three emergency panels for pulling up the battery when it is re-

EXTERIOR OF POWER HOUSE SHOWING ARCHES IN TAIL RACE

quired to be used for the three-wire lighting system, one totalizing panel, two feeder panels, two 240-volt rotary panels and one 3-



PLAN OF STEAM PIPING

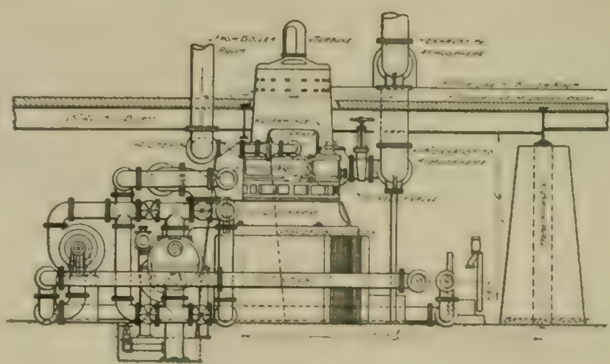
wire main panel. The alternating current switchboard, located in the gallery, contains four generator panels, four feeder panels and three rotary panels. A recording wattmeter is used in connection with the generator panels, each of which contains one ammeter for each phase, one direct current ammeter for the exciting current, one volt meter, synchronizing plugs, one double-throw oil switch and one double-throw exciting switch. It may be mentioned here that no separate exciters are used in this plant, the alternators being excited either from the battery or from the three-wire lighting circuit. On the two panels for the alternators driven by the water wheels are switches consisting of two push buttons. These are used for synchronizing and are connected with the Lombard governors, so that by pushing one button the speed of the water wheels is reduced and by pushing the other button the speed is increased. Each of the three rotary panels contains a power factor indicator, one ammeter, one double-throw oil switch and synchronizing plugs.

Storage Battery.

The storage battery comprises a very important feature in the economical operation of this plant. This battery consists of 264 cells of "Chloride Accumulators" made by the Electric Storage Bat-

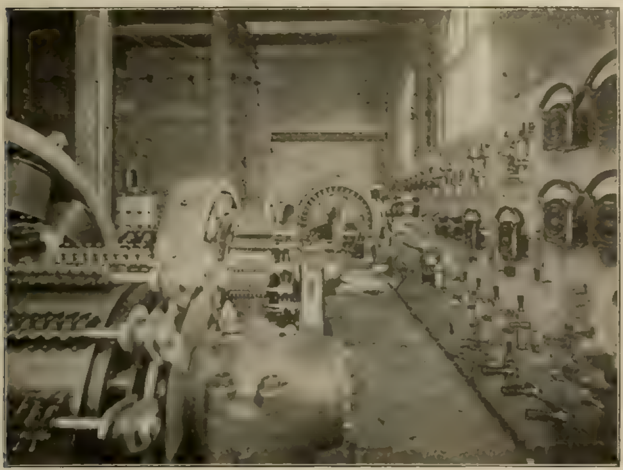
INTERIOR OF OLD POWER HOUSE

tery Co., of Philadelphia. The nominal capacity of the battery is 640 amperes at 550 volts for one hour, or 352,000 ampere hours. A



END ELEVATION OF STEAM PIPING

view of the interior of the storage battery room is shown herewith. The tanks are mounted on porcelain insulators and the floor of the room is of concrete. The terminals from the batteries are brought up to within about 2 ft. of the ceilings where the bus bars from the battery are suspended from the ceilings by iron brackets, the bars being isolated by porcelain fittings. The room has been arranged with special reference to procuring good ventilation and all of the metallic fixtures supporting the overhead conductors and other wiring are coated with lead so as to avoid the corrosion from



PARTIAL VIEW OF GENERATOR ROOM AND SWITCHBOARD.

the fumes of the battery. The present battery occupies only about half of the available space in this room, and in case conditions require it, could be duplicated without incurring any changes in the building.

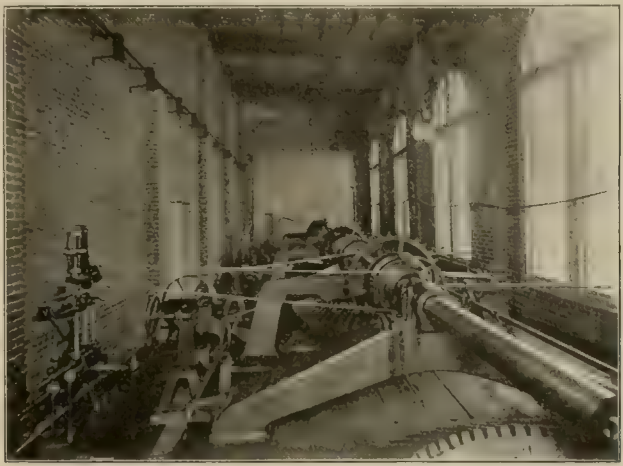
From the foregoing description it will be seen that the entire design of the station is novel, and while the steam plant may be considered the principal factor for the production of power the addition of the water power plant is a valuable auxiliary which, under the present conditions of load, will supply on an average 50 per cent of the power required. Owing to the fluctuations of the railway load and the peaks of the lighting load the maximum fluctuations of the station output is at times between 600 and 700 kw. Previously to the installation of the steam turbines and when the head of water was sufficient to supply only one water wheel and about six-tenths of another, an average load of 200 kw. was carried with fluctuations up to 660 kw. by less than two wheels in addition to the battery. The station has also been designed to operate very economically. The old station which has been abandoned required about 12 lb. of coal per kw. h. output. It is estimated by the company's engineers that the present steam plant can be operated with about 2½ lb. of coal per kw. h., and as the water power plant will generally carry half of the load the average coal consumption per kw. h. will be reduced to about 1¼ lb. In addition to this the old station required 17 attendants for each day's run, while the new plant has been designed to be operated with but six attendants.

Organization.

Messrs. Rudolph Kleybolte & Co., bankers, of Cincinnati, New York and Chicago, undertook the reorganization of the properties now merged in the Zanesville Railway, Light & Power Co., in September, 1902. Their contract provided not only for the reorganization of the securities of these properties, but also for their complete physical and operating reconstruction. Messrs. Kleybolte & Co. in turn contracted with Messrs. H. M. Byllesby & Co., of Chicago, for all of the engineering work connected with the rebuilding of the property, the designing of the new power house and its equipment. Messrs. Byllesby & Co., in connection with Messrs. Kleybolte & Co. also had charge of the reorganization of the operation of the properties.

Under the reorganization all the former operating officials were retained, the officers being as follows: President, Hon. F. A. Durban, of Zanesville; vice-president and engineer, H. M. Byllesby; general manager and assistant treasurer, W. A. Gibbs; secretary and treasurer, W. D. Breed, of Messrs. Kleybolte & Co.

Mr. Gibbs had been in charge of the property under the former management for several years and under the reorganization his powers and duties were largely increased. He took a prominent part in the reorganization of the operating conditions and in the



WHEEL SHAFT AND GOVERNOR ROOM.

reconstruction of the properties. Mr. Gibbs, together with Mr. E. C. Braun, one of the engineers of H. M. Byllesby & Co., were personally in charge of the reconstruction work, which is now rapidly nearing completion. The water power part of the plant

VIEW IN STORAGE BATTERY ROOM.

has been in operation for some time and the first of the steam turbines was successfully put in operation early this month.

At the instance of the board of health the New York City Railway Co. has issued an order to its conductors not to wet their fingers with their mouths when issuing transfers, the practice being regarded unsanitary.

The Brooklyn Rapid Transit Co. has replaced the old single truck cars on its Fifth Ave. line with modern double truck cars which afford an increased accommodation of 400 passengers an hour. The headway has been reduced, also.

Selection of Transmission Circuits.

BY ALTON D. ADAMS.

Maximum power, voltage, loss and weight of conductors having been fixed for a transmission line, the number of circuits that shall make up the line, and the relations of these circuits to each other, remain to be determined.

In practice wide differences exist as to the number and relations of circuits on a single transmission line between two points. Cases illustrating this fact are the 154-mile transmission from Electra power house to San Francisco, and the 65-mile transmission between Canon Ferry, on the Missouri River, and Butte, Montana. At the Electra plant the generator capacity is 10,000 kw., and the transmission to San Francisco is carried out over a single pole line that carries one circuit composed of three aluminum conductors, each with an area in cross section of 471,000 circular mils. From the generators at Canon Ferry, which have an aggregate capacity of 7,500 kw., a part of the energy goes to Helena over a separate line, and the transmission to Butte goes over two pole lines that are 40 ft. apart. Each of these two pole lines carries a single circuit composed of three copper conductors, and each conductor has a cross section of 105,600 circular mils. The differences in practice illustrated by these two plants is further brought out by the fact that their voltages are not far apart, as the Canon Ferry and Butte line operates at 50,000, and the Electra and San Francisco line was designed for 60,000 volts.

Economy in the construction of a transmission line points strongly to the use of a single circuit, because this means only one line of poles, usually but one cross arm for the power wires per pole, the least possible number of pins and insulators, and the smallest amount of labor for the erection of the conductors. In favor of a single circuit there is also the argument of greatest mechanical strength in each conductor, since the single circuit is to have the same weight as that of all the circuits that may be adopted in its place. Where each conductor of the single circuit would have a cross section of less than 83,690 circular mils, if of copper, corresponding to a No. 1 B. & S. gage wire, the argument as to mechanical strength is of especial force, since two equal circuits instead of one, in the case where one circuit of No. 1 wires would have the required weight, reduce the size of each conductor to No. 4 wire, of 41,740 circular mils cross section, and this is the smallest wire that it is desirable to use on long lines. Opposed to these arguments for a single circuit are those based on the supposed greater reliability of two or more circuits, their greater ease of repair, their more effective means of regulation, and the influence on inductance of a reduction in the size of conductors.

In spite of the consequent reduction in the size of each conductor, the use of two or more separate circuits for the same transmission is sometimes thought to increase its reliability, because in case of a break or short circuit on one of the circuits the other will still be available. Breaks in transmission conductors are due either to mechanical strains alone, as wind pressure, the falling of trees, or the accumulation of ice, or else to an arc between the conductors that tends to melt them at some point. As a smaller conductor breaks or melts more readily than a larger one, the use of two or more circuits instead of a single circuit tends to increase troubles of this sort. It thus seems that while two or more circuits give a greater chance of continued operation after a break in a conductor actually occurs, the use of a single circuit of larger conductors makes any break less probable.

When repairs must be made on a transmission line, as in replacing a broken insulator or setting a pole in the place of one that has burned, it is certainly convenient to have two or more circuits so that one may be out of use while the repairs on it are made. It is practicable, however, to make such repairs on any high voltage circuit, even when it is in use, provided the conductors are spaced so far apart that there is no chance of making a contact or starting an arc between them. To get such distance between conductors there should be only one circuit per pole, and even then more room should be provided for that circuit than is common in this type of construction. On each of the two pole lines between Canon Ferry and Butte there is a single circuit of three conductors arranged in triangular form, two at the opposite ends of a cross arm and one at the top of the pole, and the distance from either conductor of a circuit to either of the other two is 6.5 ft. This distance between conductors is perhaps as great as that on any transmission circuit now in use, but it seems too small to make repairs on the circuit reasonably safe when it is in operation at a pressure of 50,000 volts. There seems to be no good reason why the distance between the conductors of a single circuit to which a pole line is devoted might not be increased to as much as 10 ft. at the slightly greater expense of longer cross arms. With as much as 10 ft. between conductors, and special tools with long wooden handles to grasp these conductors, there should be no serious danger about the repair of even 60,000 volt lines when in operation. As the 60,000 volt line between Electra and San Francisco consists of only one circuit, it seems that repairs on it must be contemplated during operation.

Another example of a high voltage transmission carried out with a single circuit is that between Shawinigan Falls and Montreal, a distance of 85 miles. In this case the circuit is made up of three aluminum conductors, each of which has an area in cross section of 183,750 circular mils, and these conductors are located 5 ft. apart, one at the top of each pole, and two at the ends of a cross arm below. This single circuit is in regular operation at 50,000 volts for the supply of light and power in Montreal, and it is hard to see how repairs while there is current on the line are to be avoided.

Inductance varies with the ratio between the diameter of the wires in any circuit and the distance between these wires, but as inductance simply raises the voltage that must be delivered by generators or transformers, and does not represent a loss of energy, it may generally be disregarded in selecting the number of circuits, the distance between conductors, and the size of each conductor. If two or more circuits with smaller conductors have a combined resistance in multiple equal to that of a single circuit with larger conductors, the loss of voltage due to inductance may be greater on the single circuit than the corresponding loss on the multiple circuits, but the advantages due to the single circuit may more than compensate for the higher pressure at generators or transformers. That such advantages have been thought to exist in actual construction may be seen from the fact that the 154-mile line from Electra power house to San Francisco, and the 83-mile line from Shawinigan Falls to Montreal, two of the longest transmissions in the world, are composed of one circuit each. As inductance increases directly with the length of circuits, these very long lines are especially subject to its influence, yet it was thought that the advantages of a single circuit more than offset its disadvantages in each case.

Where several sub-stations, widely separated, are to be supplied with energy by the same transmission line, another argument exists for the division of the line conductors into more than one circuit, so that there may be an independent circuit to each sub-station. As the pressure for local distribution lines must be regulated at each sub-station, it is quite an advantage to have a separate transmission circuit between each sub-station and the power plant, so that the voltage on each circuit at the power house may be adjusted as nearly as possible to the requirements of its sub-station. An interesting illustration of this practice may be noted in the design of transmission circuits for the line between Spier Falls on the Hudson River and the cities of Schenectady, Troy and Albany, located between 30 and 40 miles to the south, which passes through Saratoga and Ballston on the way. When this transmission line is completed, four three-phase circuits, one of No. 0 and three of No. 000 copper wire, will run to the Saratoga switch house from the generating plant at the Falls, a distance of some eight miles.

From this switch house two circuits of No. 0 conductors go to the Saratoga sub-station, a little more than one mile away, two circuits of No. 000 wires run to the Watervliet sub-station, across the river from Troy and 35 miles from the generating station, and one circuit of No. 0 and one circuit of No. 000 wires are carried to Schenectady, 30 miles from Spier Falls, passing through and supplying the Ballston sub-station on the way. Other circuits connect the sub-station at Watervliet with that at Schenectady and with the water-power station at Mechanicville. From the Watervliet sub-station secondary lines run to sub-stations that control the local distribution of light and power in Albany and Troy. This network of transmission circuits was made desirable by the conditions

of this case, which include the general supply of light and power in three large and several smaller cities, the operation of three large electric railway systems, and the delivery of thousands of horse power for the motors in a great manufacturing plant.

In not every transmission system with different and widely scattered loads is it thought desirable to provide more than one main circuit. Thus the single circuit, 83 miles long, that transmits energy from Shawinigan Falls to Montreal is designed to supply power also in some smaller places on the way.

So again, the 154-mile circuit from Electra power house to San Francisco passes through a dozen or more smaller places, including Stockton, and is topped with side lines that run to Oakland and San Jose. In cases like this, where very long lines run through large numbers of cities and towns that sooner or later require service, it is obviously impracticable to provide a separate circuit for each center of local distribution. It may well be in such a case that a single main transmission circuit connected to a long line of sub-stations will represent the best possible solution of the problem. At the power house end of such a circuit the voltage will naturally be regulated to suit that sub-station where the load is the most important or exacting, and each of the other sub-stations will be left to do all of the regulating for its own load.

The greater the total loss of voltage on a transmission line supplying sub-stations that are scattered along much of its length, the

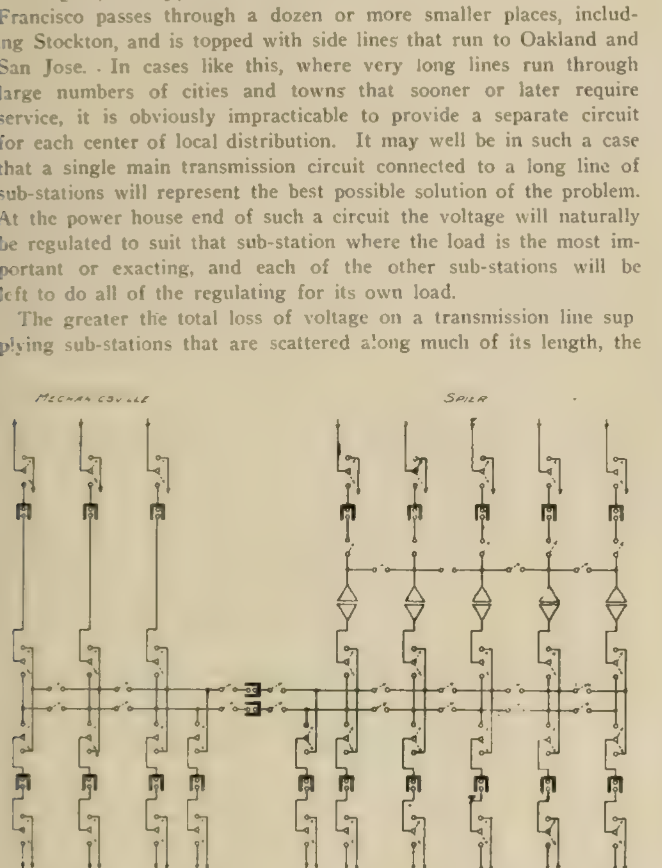


DIAGRAM OF MAIN CONNECTIONS IN WATERVLIET SUB-STATION

larger will be the fluctuations of voltage that must be compensated for at all of the sub-stations save one, under changing loads, if only one circuit is employed between the power plant and these sub-stations. Suppose, for example, that a transmission line 100 miles long is composed of a single circuit, and supplies two sub-stations, one located 50 miles, and the other 100 miles from the power plant. Assume at first that there is no load whatever at the intermediate sub-station. If the single transmission circuit operates with 50,000 volts at the power plant, and 45,000 volts at the sub-station 100 miles away when there is a full load there, corresponding to a loss of 10 per cent, then the pressure at the intermediate sub-station will be 47,500 volts. If, now, the load at the sub-station 100 miles from the power house drops to a point where the entire line loss is only 1,000 volts, and the pressure at the generating plant is lowered to 46,000 volts so as to maintain 45,000 volts at the more distant sub-station, then the pressure at the intermediate sub-station will be 45,500 volts, or 2,000 volts less than it was before. If the loss on the entire line at full load were only 5 per cent, making the voltage at the sub-station 100 miles away 47,500 when that at the generating station is 50,000, then the pressure at the intermediate sub-station will be 48,750 volts. Upon a reduction of the loss on the entire length of line to one-fifth of its maximum amount, or to 500 volts, the pressure at the generating station must be reduced to 48,000 volts, if that at the more distant sub-station is to be held constant at 47,500. At the intermediate sub-station the pressure will then be 47,750 volts, or 1,000 volts less than it was at full load. From these two examples it may be seen that the extent of pressure variation at the intermediate sub-station will depend directly on the maximum line loss, if the regulation at the generating station is such as to maintain a constant voltage at the sub-station 100 miles away.

All the foregoing has assumed no load to be connected at the intermediate sub-station, and with a load there the fluctuations of pressure will of course depend on its amount as well as on the load at the more distant sub-station.

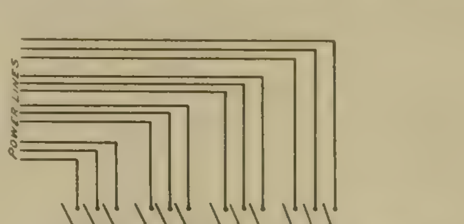
One of the strongest reasons for the use of two or more circuits in the same transmission line arises from the rapid fluctuations of load where large stationary motors, or an electric railway system is operated. When a transmission line must carry a load of stationary or railway motors it is a common practice to divide the line into at least two circuits, and to devote one circuit exclusively to railway or motor work, and another to lighting, at any one time. In some cases this division of the transmission system into two parts, one devoted to the lighting and the other to the motor load, is carried out not only as to the sub-station apparatus and the line, but also as to the transformers, generators, water wheels and even the penstocks at the power plant. It is possible even to carry this division of the transmission system still further, and to separate either the motor or the lighting load, or both, into sections, and then to devote a distinct transmission circuit, group of transformers, generator, and water wheel to the operation of each section. An example of the complete division of generating and transmitting apparatus into independent units may be noted in the case of the system that supplies light and power in Portland, Maine, from a generating plant on the Presumpscot River, 13 miles away. At this station four steel penstocks, each provided with a separate gate at the forebay wall, bring water to as many pairs of wheels, and each pair of wheels drives a direct-connected generator. Four three-phase circuits connect the generating plant with the sub-station at Portland, and each circuit between the generating plant and a transformer house outside the business section of the city is made up of No. 2 solid soft-drawn copper wires.

Each of these four sets of apparatus from head gate to sub-station is usually operated independently of the others, and supplies either the motor load or a part of the electric lighting. In this way changes in the amount of one section of the load cause no fluctuation of the voltage on the other sections. At Manchester, New Hampshire, the sub-station receives energy from four water-power plants, and is provided with two sets of low tension, 2,300-volt, three-phase bus bars, one set of these bus bars being devoted to the operation of the local electric railway system, and the other set to the supply of lamps and stationary motors. Each set of these bus bars is divided into a number of sections, and by means of these sections different transmission circuits are devoted to different portions of the lighting and motor loads. As three of the four water-power plants are connected to the sub-station by two circuits each, the division of loads in this case is often carried clear back to the generators, one generator in a power house being operated, for instance, on railway work and another on a lighting load at the same time. This plan has the obvious advantage that much of the regulation for the several parts of the entire load may be done at the generators, thus reducing the amount of regulation necessary at the sub-station. In this case the conductors of the several transmission circuits are all of moderate size, and the division of the lines was evidently adopted for purposes of regulation, rather than to reduce the amount of inductance. Thus the line between Gregg's Falls and the sub-station, a distance of six miles, is made up of one three-phase circuit of No. 4 and one circuit of No. 6 bare copper wires. The 14-mile line between the plant at Garvin's Falls and the sub-station, the longest of the four transmissions, is made up of two three-phase circuits, each composed of No. 0 bare copper wires. In the case of the Gregg's Falls plant the sub-division of the line has gone further than that of the generating equipment, for the station there contains only a single generator, the rating being 1,200 kw., while two circuits run thence to the sub-station. Another instance showing extensive sub-division of a line into separate circuits may be noted in the 7-mile transmission from Montmorency Falls to Quebec, Canada, where 16 conductors, each No. 0 copper wire, make up four two-phase circuits that connect a plant of 2,400 kw. capacity with its sub-station.

Such multiplication of transmission circuits has some advantages from the standpoint of regulation, but there are good reasons for limiting it to rather short lines, where it is, in fact, almost ex-

clusively found. On very long lines the use of numerous circuits composed of rather small conductors would obviously increase the constant expense of inspection and repairs, and add materially to uncertainty of the service. Very few, if any, transmission lines of as much as 25 miles in length are divided into more than two circuits, and in several instances lines of superlative lengths have only a single circuit each. The greatest single power transmission in the world, that between Niagara Falls and Buffalo, is carried out with two pole lines, one of which is about 20 and the other about 23 miles long. The longer pole line, which is also the older, carries two three-phase circuits, each of which is made up of three 350,000 circular mil, copper conductors. The shorter pole line carries a single three-phase circuit composed of aluminum conductors, each of which has an area in cross section of 500,000 circular mils. In electrical conductivity the aluminum circuit is intended to be equal to each of the two that are composed of copper. According to the description of the Niagara Falls and Buffalo transmission system in Vol. XVIII, A. I. E. E., pages 518 to 527, each of these three circuits was designed to transmit about 7,500 kw., and the maximum power transmitted up to August, 1901, was 15,600 kw., or about the calculated capacity of two of the circuits. According to the description just mentioned, the transmission circuits used to supply energy for use at Buffalo are regularly operated in parallel, and this is also true of the generators and the step-down transformers, though the uses to which this energy is applied include lighting, large stationary motors, and the electric railway system. Apparatus in the generating station at Niagara Falls, and in the terminal house near the city limits of Buffalo is so arranged, however that two of the 3,750 kw. generators and eight step-up transformers at the power house, together with one transmission circuit, and three step-down transformers in the terminal house at Buffalo may be operated independently of all the other apparatus.

As already pointed out, the use of separate circuits for each sub-station, and for lighting and power loads at each sub-station in very long transmission systems is often impracticable. Even in comparatively short transmissions the multiplication of circuits, and the use of rather small and mechanically weak conductors increased the first cost of installation and the subsequent expense of inspection and repairs. Much the most serious objection to operation with a single circuit in a transmission line that supplies widely separated sub-stations, or lighting, power and railway loads at the same or nearby sub-stations, is the consequent difficulty of pressure regulation on the distribution lines at each sub-station. Such a transmission line necessarily delivers energy at different and fluctuating voltages at the several sub-stations, and these fluctuations are of course reproduced on the secondary side of the step-down transformers. Even where a single sub-station with only a load of lamps is supplied with energy by a long transmission line in which there is a percentage of loss of 10 to 20, at the time of maximum demand, the problem of pressure regulation on the secondary circuits of static transformers is by no means easy. Fortunately, however, the use of synchronous motor generators, either in place of or in connection with static transformers, goes far to solve the problem of pressure regulation for distribution circuits supplied with energy from transmission lines. This is due to the well-known fact that with constant frequency the speed of rotation for a synchronous motor is constant without regard to fluctuations in the applied voltage or changes in its load. With a constant speed at the motor and its connected generator it is of course easy to deliver current at constant voltage to the distribution lines. This constancy of speed makes the synchronous motor generator a favorite in large transmission systems with both power and lighting loads. The satisfactory lighting service in Buffalo, operated with energy transmitted from Niagara Falls, seems to be due in large measure to the use of synchronous motor generators at the sub-station in Buffalo whence the lighting circuits are supplied. As above stated, the three circuits that make up the transmission line between Niagara Falls and Buffalo are operated in multiple, and in the latter place there is a large load of both railway and stationary motors. As the three circuits are operated in multiple, they of course amount to only a single circuit so far as fluctuations of voltage due to changes in these several sorts of loads are concerned. According to Vol. XVIII, A. I. E. E., pages 125 and following, the load on the transmission system at Buffalo in 1901 was made up of about 7,000 h. p. in railway motors, 4,000 h. p. in induction motors, and 4,000 h. p divided up between series arc lamps, constant pressure incandescent lamps, and continuous current motors. The railway load is operated through step-down transformers and rotary converters. The induction motors are connected either to the 2,200-volt secondary circuits of the step-down transformers, or to service transformers supplied by these circuits. On these railway and stationary motor loads there is of course no necessity for close pressure regulation. Series arc lamps are operated through step-down transformers and synchronous motors direct connected to constant continuous current dynamos. Continuous current stationary motors draw power from the transmission lines through step-down transformers and rotary converters, like the railway load. For the 2,200 circuits that supply service transformers for commercial arc and incandescent lighting the transmitted energy passes through step-down transformers and synchronous motor-generators. These motor-generators raise the frequency from 25 to 60 cycles per second. Finally the continuous current three-wire system for incandescent lighting at about 250 volts between outside wires is operated through step-down transformers and synchronous motors direct connected to continuous current generators. For this last named service rotary converters were at first tried, but were found to be impracticable because voltage fluctuations on the transmission line, due largely to the railway and motor loads, were reproduced on the continuous current circuits by the rotary converters. Since the adoption of motor generators this fluctuation of the service voltage is no longer present.



SUB-STATION TRANSFER SWITCHES
These Switches Put Any Power Line Onto Any Outgoing Line

Another case in which synchronous motor-generators deliver power from a transmission line that carries both a lighting and a motor load is that of the Shawinigan sub-station in Montreal. At this sub-station the 85-mile transmission line from the generating plant at Shawinigan Falls terminates. As already pointed out, this line is composed of a single three-phase circuit of aluminum conductors, each of which has a cross-section of 183,750 circular mils. In the Montreal sub-station the 30 cycle, three-phase current from Shawinigan Falls is delivered to transformers that lower the voltage to 2,300. The current then goes to five synchronous motor-generators of 1,200 horse power capacity each, and is there converted to 63 cycles per second, two-phase, at the same voltage. This converted current passes onto the distribution lines of the local electrical supply system in Montreal, which also draws energy from two other water-power plants, and is devoted to lighting, stationary motors, or to the street railway work, as may be required. Though separate local distribution circuits are devoted to these several loads, the fluctuations in the stationary and railway motor work necessarily react on the voltage of the transmission line and transformers at the sub-station. By the use of the synchronous motor-generators the lighting circuits are protected from these pressure variations.

As the numbers of sub-stations at different points on long transmission lines increase, and stationary motor and railway loads at each become more common, it is to be expected that the use of synchronous motor-generators for lighting service will be much

more frequent than at present. With such use there will disappear one of the strongest reasons for the multiplication of transmission circuits.

Where several transmission circuits connect a generating plant with a single sub-station, or with several sub-stations in the same general direction, it is desirable to have switches so arranged that two or more circuits may be combined as one, or so that any circuit that ordinarily operates a certain load or sub-station may be devoted to another when occasion requires. For this purpose transfer switches on each circuit are necessary at generating plants, sub-stations and often at switch houses. These transfer switches will ordinarily be of the simple knife type, and intended for manual operation when the circuits to which they are connected are not in use. As such switches are exposed to the full voltage of transmission the insulation of their conducting parts should be very high. In the extensive transmission system between the power plants at Spier Falls and Mechanicville, and the sub-stations at Troy, Albany and Schenectady, New York, a transfer switch of highly insulated construction has been much used. The two blades of this switch move independently of each other, but both are mounted between the same metal clips. Each blade is of 2 x ¼ in. drawn copper rod, and the clips supporting the two blades are mounted on top of a circular metal cap, 4¾ in. in outside diameter and 2 in. high, that is cemented over the top of a large, double petticoat, porcelain line insulator.

Clips into which these copper blades are swung in closing the switch are also mounted in caps carried by insulators in the way just described. Each of these insulators is mounted on a large wooden pin, and these pins are secured in timbers at the points where the switches are wanted. This construction of switches gives ample insulation for the line voltage of 30,000 in this system. By means of the transfer switches just described, either of the transmission circuits leaving the Spier Falls power plant may be connected to any one of the ten generators and ten groups of transformers there. At the Saratoga switch house any one of the 12 conductors, making up the four three-phase circuits from Spier Falls, may be connected to any one of the 18 conductors making up the six three-phase circuits that go south to Saratoga, Watervliet and Schenectady sub-stations, in the way indicated by the drawing. So again at the Watervliet sub-station, where energy at 26,500 volts is received from Spier Falls, and energy at 10,800 volts from Mechanicville, any single conductor from either of these water-power plants may be connected, either directly or through a transformer, with either conductor running to the railway and lighting sub-stations about Albany and Troy. Where several transmission circuits are employed, this complete flexibility of connection evidently adds materially to the convenience and reliability of operation.

CIRCUITS IN TRANSMISSION LINES.

Location of lines.	Length in miles.	Number of circuits.	Number of pole lines.	Circular mils per wire.	Cycles per second of circuit.
Electra to San Francisco	154	1	1	*471,034	60
Colgate to Oakland, Cal.	142	2	2	133,100 *211,000	60
Santa Ana River to Los Angeles	83	2	1	83,690	60
Shawinigan Falls to Montreal	85	1	1	*183,750	30
Canon Ferry to Butte	65	2	2	106,500	60
Welland Canal to Hamilton	35	1	1	83,690	60
Welland Canal to Hamilton	37	1	1	133,100	60
Spier Falls to Schenectady	30	2	1	105,600 167,800	40
Spier Falls to Watervliet, N. Y.	35	2	1	167,800	40
Ogden to Salt Lake City	36	2	1	83,690	60
Apple River Falls to St. Paul	27	2	1	66,370	60
Niagara Falls to Buffalo	23	2	1	350,000	25
Niagara Falls to Buffalo	20	1	1	*500,000	25
Farmington River to Hartford	11	1	1	*364,420	60

*Aluminum conductor.

The Cleveland Electric Railway Co. has had its wrecking car equipped with an electric hoist of five tons capacity, to be operated from the trolley wire by means of a hanger

Electrical Controller Improvements.

In the operation of electric railway cars which are equipped with air brakes passengers are often annoyed and horses frightened by the noise made by the exhaust of the air-brake valve, and mainly to avoid this vexation Mr. H. Page Wellman, superintendent of motive power of the Camden Interstate Railway Co., of Huntington, W. Va., has invented certain improvements in electrical controllers, for which he recently received a patent. His invention primarily provides for the adaptation of the controller casing as a muffler for the air-brake exhaust, at the same time utilizing the exhaust for freeing the controller parts of foreign matter, such as dust and metallic cuttings, by blowing them out. It is also intended to furnish a simple means of thus cleaning the controller when the car is not in use.

Under Mr. Wellman's patent the air-brake exhaust pipe opens into a duct or channel at the rear of the controller casing and out of the way of the motorman. In that portion of the casing wall enclosed by the duct is a series of holes through which the exhaust enters into the casing. Small nozzles are secured in these holes and extended into proximity to the controller contact parts. The nozzles are preferably made of insulating material, such as mica, fiber or wood. They are graded, so far as their bores are concerned, with the smaller openings near the bottom, or point of entrance of the exhaust pipe, thus allowing for an even blowing of air into the controller. Beneath this series of nozzles is a nozzle with a bell mouth in proximity to the blow-out magnet coil, for directing a stream of air against the coil for cooling purposes. An outlet pipe extends from the bottom of the controller to beneath the car floor. With some controllers, however, no special outlet pipe is needed, as relief is had through the hollow controller stand.

For adaptation to controllers now in use the duct or channel is formed in a separate casing equipped with a series of nozzles projected through corresponding openings in the controller casing, the device being secured to the casing by bolts. Another form provides for the exhaust pipe opening directly into a pipe within the controller casing and formed with a series of discharge nozzles, its lower end terminating in a bell-mouthed tubular extension opening adjacent to the blow-out magnet coil. By still another arrangement the duct is formed between an open-sided casing and the controller casing. In this case it is only necessary to drill the proper size holes in the rear wall of the controller casing and secure the other casing over it by means of bolts and gaskets.

A by-pass with valve between the air reservoir supply pipe and the exhaust pipe enables the controller to be cleaned out when the car is not in operation, or the air brakes in service.

By means of Mr. Wellman's invention it is claimed that not only is the annoyance consequent upon a direct exhaust into the atmosphere obviated, but the efficiency of the controller is maintained and the danger of short circuiting and blowing out is positively avoided.

New Lines and Extensions Opened.

The East Chicago-Indiana Harbor division of the Chicago & Indiana Air Line Co. was opened February 15th.

The first round trip for passengers over the new state trolley road at Bismarck, N. D., was made February 19th.

The Memphis (Tenn.) Street Railway Co. opened its New South Memphis line to traffic February 28th.

The Atlantic City & Suburban Traction Co. opened its cross-town service in Atlantic City, N. J., February 27th, the cars running from the Boardwalk to Pleasantville.

The Pacific Electric Railway Co's. new line from Los Angeles to Lamanda Park was opened for traffic March 1st. The line traverses a section rich in scenic features.

The Rosen Heights Ry., of Ft. Worth, Tex., has been completed between Rosen Heights and the Stock Yards and cars began running on regular schedule March 3rd.

March 15th regular service was instituted on the Cincinnati, Milford & Loveland Traction Co's. line between Cincinnati and Milford, O.

One tube of the North River, N. Y., tunnel has been pierced

The Jungfrau Railway.

The Jungfrau Railway is one of the most interesting among the mountain railways of Europe, not only on account of the enormous height to which it is destined to be carried (4,093 meters above sea level), an elevation hitherto unique so far as Europe is concerned, but also, from a technical point of view, on account of the use of the triphase current as a motive power, the construction of a tunnel 10 kilos. long at a height of 2,000 meters, and the topographical surveys, together with the exact and elaborate triangulation, which have had to be carried out in order to accurately determine the course. In addition to these special points of interest, there are the magnificent views which the journey offers to the eye of the tourist, for of all the mountains of Europe, the Jungfrau is one of the most famous for the beauty of the panorama which is unfolded in the course of its ascent.

GLACIER STATION AND EIGER TUNNEL.

The railway, which is rapidly advancing towards completion, starts from the Scheidegg station, at an altitude of 2,064 meters, where it joins the steam railway from the Wengeralp.

The central water power station is, however, at a very much lower level, at Lauterbrunnen. The power (2,650 h. p.) is derived from the Lütchine Blanche. The maximum fall is 40 m. 80 cm. The power house, a stone building (30 x 18 x 12 m.), includes, besides the machinery, a residence for the chief engineer, and a repairing department. It is connected by telephone with the various stations on the railway.

The installation consists of three groups of turbines, viz.: Two twin Girard turbines of 500 h. p. each, supplied by Rieter & Co., of Winterthur; two Francis turbines of 800 h. p. each, supplied by Escher, Wyss & Co., of Zurich; two exciter turbines of 25 h. p. each, supplied by Rieter & Co. Each turbine is furnished with an automatic regulator. In cold winters the water of the Lütchine is at its lowest, and consequently the power it supplies is greatly diminished. For this reason the central station includes a gas engine of 125 h. p. supplied from the Deutz works, which is a reserve.

The first set of turbines are coupled directly to two three-phase alternators of 500 h. p., giving, at 380 revolutions, 36 amperes at 7,000 volts with 38 periods; the second set to two three-phase alternators of 800 h. p., giving, at 380 revolutions, 57 amperes at 7,000 volts with 38 periods; the third set to two continuous-current exciters of 25 h. p., giving current at 60 volts.

In the middle of one of the walls of the building is the distributing switchboard. A traveling crane can be moved over any part of the power house.

The high tension conductors are supported on posts 30 meters apart, with triple porcelain bell insulators. The three wires are 7.5 m., in diameter, The potential of 500 volts for the trolley line is obtained by means of transformer sub-stations along the line containing one or two transformers of 200 kw., and apparatus for measuring and breaking the current. The sub-stations at Scheidegg and the Eiger Glacier have each, in addition, a 30-kw. transformer, 7,000 to 200 volts, for lighting and heating the various houses, hotels, etc. The high tension apparatus is protected by Siemens & Halske lightning arresters and the trolley wires by comb arresters.

On entering the tunnel the high tension wire is carried in a longitudinal groove made in the right-hand wall of the tunnel, and protected from all contact by means of an iron wire netting.

The trolley circuit is composed of two copper wires of 9 mm. diameter. They are suspended at a height of 4 meters above the rails by means of steel span wires 6 mm. diameter. These latter are attached to wooden posts placed on either side of the track, and doubly isolate the wires from contact. In the tunnels, these span wires are fixed to bolts cemented into the walls.

The return current is carried by the rails, which for this purpose are bonded at each joint by copper wires of 7 mm. diameter. These bonds are placed between the rails and the fish-plate, and fixed to the former by rivets. The track is also cross-bonded at intervals of 90 meters by a copper wire 9 mm. in diameter.

The weight of each train, consisting of an engine and two cars, is 28 tons. The speed is 8.5 km. per hour on a grade of 25 per cent. The theoretical power required is 220 h. p.; 230 h. p. at the axles of the toothed wheels.

The first two locomotives were constructed by the Swiss Locomotive Construction Co., of Winterthur, in conjunction with Brown, Boveri & Co., of Baden. The weight of each is 14 tons, length 4.376 m., breadth 2.57 m., height above rail 2.945 m. A low frame rests on two axles, between which it carries the two toothed wheels with their shafts and gearings. The two motors, of 150 h. p. each, make 760 revolutions per minute, and are placed on the frame. The motors drive the toothed wheels by means of pinions, mounted on both ends of their shafts. A tachometer coupled to the shaft of one of the motors registers the speed.

The hand brakes consist of shoes which are pressed by means of screws and levers against a drum fixed to the toothed wheel. Each toothed wheel carries two of these drums, and to each drum two shoes are applied. The rubbing surfaces are not smooth, as in order to increase the friction lines are scored in them longitudinally. Another brake with a double rod is applied by the tension of a strong spring to drums carried by the shafts of the motors. It can be actuated by slight pressure on a lever, and acts automatically by centrifugal force, as soon as the speed of the train exceeds the normal, or the moment the electric energy fails. In the latter case it is set in motion by a solenoid which drops its armature.

During the descent the reversed motors must, by synchronism, work at the same rate as during the ascent, assuming that the alternators at Lauterbrunnen revolve at the same rate. In order to dispose of the superfluous electric energy produced during the descent, resistances have been inserted in the high tension cable at Lauterbrunnen, and in case of danger the motor has only to be reversed in order to ensure either a stoppage or a reversal of the train's motion.

The current is collected by four trolleys, two for each trolley wire.

STATION OF THE EIGER GLACIER

The electrical equipment of the last three locomotives was supplied by the Oerlikon works. Three independent brakes can stop the whole train. A grip fixed on the front axle prevents the toothed wheel from rising. There are two motors of 120 h. p. running at 790 revolutions per minute, with 450 to 550 volts. Each motor weighs 2,100 kg. On the shaft of the front motor is built a little continuous-current dynamo of 6 poles, which gives 150 amperes at 25 volts with a speed of 700 revolutions. The current is collected by means of plates having a rubbing surface of aluminum. The lighting is effected by means of incandescent lamps, with two oil lamps in case of emergency. The descent may be made by cutting off the current from the central station.

During the ascent, the locomotive is at the back of the train. A complete train carries 80 persons. The baggage cars weigh 2,600 kg. (5,720 lb.) empty and can carry a load of 8 tons (17,200 lb.) They are provided with a brake which grips the rack.

The track, with its Strub teethed rail, is of 1 meter gage, and is laid with two steel rails 10.5 meters long and .10 meter deep. The weight of the rail is 20.6 kg per meter. There are three toothed

rails [illegible] meters long and 17 cm. deep, made of soft steel, and weighing [illegible] kg. per meter (70 lb. per yd.). To each rail length 12 [illegible] and each weighing [illegible] kg., placed 50 meters apart at the [illegible] and 1 meter apart along the rest of the track. The fish plates for the toothed rail weigh 7.94 kg. and for the track rail [illegible] kg.

The piercing of the great tunnel is being accomplished by means of electric percussion borers supplied by the Union Elektricitäts-Gesellschaft and by Siemens & Halske. The workmen are divided into three shifts of 8 hours each. A transformer of 30 kw. capacity serves for lighting purposes, and for melting the snow in order to obtain the water necessary for the boring apparatus. For the boring machines of the first-mentioned firm, three dynamos have been installed, capable of driving respectively six, four and two boring machines at once.

The ventilation of the passageway is effected by means of a ventilator driven by an electric motor of 9 h. p. The air channel is made of metal pipes having an interior diameter of 250 mm.

It is from the Eiger Glacier that the tunnel work commences. At this point there is a station with a restaurant, provision store, general supply store, workmen's dwellings, a building containing transformers, etc. Here the engineers and workmen live who are

RESTAURANT IN UNDERGROUND STATION OF EIGERWAND. (2,867 M. ALTITUDE).

employed in the construction of the tunnel, and here they spend the whole year.

As we have said, the track starts from Scheidegg (2,064 m.) and from thence, in the open except for a tunnel 87 meters long, is carried to the Eigergletscher (2,323 m.). The line then enters the great tunnel and reaches Rothstock station (2.880 km., altitude 2,530 m.) whence the ascent of the Rothstock (2,668 m.) can be made. Then we come to the Eigerwand station, cut out of the rock. Thence the tunnel describes a curve, and sweeping round from the south side of the Eiger, arrives at Eismeer (3,156 m.) from which it is easy to reach the line of perpetual snow. The line then turns westward, and keeping a straight course, reaches, by means of an ascent of 6.6 per cent, the station at Jungfraujoch. (3,421 m.). Thence the line ascends an incline of 25 per cent as far as the Jungfrau station, at an altitude of 4,093 m., whence a lift conveys the passengers to the summit a distance of 73 m.

The line is at present only completed as far as the station at Eigerwand, but it already affords to some thousands of tourists an opportunity to admire the northern wall of those giants of the Oberland, the Eiger, the Moine, the Jungfrau, with their glaciers clinging to the rocks in some inexplicable way, the snow-crowned peaks of the Blumlisalp, the Breithorn, the Tschingelhorn, the Lauberhorn, the Tschuggen, Mannlichen, and then of the Faulhorn and the Schwarzhorn, the Titlis, the Mettenberg, and the Wetterhorn; the avalanches which every moment descend with a roar from the Eiger, the Moine, the glaciers of the Guggi and the Giessen; of surveying, from the Rothstock, above the Lauberhorn, the lakes of the Swiss table-land as far as the ranges of the Jura, the Vosges, and the Black Forest. A few months more, and from the summit of the proud ice-clad Jungfrau, when the glorious view will be unfolded before his admiring gaze, the traveler will be penetrated by a sense of the littleness of man in the presence of these mighty peaks whose solemn silence is only broken by the thunder of the avalanche.

Tennessee Notes.

The Nashville Railway & Light Co. has extended its First St. line 1½ miles from Oldham St. to the 17th district schoolhouse. This is a single-track line laid with 70-lb. rails. A 30-min. schedule is maintained at present. It opens a territory that hitherto has not had street car facilities. The Fatherland St. line, from Second St. to 11th St., has been reconstructed and double tracked for five blocks farther than formerly. It was relaid with 70-lb. rails. The St. Cecilia line tracks have been connected with the main line, so that now the St. Cecilia cars run through the transfer station, thus abolishing the system of street corner transfers to and from the St. Cecilia line. The junction of the St. Cecilia, or old "New Town" track, with the tracks of the main system has been the subject of a lengthy fight between the city and the company, and even after an agreement was entered into the work has been delayed until now. The Cedar St. cars will hereafter be operated over the new track provided by the junction. Work has begun on the reconstruction and double tracking of the Church St. line, from the Church St. viaduct and over Felder Ave. to the Coliseum Building.

On February 4th the annual meeting of the stockholders of the Nashville Railway & Light Co. was held. The old officers were reelected, as were all the old directors with the exception of Mr. R. Lancaster Williams, resigned, whose successor is Mr. A. H. Ford, financial agent of Messrs. Isidore Newman & Sons, New Orleans. The report of the engineers, Messrs. Ford, Bacon & Davis, showed that over $500,000 had been expended on reconstruction work in 1903; that 19 miles of track were entirely reconstructed, which, with 10 miles previously done, makes 29 miles now in first-class condition, leaving 37 miles to be reconstructed. It is expected that better progress will be made this year, as a great deal of time was consumed last year in changing the gage to standard. Other reports of the company showed affairs to be in a prosperous condition, the receipts showing a fine increase. In 1903, also, 19,500,000 passengers were carried, a big gain over 1902.

A 1,500-kw. turbo-generator has been ordered from the General Electric Co. for the new power station, as well as an additional battery of 1,000-h. p. Babcock & Wilcox boilers, to be installed by May 1st. The entire business of the company will then be taken care of by the new plant.

A bill requiring the Nashville Railway & Light Co. to mark off sections of its cars for the accommodation of colored people and to prevent their occupying any other part of the car than that set apart for their use will be introduced in the city council. The proposed ordinance is similar to that in force in New Orleans. It is believed that the company will oppose the passage of the ordinance, feeling that there is not the necessity for it in Nashville that there is in New Orleans, where the colored population is much greater.

The Chattanooga Electric Railway Co. has issued 50-year bonds to the amount of $2,000,000, dated Jan. 1, 1904, bearing 5 per cent interest, payable in gold coin. These bonds will be used to take up $1,000,000 of bonds outstanding, cancel a floating debt of $300,000 and the balance for extensions, betterments and repairs. This is taken to mean that the negotiations which were under way for the consolidation of the Chattanooga Electric Railway Co. and the Rapid Transit Co. of Chattanooga have been broken off.

The transfer of the property of the Knoxville Traction Co. and the Knoxville Electric Light Co. from the Railways & Light Co. of America to Messrs. Ford, Bacon & Davis, of New York, and the interests they represent, took place February 9th and the new owners have taken charge of the property. It is announced that at least $600,000 will be expended in improvements. Mr. C. H. Harvey, formerly general manager of the two companies, has been elected president.

The Pan Handle Traction Co., Wheeling, W. Va., has adopted a new uniform for its conductors and motormen. It resembles the regulation steam road uniform and has the leters P. H. T. in gold on the coat lapel.

The Encouragement of Urban Trafic.*

BY R. W. WESTERN, C. E.

In tramway enterprise, as in every other kind of business, the golden rule for achieving commercial success is "find out what it is your customers want, and see that they get it."

The first question to settle is, therefore, what do tram-users really want?

Of all the possible motives which may induce a man to enter and use a tram-car, there are only three sufficiently active and universal to be worth taking into account.

He may enter a tram (1) for the mere pleasure of using it, (2) to save himself trouble, (3) to save time.

Most other possible motives may be resolved into two or more of these.

Thus, if a man gets into a tram on account of the state of the weather it will be partly to save himself the trouble of withstanding its inclemency, partly to reduce the period of his liability to exposure to it, and partly because it is under the circumstances more pleasurable to be in the tram than on the pavement.

But this first motive, i. e., the use of the tram for pleasure, is of no great importance in towns and often is not really at work where it would most seem to be.

For instance, the users of the tramway ascending Great Orme's Head at Llandudno might be supposed to be doing so from the mere pleasure derived from its use, but experience will convince a careful observer that the pleasure begins at the top, that the tram-cars are chiefly used to avoid the trouble of walking up, and that it is therefore the second motive that predominates with the users.

The discussion may consequently, with advantage, be confined to the consideration of the second and third motives alone, particularly as only urban traffic is now being considered. Two distinct and divergent types of tram service will be required, according to which of these motives is in the ascendant.

In order to show this more clearly it will be better to present the elements of the problem as tangible quantities.

Suppose the path of each tram-user from his house or office to the tram-line, each time he uses the trams during a certain period, is measured and the sum of these distances divided by the total number of users. This will give the average distance the user walks both to and from the tram line. Represent it by k in miles.

If the trams have only fixed stopping places, and the average number of n to the mile, the average distance the customer must walk to and from his car will be altogether $2\,[k + (1 \div 4n)]$, the side streets being taken as at right angles to the tram-line.

Now, if the predominant effective motive of the customers to use the trams is to avoid trouble and fatigue, practically the only way in which the management can respond will be by doing away with the quantity $1 \div 4n$, and the one important thing for the management to look after will be that the drivers are alert, that they respond with promptness and stop with precision at every spot required.

The trouble and fatigue of walking being thus reduced to a minimum, the less serious trouble and fatigue of waiting for a tram will, with such frequent stopping, be more cheaply reduced by increasing the number of trams at the expense of size and speed than by increasing size and speed at the expense of numbers.†

Indeed, horse cars are good enough for this sort of traffic.

The hypothesis that tram-users are chiefly actuated by the desire to save themselves trouble and fatigue cannot therefore be true, at all events in Great Britain at the present time.

In ancient days before MacAdam, when roads were bad and carriages springless, the people who drove in the latter did so no doubt to avoid fatigue, since they could walk as fast or ride faster. The vogue of Sedan chairs was an outcome of this habit of mind; and since ingrained beliefs die hard it is not surprising if the idea that the prime use of vehicles is to economize physical effort still lingers on in the sub-consciousness of managers of transport and makes itself felt in certain persisting features of the tram service.

There may be places in other countries; in the tropics, in the East, where avoidance of trouble and fatigue is the ruling motive of tram-users. In such places efficiency in tramway management would exhibit itself in manner indicated above.

There remains the third motive to be considered—the saving of time.

The elimination of the other two shows this must be the most important, and the rise and development of modern electric traction, properly considered, strongly confirms the view that it overwhelmingly predominates the others during the greater part of the day if not during the whole time.

There may be a few exceptions at seaside places and pleasure resorts, but for most practical purposes an urban tramway concern may regard itself as a purveyor of time to the public.

Time is what the public really want and the commercial success of the concern will be in proportion to the efficiency with which it can supply time to its customers.

This fact has not been fully grasped, and closer adjustments of detail in tramway management may yet be made in the light of it.

Fixed stopping places are of course essential.

It is waste of money to unduly ornament or upholster the inside of the car; it is sufficient if its condition does not cause pain or discomfort, the money being much better spent in improving the service.

It does not matter if the passenger must be smart in his entry and exit, or that he must mount two flights of stairs to reach a seat on the top of a two-deck car, provided he saves the loss of time incurred by waiting for another car. The true commercial policy is to spend all available money in giving him what he really wants; he really wants to save time, trouble and fatigue are less important to him, and even if he grumble loudly he will use the trams the more.

Other consequences ensue which require a more precise terminology. Let the average length of journey be l miles, v the speed between stopping-places in miles per hour, s the average number of seconds lost by the tram during a stop, and w the average number of minutes spent at a stopping-place while waiting for a tram.

Then the average time occupied by a passenger in his complete journey from door to door, supposing he does his walking at 3½ miles per hour, will be

$$\frac{2}{3\frac{1}{2}}\left(k + \frac{1}{4n}\right) + \frac{l}{v} + \frac{nls + 60w}{3600} \text{ hours}$$

$$= \frac{4}{7}k + \frac{1}{7n} + \frac{l}{v} + nl\frac{s}{3600} + \frac{w}{60} \text{ hours.}$$

It should be the object of good tramway management to use every means in its power to make this expression as low as possible. A possibility offers itself in the determination of n the average number of stopping places per mile.

If too near together the average of time saved in walking along the tram-line to the nearest stopping place will not compensate for the time lost during the tram-ride in more frequent stoppage.

Now, $(1 \div 7n)$ hours is the time spent in walking along the tram-line to a stopping place, and $(nls \div 3{,}600)$ hours is the time lost by the passenger in subsequent stoppings of the tram during his journey.

Then $(1 \div 7n) + (nls \div 3{,}600)$ should be a minimum. Equating the derived coefficient to zero—

$$\frac{1}{7n^2} = \frac{sl}{3600}$$

Whence.................... $n = \dfrac{60}{\sqrt{7sl}}$

If l, the average journey on the tram is taken to be two miles, which is very near the usual distance for large towns, and s the average number of seconds lost by the tram during a stop is taken at 15 seconds, which is not far from the truth when the trams are well driven and the service smartly conducted

$$n = \frac{60}{\sqrt{210}} = 4.15$$

Therefore, if n, the stoppages, average 4.15 per mile, this will be the number most favorable to economizing time under the conditions named.

	Hours.
The time spent in walking along the line then becomes . . .	.0347
The time lost in stoppages becomes	.0345
Total	.0692

*Reprinted from the Official Circular, January, 1904, of the Tramways and Light Railways Association.

†See paper on The Cost of Stopping by Mr. Western in the Official Circular, October, 1902.

If n were [illegible] the time spent in walking would be	.0292
The time spent in stoppages would be	.0409
Total	.0701
If n were [illegible] 4.8 the time spent in walking would be	.0302
The time spent in stoppages would be	.0399
Total	.0701

Thus 4.15 is the happy mean under these conditions. The figures also show that within fairly wide limits no appreciable time is gained or lost by a change in the value of n. Hence, from the consideration of customers' point of view alone, it would seem that there is no advantage in having fixed stopping-places closer than one-quarter of a mile apart, particularly during the peak periods, morning and evening, when every one is in a hurry. If, in addition to this, we take into account the fact that the stoppage of a loaded tram car in full career is a costly operation both in energy lost and in wear and tear, it is evident that the present practice is to place the stopping places in the towns too close. It is probably the result of a late survival from the times when people used vehicles chiefly to avoid fatigue.

The introduction of longer intervals, though it would, of course, meet with violent opposition from persons who happen to live or do business in the immediate vicinity of abandoned stopping places, would enable tramways to meet a wider want that could only result in better custom and higher returns.

By the reduction of the number of stopping places the intervals between each tram would be automatically diminished, provided the speed between stopping places was maintained, which would be a further advantage accruing to the policy proposed. But this introduces another consideration of even greater importance than the former.

Say a three-minute service is supposed to be provided, if alternate cars are only a minute out there is a very appreciable reduction of the commodity supplied to passengers, viz., time saved.

For a perfect three-minutes' service the average time of waiting would be 1½ minutes. We may assume passengers to be arriving at the stopping places at any average uniform rate, the particular rate does not alter the result, so for the sake of simplicity say they arrive at the rate of one in each minute. Then, starting from the departure of the punctual car, the next being one minute late would not have arrived until four minutes had elapsed, during which time four persons would have waited an average of two minutes each, making a loss of eight men-minutes, if such an expression may be allowed. The next car will arrive after two minutes, involving a loss of two men-minutes. So the total loss is 10 men-minutes for the cycle of two trams, instead of nine men-minutes as the perfect service would involve.

This assumes that when the first tram arrives there is room in it for all four. If the capacity of the tram service were exactly calculated to the traffic, one person would be closed out and have to wait another two minutes till the second tram arrived, thus making the total loss 11 men-minutes, or an average of 11 ÷ 6 = 1.83 minutes ahead. But a tram service cannot be expected to be run with even as much accuracy as this. Blocks and obstructions may recur with a frequency it is not always in the power of the management to reduce, which may make the average time of waiting even greater than the average interval between trams.

Returning to the expression given for the average total time occupied by a journey from door to door:

$$k + \frac{1}{7} + \frac{1}{7n} + \frac{l}{s} + \frac{n\,l\,s}{3600} + \frac{w}{60} \text{ hours;}$$

the first term can ony be altered by the construction of branch iines, which is not the subject of the present inquiry. We have seen that in typical circumstances the terms (1 ÷ 7 n) and (n l s ÷ 3600) should be about the same, and together about equal to .07 hours, or 4.2 minutes. Also (w ÷ 60) would be say 2.5 minutes. Whereas (l ÷ 5), which is the total time occupied in moving between stopping places, must be about 15 minutes if the speed be taken at 8 miles per hour. This last, therefore, is the most promising term to attack. A 5 per cent improvement here would save the customer more than a like improvement in any other term. And this is a point worth emphasis in view of the difficulties often made by local authorities to any increase in the speed of trams.

Adding all terms together, and allowing 7 minutes, i. e., 3½ minutes at each end for the doubtful amount of the first term, we arrive at something like 29 minutes as the average time spent by a tram-user in a journey from door to door under typical conditions of urban traffic.

The value of time to the tram-user probably averages 6d. per hour, or not less than this, so that nearly 3d. is paid in time as well as 1d. in money.

Thus an improvement in the service saving 1 per cent of the total time would be sufficient compensation for a 3 per cent increase of fare. The reduction of k, to be effected by branch lines in side streets, might in certain cases afford, on these grounds alone, a sufficeint justification for construction of the lines.

The conclusions are, that for the encouragement of urban traffic it is wiser to study the passenger's time rather than his comfort, which may be done, first, by increasing speed between stations; secondly, by increasing the regularity of service; and, lastly, though not necessarily least, by reducing the number of stopping places.

Canadian Notes.

The Canadian Niagara Power Co. has applied for a six-months' extension, the company agreeing that the initial output of power on Jan. 1, 1905, shall be 50,000 h. p., instead of 20,000 h. p., which the original agreement provided should be ready by July 1, 1904.

Messrs. Wallace & Little, of Woodstock, have applied for a Dominion charter for an electric railway between Hamilton and Brantford. Mr. David Brennan, of Detroit, and other American capitalists are said to be interested.

A bonus of $4,000 has been granted to the Waterloo & Wellesley Electric Ry. by the ratepayers of Waterloo.

The Guelph Junction Railway Co. has applied for a charter to build an electric line from Guelph to Goderich, with branches to Listowel, and St. Marys and Clinton, via Stratford.

Mr. T. H. Luscombe, of London, Ont., is solicitor for the North Midland Electric Railway Co., which has applied for a charter.

Mr. A. H. McDonald, of Guelph, is solicitor for the Walkerton & Lucknow Railway Co., which is seeking incorporation to build an electric road from Walkerton to Lucknow.

Messrs. Chrysler & Bethune, of Ottawa, are solicitors for the Ottawa Counties Railway Co., which has applied for a charter to build an electric line from Ivanhoe, Ont., to a point near Agincourt.

With a capital of $100,000, Hon. John Sharples and Messrs. J. Bell Forsythe and A. C. Dobell, of Quebec, are forming a company to build an electric line to connect the parishes of St. Colomban, Sillery, Bergerville and Charlesbourg with Quebec.

Dr. Payette and Mr. H. Fontier, of Montreal, and Mr. J. E. E. Dickson, of Westmount, Que., have applied for a charter for an electric road through the counties of Hochelaga, Jaques Cartier, Laval, Two Mountains, Argentine and Terrebonne.

Messrs. Campbell, Pitblado, Hoskin & Grundy, of Winnipeg, will apply for a charter to build an electric railway within a radius of 75 miles of Emerson, Man., and to construct and maintain a water power development on the Roseau River.

Messrs. McDonald & Winn, Rossland, B. C., are solicitors for a company which plans to build an electric line from Crawford Bay on Kootenay Lake to a point near Fort Steele.

The Metropolitan Railway Co., Toronto, has agreed to build at least 150 more miles of track within four years. It now operates on 150 miles of track.

The Toronto Street Railway Co. owns 205 open and 296 closed motor cars, and 92 open and 78 closed trailer cars.

The New York board of aldermen has decided not to repeal the ordinance, recently adopted, which provides that cars shall stop at the near side of cross streets. It is stated that already it has been shown that the new rule prevents accidents.

The Topeka Railway Co. has entered into an agreement with the Atchison, Topeka & Santa Fe Ry., by which it will deliver freight in the city for the steam road, employing at present eight freight cars. A spur is being built to connect with the Santa Fe tracks.

Hiring, Training and Handling Employes in Electric Railway Work.

BY CHARLES H. COX.

The hiring, training and handling of employes on electric railways to-day are undoubtedly matters of the greatest importance both to the companies and to the public, and too much care and precaution cannot be exercised in the details connected with this phase of the work. Seemingly unimportant matters for one reason or another are many times lost sight of, but this neglect of details is invariably productive of unsatisfactory results.

It is not my desire to comment or criticise any particular method of handling this matter, but simply to give a few facts as they have come under my observation during a long and active experience in connection with railway work, with particular reference to the small and average-size road. This subject should be divided into two heads, namely, employing and handling men for city service, and for interurban service.

The methods of handling and employing men are as different as the temperaments of the individual managers who do the employing. The matter of selecting men for modern electric railway service is a problem which confronts every manager at all times and therefore requires him to exercise his best judgment in order to select a superior grade of men, and I have found by experience that far better results are secured in this direction by employing men who make personal application and who expect and desire to get a position and hold it by their own merit rather than by the influence of others who may be connected with the road in an official capacity or associated with it in a financial way.

The manager or superintendent of a road should be the sole judge of whom he will hire and should be in absolute control of the men in service, as it is to him that the public look for attentive, polite, courteous and accommodating motormen and conductors and good service. It is to him that the stockholders look for dividends and the president and directors for the physical condition, general appearance, harmony, economy and popularity of the system. Men who have come to the company through influence are at times apt, in a measure, to become indifferent, negligent to duty, or talkative in a manner derogatory to the management or detrimental to the interests of the road. Often they appear to feel a little better or more independent than their fellow workmen, which fact tends to create a feeling of discord and jealousy that reacts all along the line, manifesting itself at times when loyalty to superiors, interest in their work and a desire to do all in their power to make the enterprise a success is required to render to the public a satisfactory service and to the company a revenue on the capital investment.

It is a well-established fact that in the present stage of electric railroad development men of a higher grade of intelligence are required for the operation of cars than in former days when horse-car conditions were in vogue. It is also true of the railway industry, even more than of other industries, that the two most important requirements for mutual prosperity are that the capitalists and employes undersand each other's aims and that each must act in harmony with the purposes of the other.

In selecting men for the service their general make-up and appearance should be the first thing considered. Then their character and habits should be carefully looked into. Next their ability to occupy the position for which they have applied and their disposition to subject themselves to the rules and regulations of the company regardless of their own ideas in matters pertaining to their work. Then their physical condition and other qualifications, more or less varied according to the class of work. It must be borne in mind that desirable men are in demand at all times and that a great many men that are employed in street railway work can earn as much or more money in other branches of industry.

It is also well to bear in mind that there is a large army of floating railway men, otherwise known as "tramp" motormen and conductors, who go about from place to place, staying only a limited time anywhere and ignoring to a certain extent rules governing employes and many times operating the cars according to their own ideas. These men, as a class, are to be avoided, as in most cases they are very expensive in more ways than one. It will be found that many times they have been responsible for serious accidents.

I have found the best method of determining the qualifications of applicants is to have a printed form of application giving a complete record of the applicant for a period of at least five years, with a number of satisfactory references from recent employers and others, together with a statement of the applicant's physical condition obtained upon examination by a local physician, the same recorded upon forms prepared for that purpose.

The form of application for employment used by the writer is printed on a sheet of the company's letter head and reads as follows:

APPLICATION FOR EMPLOYMENT.

Middleboro,..................190....

.....................................Supt.

Dear Sir: I hereby make application for a position as........... in the service of the company. Believing that I am physically qualified and competent to discharge the duties of said position and with the full understanding that in the event of my securing employment I am to abide by such rules and regulations governing its employes as the management may from time to time establish.

If employed I promise to loyally and faithfully serve the company and to do all in my power to further its interests. To conduct myself honestly, soberly and with proper obedience and respect to its officials, and courtesy to passengers and the public.

Age........years. Where born?................. Height........
Weight.......... Color of eyes.......... Color of hair..........
Married or single............ General condition of health.........
Employed the past five years as follows (give date as near as possible): ....
Reasons for leaving...
Have you ever been employed by a railroad or railway company other than stated above? If so, give name of company, location, in what capacity and length of time employed........................
References ....
Addresses ....
Have you ever been convicted of a misdemeanor or felony?........
Do you use intoxicating liquors?.................................

(Full name of applicant)............................
(Residence) ....
(P. O. address).......................................

After this blank has been filled out by the applicant the following letter is addressed to each of the parties whom the applicant names as references:

Middleboro, Mass.,............190....

M.......................................

Dear Sir: In applying to this company for a position as....... .... Mr. ...., age....... height........ft.........in., eyes........, hair........, complexion ...., born in...............................refers us to you. Will you favor us with your opinion of his honesty, character, habits and ability, etc. Please state definitely as to honesty and habits. Has he ever to your knowledge been employed by any railroad or railway company? It is very essential to applicant that this letter be answered promptly, also if ever in your employ that the dates of entering and leaving your service be given. The information that you give us will be thankfully received and considered confidential.

Very truly yours, ...

N. B. Employed as.......... from .... to..........

The form to be filled out by the medical examiner is as follows:

Physical examination of.............................for the position of....................
Date of examination.......... Place of examination..........
Analysis of urine.....................reaction.....................
Sp. G............ albumen .... sugar...

Have you had gall stone or gravel?............Have you ever had any difficulty in urinating.............Is the gait firm and easy.............Any deformities?..........
Age.........Weight.........Height.........Hearing.........
Color of eye.........Color of hair.........Complexion.........
Is the sight good.........Vision (L.).........(R.).........
Color blindness..................... Have you ever been vaccinated or had smallpox?..................... Have you ever received an injury or a wound upon the head.............When were you last attended by a physician.............
For what complaint.............Name of physician.............
Are you subject to fits?.......Are you subject to dizziness?.......
Have you ever had fainting attacks?..........Chest measurements: Forced inspiration..........Forced expiration..........
Lung examination: Percussion..........Auscultation..........
Measurement of abdomen..........Examination of abdomen..........Are you ruptured?..........
Have you a chronic cough?.......... Have you catarrh?..........
Have you any chronic disease?............ Rate of respiratory action..................... Heart................. Pulse (rate and character)..................... Have you varicose veins?...........
Is there freedom from the swelling of the feet?............Are you subject to rheumatism?.............Do you use intoxicating liquor?..............Do you use tobacco?.............
After having carefully examined the applicant I am of the opinion that he is...................physically qualified for the position of ....and should be rated at..............
per cent..
Cause of rejection..
Remarks..
Signed..
Dated this.....................day of......................190....

The physical condition of the applicant is one of the most important factors to be taken into consideration in selecting men, as conductors and motormen are oftentimes called upon to perform duties in connection with their work that are out of the ordinary routine and which bring extra strain on them. It is therefore necessary to have men that can stand this without injury to their health and who will not be found incapable of performing such work. I consider men from 30 to 45 years of age the best stock from which motormen can be selected. In case of a man having had previous experience, however, I have found a great many first-class men several years older. Men of this class are more likely to use better judgment in the operation of their cars.

A man of not less than 5 ft. 7 in. and weighing not less than 165 lb. will, if other qualifications are up to standard, make the best appearing motorman, while I prefer smaller and younger men for conductors. A man 21 years of age who is steady, polite, patient, active and reliable, weighing from 120 to 175 lb., will be found to give the best satisfaction. Married men in either case are preferable.

Above all things an intemperate man is to be avoided, as it is a physical impossibility for a man to dissipate at night and give proper attention to business the next day. It matters not whether dissipation be periodical or otherwise, as he is liable to allow this condition of affairs to take place when his services and best judgment are required to perform the work which was laid out for him, and the future of the company in many cases may possibly be determined by a single act of his. Furthermore, the patrons of the road justly demand that an employe shall give his undivided attention to his business, as their lives, limbs and property are intrusted to his keeping, whether they are riding on the car or passing on or over the tracks.

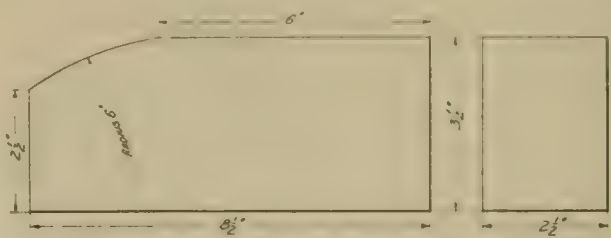
Neatness is an essential qualification for both motormen and conductors, as carelessness in personal appearance will invariably denote that he is careless in other matters. Patience and politeness are two virtues which are necessary in the make-up of anyone, particularly in conductors and motormen, who are constantly meeting all kinds of people under all conditions. Perseverance is also an important factor in the make-up of first-class motormen. Accuracy of judgment and promptness in action are two essential qualifications which must not be overlooked in an applicant.

In selecting men for city service under average conditions it is many times desirable to pick men out with previous experience, as they can be easily broken in and instructed as to the operation of the cars and equipment to suit conditions peculiar to the locality. I have found that this class of applicants invariably makes the best men for city service. On the other hand, on interurban service with long lines and high-speed cars it is very necessary to have men, particularly motormen, who thoroughly understand not only the operating of cars under favorable conditions but the principles of the motors and other parts of the equipment, in order that they may detect any defection and remedy the same in an emergency, thereby not crippling the service or otherwise jeopardizing the interests of the company.

The subject of handling and training men in street railway work will be treated in a future article.

Beveled Brick for Track Paving.

This special brick, which is shown in the accompanying illustration, has been designed to allow room for wheel flanges and yet offer no attraction to wagon traffic. The bevel is practically self-cleaning, and it makes a style of paving that has given very good



BEVELED BRICK FOR TRACK PAVING.

satisfaction since its adoption by a New England road which has laid several miles of brick pavement during the last five years. The early pavement laid by the company referred to was laid in conjunction with deep girder rail, but the company now uses 7-in. T rail with this special form of beveled brick, which was especially designed for it.

Some of the track was paved with this special brick at gage lines more than three years ago, and yet, so durable is the paving, it is

TRACK PAVED WITH BEVELED BRICK.

difficult to distinguish the old from work that has been laid within the last six months. The brick used is known as the "Porter," and the dimensions are shown in the accompanying sketch.

Using Current to Thaw Out Water Pipes.

The plumbers of Elmira, N. Y., having discovered that electricity will thaw ice in water pipes, called upon the electric light department of the Elmira Water, Light & Railroad Co. a number of times for assistance last month. In each instance the superintendent of the department, Mr. H. M. Beugler, sent men, wires and a 50-h. p. transformer and cleared the obstruction in a very short time. By inserting a positive wire in one end of the frozen pipe and a negative wire in another opening about 100 ft. distant, the thawing process actually consumes about seven minutes. The work of preparation, unloading and loading the wagons, etc., requires about 50 minutes. The cost to the plumbers is about $5 an hour.

A similar method has been employed by the Escanaba (Mich.) Electric Street Railway Co., under direction of the superintendent, Mr. A. L. Gillette.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

COMPANY CHARGEABLE WITH NOTICE THAT PASSENGERS ALIGHTING ARE LIABLE TO CROSS ADJOINING TRACK—CARE REQUIRED.

Reed vs. Metropolitan Street Railway Co. (N. Y. Sup.), 84 N. Y. Supp. 454. Nov. 13, 1903.

A street railway company is chargeable with notice, the first appellate division of the supreme court of New York holds, that passengers, when they alight from a car at the place where it delivers them, are liable to cross to the opposite side of the street, and hence over the adjoining track; and the obligation is imposed upon the company to exercise reasonable care in the operation of its cars, having regard to such condition.

PRESUMPTION FROM HEATING OF PLATE OVER WHEEL SETTING A PASSENGER'S CLOTHES ON FIRE —CARE REQUIRED.

Powell vs. Hudson Valley Railway Co. (N. Y. Sup.), 84 N. Y. Supp 337. Nov. 11, 1903.

A woman standing in a crowded car over one of the wheels having had her clothes set on fire by the plate over the wheel being overheated by reason of the friction caused by the plate being pressed down upon the wheel, the third appellate division of the supreme court of New York holds that the heating of this plate raised a presumption of the failure to exercise such care as was required, the duty of the operating road toward its passengers being to use the utmost diligence and care for the protection of the passengers.

DUTY TO HOLD CARS MOTIONLESS UNTIL PASSENGERS HAVE TIME TO GET SAFELY ON AND OFF—JUDICIAL NOTICE NOT TAKEN OF CLOSENESS TOGETHER OF TRACKS.

Scamell vs. St. Louis Transit Co. (Mo. App.), 76 S. W. Rep. 660. Nov. 3, 1903.

One of the most imperative duties of street railway companies, the court of appeals at St. Louis, Mo., says, is to hold their cars motionless until passengers and persons taking passage have time to get safely on and off; nor can there be a more flagrant violation of duty than to start a car without giving ample time for this purpose. It also holds that, unless they are in evidence, courts can take no notice of such facts as that two tracks are so close together that a passenger getting off on the inner side of an open car on one track must necessarily step on the other track.

NO PENALTY UNDER STATUTE FOR OVERCHARGE FROM MISTAKE IN APPLYING PROVISION FOR FARES ACCORDING TO GRADE.

Goodspeed vs. Ithaca Street Railway Co. (N. Y. Sup.), 84 N. Y. Supp 383. Nov. 11, 1903.

The trial court having found that the company's contention that the right existed under section 37 of the railroad law to charge more than five cents by reason of the grade which was overcome was a mistake made in good faith, and without gross negligence, which finding was not challenged, the third appellate division of the supreme court of New York holds that the case was covered by that provision of section 39, under which this action was brought, that the penalty should not be incurred if "such overcharge was made through inadvertence or mistake, not amounting to gross negligence."

MAY EJECT PASSENGER FAILING TO PRODUCE TICKET APPARENTLY GOOD ON ITS FACE OR TO PAY CASH FARE.

Brown vs. Rapid Railway Co. (Mich.), 96 N. W. Rep. 925. Oct. 27, 1903.

As between conductor and passenger, it is incumbent upon the passenger, the supreme court of Michigan holds, to produce as a ticket one which is apparently good upon its face, or pay the fare in cash, and, failing to do this, the conductor has the right to eject the passenger from the car. Any other rule, it says, would result in unseemly contests between the passenger and the conductor, and would put upon the conductor the burden of determining at his peril, by facts not evidenced by the ticket produced, whether the passenger was entitled to a ride.

NOT LIABLE FOR FALLEN HORSE KICKING PASSENGER.

Roedecker vs. Metropolitan Street Railway Co. (N. Y. Sup.), 84 N. Y. Supp. 300. Nov. 6, 1903.

When a car had been pushed back from a fallen horse the latter in its struggles in some manner kicked between the car and dashboard, striking a passenger standing on the front platform. Assuming that the driver of the car was negligent in whipping his horses in going around a curve, so as to cause one of them to fall upon the ground and under the car, the first appellate division of the supreme court of New York holds that such negligence in the operation of the car and in the management of the horses was not the proximate cause of the passenger's injuries, for which the company was legally liable.

CONDEMNATION OF ADJOINING STRIP OF LAND AUTHORIZED.

Middlesex & Somerset Traction Co. vs. Metlar (N. J. Sup.), 56 Atl. Rep. 142. Nov. 9, 1903.

The New Jersey traction act of 1893 (sections 13, 14, Gen. St. p. 3239), authorized the condemnation of land for the construction of any railway built under the provisions of this act, "either as an extension of the line of an existing railway, or of a new line not exceeding sixty feet in width." A company, operating on leased land a railway so built, procured the appointment of commissioners to condemn a strip of land adjoining the strip on which its existing line was operated, the two together not exceeding 60 feet in width. The supreme court of New Jersey holds that the proceeding so taken was within the provisions of this act.

FINALITY OF RAILROAD COMMISSIONERS' DECREE AS TO CROSSINGS.

Boston & Maine Railroad vs. Saco Valley Electric Railroad (Me.), 56 Atl. Rep. 202. Aug. 18, 1903.

The supreme judicial court of Maine holds that, under the statutes of that state, the whole question of how railroad crossings shall be constructed and maintained is left, in the first instance, to the sound judgment and discretion of the railroad commissioners for determination; and their decision, when made, is final, unless an appeal is taken. They have no authority to modify or change such a decree once made, except upon a new application, notice, and hearing; nor can they, before appeal, make a temporary decree which does not purport to represent their sound judgment and discretion in the premises. Such temporary decree is void.

FOLLOWING BY PASSENGERS OF DIRECTIONS OF CONDUCTOR SENDING PASSENGER DESIRING TO ALIGHT ONTO PLATFORM WHILE CAR IN MOTION.

Hemmes vs. Muskegon Traction & Lighting Co. (Mich.), 97 N. W. Rep. 30. Nov. 9, 1903.

The conductor is in charge of his car, and his directions, the supreme court of Michigan says, are usually followed by passengers. It would not be reasonable to require passengers to lightly disregard them, and they may reasonably believe that it will not be imprudent for them to follow them. The court is not willing to say that such a direction as that a woman desiring to alight should go onto the platform with the car in motion is negligence in all cases, or that it might not be in others. Certainly a conductor who should send a child or a decrepit or weakly or drunken person to the platform while the car is in motion would be open to criticism, and a jury might, under some circumstances, be bound to find such an act negligence. Ordinarily, it is a question of fact to be left to the jury.

WHEN CARS MAY BE SAID TO BE UNDER CONTROL SPEED AND NEGLIGENCE.

Mauer vs. Brooklyn Heights Railroad Co. (N. Y. Sup.), 84 N. Y. Supp. 76. Oct. 22, 1903.

Cars are under control, according to the second appellate division of the supreme court of New York, it may be said, when they are running at any given rate of speed, so long as the machinery and the attendants are in condition to respond to the necessities of the situation; but the control which the law demands at street intersections is such control as will prevent, in the absence of negligence on the part of pedestrians or others lawfully using the highway, the occurrence of accidents, and seven or eight miles an hour is not, as a matter of law, such control. The question of negligence does not depend so much upon the rate of speed as upon the ability of the motorman or other servants to prevent accidents, and it is always a question of fact, taking into consideration all of the circumstances, whether the operation of the car was negligent or not.

LOCALITY WHERE TWO STREETS PRACTICALLY MEET IN A THIRD TO BE TREATED AS AN INTERSECTION OF STREETS.

Freeman vs. Brooklyn Heights Railroad Co. (N. Y. Sup.), 84 N. Y. Supp. 108. Oct. 22, 1903.

Where two streets bearing different names comprised what was termed a continuous line of traffic, although their direction was not within a few degrees identical, and the most westerly point of the east line of one was directly south of the most easterly point of the western curb of the other, the point of such meeting if it may be so called being intersected by a third street on which there were street railway tracks, the second appellate division of the supreme court of New York holds that, as to the rule of law which holds that street railroad companies and other users of streets have equal rights at their intersection, this location must be held to be such an intersection. And it holds that the point of ingress should not be held to affect the rights of those who have occasion to use such intersections of streets. The boundaries of an intersection of streets, it says, enclose a spot peculiar to the law, in that no paramount rights are known there, and no limitation of this doctrine should be indulged against a class of individuals or vehicles that enter from any particular point.

LIABILITY FOR INJURIES INFLICTED BY RUNNING FREIGHT CARS IN VIOLATION OF LAW.

Daly vs. Milwaukee Electric Railway & Light Co. (Wis.), 96 N. W. Rep. 832. Oct. 20, 1903.

This was a personal injury case. It was contended that the complaint failed to state a cause of action because it did not specifically allege any negligence of the defendant in operating the train or in the construction of the cars or the track or otherwise. The supreme court of Wisconsin says that it did allege that the defendant was only authorized to use its tracks and railway for transporting passengers. Had the injury resulted from the use of such passenger cars, there might have been some force in the objection. But the gravamen of the complaint was that the plaintiff was injured by reason of the defendant running freight cars upon its tracks without authority and in violation of law. To the extent that the defendant exceeded its authority by running freight cars over its tracks without legislative permission, express or implied, it must be regarded as acting in violation of law, and hence answerable accordingly. The theory is that, the act being wrongful, the party doing it is answerable for all the consequences that flow therefrom to a person who is not chargeable with negligence by reason of which the injury is inflicted. The allegations of the complaint, if true, were sufficient to authorize a jury to find that the plaintiff's injuries were without fault on his part, and were actually caused by the running of freight cars on the defendant's tracks in violation of law; and hence the complainant stated a cause of action.

VALIDITY OF AGREEMENT WITH ABUTTING PROPERTY OWNERS TO PAVE STREET.

Farson vs. Fogg (Ill.), 68 N. E. Rep. 755. Oct. 26, 1903. Rehearing denied Dec. 4, 1903.

An electric street railway company agreed with certain abutting property owners to pave a public city street, for some consideration, which was supposed to operate for their benefit. The supreme court of Illinois is of the opinion that the company had no power to make any such agreement. Nor has a court of chancery the power to decrease the specific performance of any such agreement. It says that it is a well-settled doctrine in this state that a city holds the title to its streets in trust for the public, and cannot turn over such streets to private parties to be improved. The power conferred upon the city to pave, etc., the streets and crosswalks is vested exclusively in the city council, and cannot be shared by it with any other body or person.

If a court of equity should require the company to pave the street, it would require it to take possession of a public street which belongs to the city and is held in trust by the city for the use of the people. To order the company to take possession of the street would be to order it to create an obstruction in a public street, and clothe an outside corporation with the power which the law vests in the municipality.

It is true that the common council, in granting leave to a street railway company to lay its tracks in the street, sometimes imposes, as a condition, that the street railway company shall keep the street between its tracks paved, and perhaps the common council might make it a condition that the street railway company should keep more of the street than lies between its tracks paved and in repair. But a street railway company has no power, by virtue of its own charter, to pave the streets of the city outside and independently of the consent of the city itself. Independently of any provisions of the charter, it must be true that a street railway corporation organized under the laws of Illinois has no power from the nature of its organization to engage in the business of paving streets.

WHEN ONE ACQUIRES THE RIGHTS OF A PASSENGER —ACTS CONSTITUTING INVITATION TO BOARD MOVING CAR—QUESTION OF CONTRIBUTORY NEGLIGENCE DEPENDENT ON CIRCUMSTANCES.

O'Mara vs. St. Louis Transit Co. (Mo. App.), 76 S. W. Rep. 680. Nov. 3, 1903.

The right of a person to carriage as a passenger on a street car, the court of appeals at St. Louis, Mo., says, rests on a contract, the essential ingredients of which are that the person must signify his intention to take passage, either by words or conduct, and the carmen must assent, by words or conduct, to his becoming a passenger. It is not necessary to the status of passenger that a person be actually on a car, but he is entitled to the privileges of that status while attempting to get on, if the car has been stopped by those in charge for the purpose of receiving him or any one desiring to take passage. Nor is it absolutely essential that the car should be standing still when a person attempts to board it, in order for him to acquire the rights of a passenger. If carmen, instead of stopping their car, bring it to a slow movement at a crossing where passengers are received, in obedience to

a signal from a bystander that he wishes to take passage, their conduct is an invitation to him to get aboard; and when he starts to do so he becomes a passenger, and entitled to be guarded from harm with high care.

The question of the plaintiff's contributory negligence, the court says, stood entirely apart from the question of whether he was a passenger when he was hurt, and was to be ascertained from other facts. Whether he was a passenger depended, in the circumstances of this case, on a finding that he made known to the motorman his desire to become one, and the motorman's response to his signal, and acceptance of him as such, by stopping or slowing the car to receive him. The plaintiff's alleged contributory negligence depended on whether, all the circumstances considered, a man of ordinary prudence, of his years, would have attempted to get on the car. The movement of the car may be so rapid that it would be manifest negligence to endeavor to board it, or a person may be so infirm and incumbered by burdens as to make it negligence for him to attempt to board a car moving at a slow speed. But the issue of alleged contributory negligence on the part of a person hurt while trying to get on a car in motion is mostly a jury issue.

DUTY OF MOTORMAN TO KEEP CAREFUL LOOKOUT AHEAD AND AS TO PERSONS UPON OR APPROACHING TRACK, AT CROSSINGS, AND TO YOUNG CHILDREN.

Forrestal vs. Milwaukee Electric Railway & Light Co. (Wis.), 97 N. W. Rep. 182. Nov. 17, 1903.

It goes without saying, the supreme court of Wisconsin declares, that it is the duty of a motorman in charge of an electric street car to keep a careful lookout ahead upon and in the vicinity of his track so far as the performance of his other duties will reasonably permit, to the end that he may avoid injuring any person that may accidentally or otherwise place himself in a dangerous situation in the pathway of such car; that the degree of diligence in that regard, in order to come up to the standard of ordinary care which the law requires, varies with time, place, amount and character of travel upon the street, opportunity for the motorman to see persons using the street for ordinary travel as they approach the track and for such persons to see the approaching car, and all circumstances naturally calculated to increase the hazard of injuring such persons. The care thus indicated, in law, charges the motorman with the duty to use ordinary care to avoid dangerous consequences from causes within his knowledge, and from those which he might, by the exercise of proper vigilance, have knowledge of as well. He is bound not only to keep the careful lookout indicated, but to observe persons approaching the track, or so circumstanced as to suggest a reasonable probability of such approach unconscious of danger, whom, consistent with proper attention to his general duties, he might observe, and to handle his car, so far as ordinary care will permit under all the circumstances, so as not to injure them. Obviously, these principles require a motorman at a street crossing to exercise greater care than between crossings, and much more care in case of very young children approaching the track unconscious of an approaching car, or being so circumstanced as to suggest a probability of such approach, than in case of adults. And the court holds that there can be no doubt that it was the duty of the motorman, in this case, as his car approached the crossing, to observe children near the track in such an attitude as to suggest a probability of their placing themselves in the way of the car, and to use all reasonable care to avoid injuring them in the event of that probability changing to a certainty.

DEED OF RIGHT OF WAY CONSTRUED NOT TO AUTHORIZE BUILDING OF TRESTLE FOR CROSSING STEAM RAILROAD—NO INJUNCTION ACCOUNT OF ERECTION OF TRESTLE REQUIRED BY RAILROAD COMMISSIONER—NO LIABILITY TO PROPERTY OWNERS FOR CUT OR FILL OF STEAM RAILROAD CROSSED OR FOR NARROWNESS OF SUBWAY CONSTRUCTED THEREUNDER.

Lane vs. Michigan Traction Co. (Mich.), 97 N. W. Rep. 354. Nov. 17, 1903.

By a deed granting a right of way the traction company was authorized to construct, etc., and operate a road "substantially as the poles and trolley wires of said company are now erected and maintained on Washington street." Another provision was: "It is further understood that party of the second part * * * shall be required to operate its electric railway over the right of way hereby granted, substantially in the same manner, as under the franchise granted to it by the city of Kalamazoo, and under which it operates its line over Washington avenue at present." The ordinance referred to provided that the rails should be laid and maintained in such a manner as not to obstruct the free passage of vehicles over the same, and the upper surface of the same should be laid flush with the surface of the streets, and such tracks should conform to the grade of the streets, "as now established, or as may from time to time be established."

The supreme court of Michigan holds that, under the provisions of the deed quoted, the intention to limit the easement to a surface easement was plain, and that it could not be construed to convey more than a right to build a road conforming to the street or surface; that the contention that the deed gave a right to build and maintain a trestle required by the railroad commissioner for crossing a steam railroad was untenable. But, the company having lawfully and in good faith constructed and put in operation a permanent public improvement, and, without its fault, the police requirements of the state having made the erection of a trestle necessary, the court holds that the grantors of the right of way by such deed were not entitled to have a court of equity compel the company to tear up its track and abandon its road, but were entitled to reasonable compensation for such damages as were fairly chargeable to the erection of the trestle upon their land.

The court further holds that the traction company was not to blame for the cut or the embankment of another steam railroad crossed. Each had the right to make its cut or fill, and the traction company committed no actionable wrong when it arranged with the latter for a subway. It was responsible for its trestle and embankment, and for nothing more. And, where it constructed a subway the property owners did not have their rights infringed by a failure to construct a subway wide enough to accommodate travel aside from its road, the highway then terminating without crossing the steam railroad track.

ABUTTER ENTITLED TO INJUNCTION AGAINST CONSTRUCTION OF STREET RAILWAY ON UNACCEPTED STREET OR HIGHWAY, OR WHICH WILL OBSTRUCT A STREET OR PUBLIC HIGHWAY—NOT AN ADDITIONAL BURDEN—CONTOUR OF SURFACE OF STREET TO BE FOLLOWED—PUBLIC AUTHORITIES CAN CONFER NO LICENSE TO ENTER UPON PRIVATE PROPERTY.

Russell vs. Chicago & Milwaukee Electric Railway Co. (Ill.), 68 N. E. Rep. 727. Oct. 26, 1903. Rehearing denied Dec. 2, 1903.

The supreme court of Illinois holds that even if it could be held that the place where the company constructed its street railway in front of the complainant's property was a street or public highway, she should still have her injunction, the company having appropriated exclusively to its own use at least 25 feet of the highway; having erected an obstruction in the street ranging from 2 to 3 feet high at the south end to about 25 feet at the north end, gradually and constantly increasing from where it began at the south until the extreme was reached at the north. While the county or municipal authorities may grant to street railway companies the use of the highways, it is only the use in common and in connection with the public that they may grant. Such companies cannot appropriate the whole or any portion of such streets and highways to their exclusive use and control, the statute expressly limiting the right of company to such manner as not to "unnecessarily obstruct the public use of such street," etc. Where it is established by proof, or admitted, that the place in question is a public highway, the property owner, ordinarily, is presumed, in law, not to suffer damages from the proper construction thereon of such railroads, upon the theory that such use is compatible with the use in common with the public, and does not impose upon such street or highway an additional servitude. But this is upon the theory that such street railways shall follow the natural contour of the surface of the streets.

If the place in question was not a public highway, the public authorities had no power to confer license upon the company to enter upon it for any purpose. The place in question not being

a public highway, and the fee being in the complainant, the decree finding that she was the owner of the entire street, subject to an offer of dedication, and subject to its acceptance by the public authorities, it was the duty of the electric company to bring itself within the exception to the rule by which it might occupy other territory than a public highway, and to compensate the complainant for her damages before constructing its road. The circuit court erred in decreeing a bond to be taken from the defendants, and requiring the complainant to institute proceedings for her damages, and in not granting an injunction. The appellate court erred in modifying that decree, and directing that the company should proceed to condemn the right of way, and in requiring the complainant to pay any portion of the costs. The decree should have been for a mandatory injunction.

OBLIGATION TO PAVE FULL WIDTH OF STREET WHERE SIDINGS ARE MAINTAINED MAY BE ENDED BY REMOVAL OF LATTER

Shamokin Borough vs. Shamokin & Mt. Carmel Electric Railway Co. (Pa.), 56 Atl. Rep. 64. July 9, 1903.

The defendant company was authorized by ordinance to construct a single-track railway with necessary sidings. It laid a single track on one side of a street, and a siding 400 feet long on the other side. The intention was to use this siding in connection with a branch road, which was never built, and the siding was not used except occasionally for the storage of cars. The road was constructed in advance of street improvements, and the ordinance imposed on the company the duty to pave the parts of the streets on which its tracks were laid, and to pave the whole width of the streets from curb to curb where sidings were laid, when the borough should pave the other parts of the streets. The council relied on the belief that, as matter of law, it could prevent the removal of the siding mentioned, and thus for all time place the cost of street improvements on the company. The supreme court of Pennsylvania holds that in this it was mistaken. It holds that the fact that a siding had once been placed on the street would not make the company liable forever. If it became necessary to relocate the siding, the company would be liable for the paving of the new location and relieved as to the old one. If, as in this case, it was found unnecessary, its removal would relieve the company from all liability. The obligation was, in effect, to pave the full width where sidings were maintained.

DUTY OF ABUTTER TO REMOVE FENCE IN HIGHWAY AFTER NOTICE—RIGHT TO GRADE AND REMOVE OBSTRUCTIONS—DAMAGES FOR INJURY TO PRIVATE CROSSINGS—WHEN NONE FOR INJURY TO FENCE IN HIGHWAY—ELECTRIC ROAD NOT ADDITIONAL BURDEN.

Georgetown & Lexington Traction Co. vs. Mulholland (Ky.), 76 S. W. Rep. 148. Oct. 8, 1903. "Not to be officially reported."

If the latter party's fences were upon the highway over which the company had been granted by the county fiscal court the right to construct and operate its electric line, the court of appeals of Kentucky holds that then it was his duty to remove them upon the demand of the company, if they interfered with the free use of the grant in question. The grant to the company carried with it the right to grade its proposed line in such a manner as to make the easement available. This involved, of necessity, the right to remove all obstructions in the public highway inconsistent with its free use for the purposes of the grant. If these fences obstructed the free use of the grant to the company, it had the right to remove them. If the allegations of the company were true, then the party was a mere licensee, and could be required to move at any time. The grant to the company being inconsistent with his right longer to maintain his fences on the highway, it was his duty to move off upon request of the company.

The party owned land on both sides of the highway, and the court holds that as to the private crossings which he had, he was entitled to recover such sum as would compensate him for the inconvenience or loss sustained by him between the time the crossings were injured by the company and the time it restored them, if it had done so. If his fences were upon the highway, he was not entitled to recover any damage by the acts of the company which would not have accrued to him had they been upon his own line, provided he had prior notice that the company needed that portion of the highway occupied by them for the enjoyment of its grant. If the cuts on the west side would not have undermined his fencing on that side had it been back on his own line, then he was not entitled to damage by reason of the cuts. If the fills on the east side would not have injured his fencing had it been back of his own line, then he was likewise not entitled to damage by reason of the fills. The electric roadway in question was not an additional servitude upon the highway, and he was not entitled to anything growing out of the fact that the company had constructed and was operating a line along the highway in front of his farm.

VALIDITY OF ORDINANCE REQUIRING AIR OR ELECTRIC BRAKES—JUDICIAL NOTICE TAKEN OF DESIRABILITY OF COMPELLING EQUIPMENT OF CARS WITH CERTAIN MEANS OF STOPPING—PREPONDERANCE OF ORAL TESTIMONY NOT DECISIVE—NOR LARGE OUTLAY REQUIRED—NOT PRESUMED ANY ONE WILL USE INEFFECTIVE ELECTRIC BRAKES

People vs. Detroit United Railway (Mich.), 97 N. W. Rep. 36. Nov. 9, 1903.

The question in this case was as to the validity of a city ordinance punishing the operation of cars not equipped with air or electric brakes. It was contended that this ordinance was invalid—First, because it could be said not to provide for brakes which would tend to lessen danger; second, because its enforcement would require an outlay large in comparison with the benefits which would result from the use of such brakes as were required by it. The object of this ordinance, the supreme court of Michigan says, was to compel the equipment of street cars with the means of stopping with certainty and expedition. The court may take judicial notice that this is desirable, for it is judicially cognizant of the fact that the use of street cars is necessarily attended by imminent danger to citizens who are upon the highway, as well as passengers. It is past controversy that the city may regulate the conduct of defendant's business to the extent of requiring reasonable safeguards against danger.

This ordinance, the court goes on to say, was in harmony with the statute which for many years has required the equipment of steam passenger cars with air brakes. Before the court should say that a similar requirement as to street cars is unreasonable, and therefore invalid, it should be made to appear clearly either that there is no necessity for a more efficient brake than a hand brake upon street cars, or that neither an air nor an electric brake would be such; and if the hand brake is not to be dispensed with, it would be necessary to show that such a car equipped with both would not be safer than with the hand brake alone. If it might be said that a preponderance of the oral testimony supported the view that this ordinance was unreasonable, the court thinks that would be insufficient to justify it in nullifying the ordinance. It was not improbable that the exact device used on large cars might not be adapted to use on a small one (especially where but one set of trucks was used) without some modification; but that was not shown to be mechanically difficult, and every one knows that such problems are being solved daily in the realm of mechanics.

The court does not feel called upon to say much about the claim that this ordinance should be held invalid upon the ground that it would require a large outlay, or that it took property without due process of law. It is too well settled, it says, that the state or city may enforce regulations clearly looking to the safety of the public, and reasonably adapted to such end to make it necessary. All property is held subject to the exercise of the police power.

It was also contended that the ordinance was invalid even if the air brakes could be said to be effective, because it did not designate between air and electric brakes, which last were said to be clearly shown to be ineffective. But the court thinks there was no force in this point. It says that it is not to be presumed that any one will use the latter under such circumstances. Defendant certainly is not required to.

Street Railway Parks in 1904.

In response to inquiries which were sent out by the "Review," a number of street railway companies which own or control parks have submitted briefly their plans as to improvements and additional attractions contemplated for the 1904 season, and they are presented herewith. In a good many instances there are no changes contemplated. In addition to furnishing this information, the majority of the companies made returns of the attendance at the parks last season, stating also the number of persons carried to the parks in the cars. Brief data are also submitted as to the sort of park attractions which have been found to pay the best, prices of admission, etc., and other information which may be helpful to street railway park managers in general. Of interest, also, are the reasons given for leasing or operating the parks, as the case may be, some companies preferring to lease, while others find it more advantageous to operate the parks themselves. In almost every instance, too, the manager reported as to whether the park is self-supporting, or whether its maintenance is charged to the railway traffic account. Following are the data obtained:

The Cincinnati (O.) Traction Co. controls the Cincinnati Zoological Garden through ownership of a majority of the stock of the Cincinnati Zoological Co. The attendance at the Garden last season was 400,000, of which, approximately, 390,000 were carried on the cars. The Garden attractions, aside from the animals, include daily afternoon and evening concerts during the summer. One fee admits to all, the charge for adults being 25 cents and for children under 12 years of age, 10 cents. Although the Garden is not run for profit, it being contrary to the by-laws to pay dividends, all profits to be expended on betterments, it is self-supporting. The Cincinnati Traction Co. took hold of the Garden to save it from financial depression, and may be said to have a twofold purpose in operating it, to uphold a widely-known public institution, and to maintain quite a large feeder. There are three lines of cars to the park the year round. On heavy days during the summer a special short line is run from the heart of the city, and a close headway is maintained on the regular lines. The Garden has never been leased. Next season the Garden company expects to build a new herbivora, or building for hay-eating animals, to cost $50,000, and will make other improvements. The business agent of the Garden company is Mr. Walter A. Draper.

The Cincinnati Traction Co. also owns the ground on which is located Chester Park, which is leased to Mr. J. M. Martin. The approximate attendance at Chester Park last season was 800,000, of which practically all were carried on the cars. The price of admission to the park is 10 cents and the charge for the numerous attractions is as a rule 5 cents. Arrangements for handling heavy park traffic are the same in nature as those made to handle the traffic at the Zoo.

The Saginaw Valley Traction Co., of Saginaw, Mich., owns and operates Riverside Park, the management being of opinion that it can control its parks to better advantage and with less trouble than by leasing them. No improvements are contemplated for next season, other than certain improvements to the vaudeville casino. The company charges 15 cents for a round-trip ticket, which includes admission to the park. Reserve seats are sold at the theater for 15, 10 and 5 cents. Last season the attendance was 150,000. With the five-cent admission charge at the gate, which is included in the round trip, the park is about self-supporting. All the park attractions pay, but the roller coaster is the most remunerative. No arrangements are made for handling the traffic, other than to put on extra cars as necessary. The park manager is Mr. L. W. Richards.

The Bay City (Mich.) Traction & Electric Co. owns and operates Wenona Beach and contemplates installing a roller coaster and a zoo for next season. The attendance at the beach last season was 170,000. The operating conditions are the same here as at Riverside Park, which is operated by the Saginaw Valley Traction Co., both the Saginaw and Bay City companies being under the same management. The park is likewise self-supporting.

The New Orleans (La.) Railways Co. owns West End, which is a park and lake resort, and it also runs to Athletic Park, which it does not own, and which is a base ball park, although last year there was an opera company there. The company finds it advantageous to lease the attractions at West End. Athletic Park is operated by a lessee, also. The attendance at West End last season was nearly 600,000, and at Athletic Park about 400,000, all being carried on the cars. The admission is free to both parks, a fee being charged to attractions at the base ball park. Last year the admission to the base ball park was 10 cents. The company makes a donation to the base ball fund every week. West End is principally a charge upon the railway traffic. There will be no additional improvements this year. At West End band concerts, vaudeville and vitagraph exhibitions form the leading attractions. To handle the traffic trains are run to West End, and there is a quick and close service to Athletic Park. The lessee and manager of West End is Mr. Joke Wells; the lessee of Athletic Park is the base ball league.

The Elgin, Aurora & Southern Traction Co., Aurora, Ill., owns Riverview Park, which it prefers to operate itself, especially as the attendance has to be promoted by the railway company. A number of improvements are contemplated for next season, such as a bathing pool, a large goldfish pool, a deer park and an addition to the zoo, besides a general improvement in small details. No record was kept of the attendance last year, there being no fee to the grounds, but practically all who visited the park were carried in the cars. It costs 10 and 15 cents to get into the theater, and the admission to the dance hall is 10 cents. There is a fine base ball park adjoining which is leased to the local club. The company has found that vaudeville and other theatricals do not pay very well, but dancing and refreshments are quite remunerative. Still, the park is practically self-supporting. To care for the heavy park traffic cars are run from, say, one car every half hour to three 12-bench open cars every 10 minutes. The manager of the park is Mr. W. C. Braithwaite.

The Elmira (N. Y.) Water, Light & Railroad Co., which owns and operates Rorick's Glen Park, will increase the seating capacity and build proscenium boxes at the casino this season, and will also add a number of side attractions at the park. The company prefers to operate its park, as it can better maintain a high standard of attractions and can operate the cars and park in conjunction to better advantage. The admission to the park is free to patrons of the road, and 600 seats in the theater are free; the reserved seats cost 10 and 15 cents. The attendance last season was 2,000 per day. The park is just about self-supporting. The theater, where light opera and musical comedy are given, pays the best. To handle the traffic the company runs trains of three cars, with two extra trains running as a section of a regular train. The company also carries a good many people to Eldridge Park, which is owned by the city. The company's park manager is Mr. Herbert Salinger.

The Savannah (Ga.) Electric Co. operates three pleasure resorts, known as the Casino, the Isle of Hope and Lincoln Park, the last named being for colored patrons. It leases the park buildings and privileges, but maintains the grounds and structures. The company also operates the vaudeville and light opera entertainments and out-door attractions. The approximate attendance last season was 85,000 persons, that being the number carried on the cars. The admission to the park is free, while a charge of 25 and 30 cents is made for the theater entertainments. The company endeavors to make each of the attractions self-supporting, except the music, but it reports that the parks are not quite self-sustaining. For handling heavy park traffic a 10-min. schedule is provided, with extra cars between the regulars. This year, at the Casino, the company will build a toboggan slide and a carousal and install a laughing gallery. The park lessee, who is also the park manager, is Mr. L. W. Nelson.

The International Railway Co., of Buffalo, N. Y., controls and

operates Olcott Beach, Olcott, N. Y., finding it advantageous to operate the park rather than to lease it, as in this way all attractions and concessions are directly under the company's control to regulate. No improvements are contemplated for next season. Last season the attendance was 300,000, all carried on the cars. The admission to the park is free to patrons of the railway, 10 cents being charged for persons who reach the park by other means. This charge, however, is more for the purpose of excluding boys and rowdies. No charge is made for the attractions, and consequently the maintenance of the park may be considered a charge on the railway traffic. All the features seem to be equally popular. There are a rustic theater, electric riding gallery, miniature railway, swings and other amusements. No extra provision in the park is required to care for the traffic, sufficient service on the railway being all that is necessary.

The Augusta (Ga.) Railway & Electric Co. owns and operates Lake View Park and Monte Sano Park, but leases its theater at the latter park. The company has found that it is less expensive to operate the parks itself. No additional features are contemplated for next season, but the company is already doing considerable repainting and repairing. The attendance at Lake View Park last season was 150,000; at Monte Sano Park, 60,000. The cars carried the entire attendance. The parks are free, but there is an admission to the theater of 25 or 35 cents, according to location of seats. At the theater vaudeville and light opera are the principal attractions. The most remunerative feature of the parks, however, are the fireworks. The parks are stated to be more than self-sustaining. The company's lines to both are double tracked. The lessee of the theater is Mr. Joke Wells; the manager of the parks is Mr. George H. Conklin.

The Philadelphia (Pa.) Rapid Transit Co., which owns and operates Willow Grove Park, situated at Willow Grove, Pa., does not contemplate installing new attractions this year, but will make the necessary repairs. The attendance at this park last year was about 3,000,000, or one-half of the number of persons that patronized the Willow Grove cars. The company finds it better to operate the park itself, inasmuch as it has complete control. There is no charge for admission to the park; the price of admission to the amusements is 5 and 10 cents. The park is eminently self-supporting and all the attractions pay, last season the "coal mine" taking the lead. To handle the heavy traffic extra cars are operated on the trolley line and extra trains are run on the steam road. Last year the heaviest day was the Fourth of July, when the estimated number of visitors was 175,000. The park manager is Mr. C. P. Weaver, 810 Dauphin St., Philadelphia.

The Tri-City Railway Co., of Davenport, Ia., and Rock Island, and Moline, Ill., controls two pleasure resorts, one being known as the Black Hawks Watch Tower, 2½ miles south of Rock Island, and the other as Prospect Park, which is situated outside of the southern boundary of Moline. The company finds it better to lease, as then the public does not expect so much and the railway management is relieved of the park business during the busy season. The admission to the parks is free. Last season the attendance at the Black Hawks Watch Tower was 70,000, of which 50,000 were carried on the cars, while the total attendance at Prospect Park was 120,000, of which 100,000 were passengers. The watch tower park is said to be the more remunerative; in winter the parks become a charge upon the traffic, but are self-supporting in summer. The heavy traffic is handled by extra cars. Nothing especial is planned in the way of improvements. The lessee and manager is Mr. J. W. Krell.

The Dartmouth & Westport Street Railway Co., of New Bedford, Mass., controls and manages Lincoln Park, the company preferring to operate its park to prevent fraudulent practices and to see that good order is maintained. The approximate attendance last season was 100,000, of which at least 80,000 were carried on the cars. The admission to the grounds is free and dancing, Punch and Judy shows and swings are free also. There is given open-air vaudeville, to which admission is charged and a charge of five cents is made for a ride on the merry-go-round. Refreshments are sold on the grounds and the returns show that the restaurant feature is the most remunerative. The park is not entirely self-supporting, however. To care for the traffic the company runs a sufficient number of extra cars during the hours when the travel to and from the park is heavy. No additional features are contemplated for next season. The manager of the park is Mr. I. W. Phelps.

The Dayton, Springfield & Urbana Electric Railway Co., of Springfield, O., owns and operates two resorts, Tecumseh Park and Silver Lake. It finds it more advantageous to operate, as the attractions and the car service may be better adjusted. For next season the company will build water chutes at both places, and will install a labyrinth at Tecumseh Park. The attendance last season was 250,000, of which 240,000 were patrons of the cars. No admission is charged to the park, but it costs five cents to sit in the grand stand, and five cents to ride on the miniature railway or the merry-go-round. Some of the attractions pay, the base ball games being the best drawing cards, but the park is a charge on the railway traffic. For handling the traffic the company runs a half-hourly service, and sometimes increases it to 15 minutes. The manager of the park is Mr. F. Ehring.

The Pittsburg (Pa.) Railway Co. leased its Kennywood Park last season, so this year it will operate only three parks—Calhoun, Oakwood and Southern—and it may lease the Oakwood Park to outsiders this season. In addition to the parks the company operates the famed Duquesne Garden. Last year the attendance at the different parks amounted to 200,000 persons, who were transported both ways on the company's cars. For accommodating the park traffic the company runs additional cars, trippers and trailers. Admission to the parks is free and the charge for the various attractions is 5 or 10 cents, as the case may be. The parks are good investments and more than self-supporting. This year, besides usual renovation, new novelties will be introduced and a specialty made of vaudeville shows, summer opera and the like. The company's park manager is Mr. A. S. McSwigan.

The Negaunee & Ishpeming Street Railway & Electric Co., of Ishpeming, Mich., controls and operates Union Park and Cleveland Grove, the most attractions being at the former, and the latter being especially desirable for picnics and dances. The company feels that it can control the tough element better by operating its own park. The attendance last season was 100,000, of which 75 per cent was carried on the cars. There will be no improvements to speak of this year. The admission to Union Park, where the base ball games are, is usually 25 cents, although some attractions are cheaper and some cost as high as a dollar. There is no cost for admission to the grove. To handle the traffic extra cars are run whenever needed. The manager of the resorts is Mr. H. F. Pearce, the superintendent of the company.

The Grand Rapids, Holland & Lake Michigan Rapid Ry., of Holand, Mich., owns and operates Jenison Electric Park and next season will add bowling alleys, a shooting gallery and a whirlpool to the attractions. The company prefers to operate the park, as it can then regulate the discipline of the park employes and the manner in which the attractions are operated. The admission is free and five cents is charged for the various attractions, except that the use of the dance pavilion is free. Last season the attendance was 200,000, the number carried on the cars being 150,000. All the attractions pay, but the Fig. 8 toboggan is the most remunerative. The park is self-supporting. To handle the park traffic additional summer cars are run. The manager of the park is Mr. Charles Floyd.

The Cincinnati, Dayton & Toledo Traction Co. owns Lindenwald Park and leases it, being of the opinion that the park business is separate from the railway business, or should be, and that the railway company can get the benefits just as well and escape the liability. Last season the attendance at the park was 150,000, of which 75,000 rode in the cars. This year the base ball park will be moved to the rear of Lindenwald Park, but no other improvement or additional attraction is contemplated. Admission to the park is free; the theater charges are 10, 15 and 25 cents. The theater supports the park and renders it self-supporting. To handle heavy traffic extra motor cars are run with trailers. The lessee and manager of the park is Mr. John Foster.

The Lynchburg (Va.) Traction & Light Co., which owns Rivermont Park, will improve the grounds and renew the flower beds this season, but contemplates no other improvements. It leases the casino in the park, but operates all the other features itself. Last season 250,000 patrons attended the park. There is no charge to enter the grounds, the only charge being that of the casino, which is 15 or 25 cents, according to location. The expense of

maintaining the park is carried to the railway operating account. The casino is the most remunerative feature. The number of cars operated varies with the attendance. The lessee of the casino is Mr. Joke Wells and the manager of the park is Mr. R. D. Apperson, president of the company.

The Binghamton (N. Y.) Railway Co. has two pleasure resorts, the Casino at Endicott, N. Y., and Ross Park at Binghamton. It contemplates putting in a miniature railway at Ross Park this year, and will increase the illumination facilities at the Casino. Last season the attendance at Ross Park was 300,000; at the Casino, 150,000. At least 75 per cent was carried on the company's cars. The company prefers to operate its own resorts, thereby controlling the policy. The admission to Ross Park is free; at the Casino five cents is charged for chairs. Both are practically self-supporting. The extra traffic is handled by increased car service. The park manager is Mr. J. P. E. Clark, general manager of the company.

The Pennsylvania & Mahoning Valley Railway Co., of New Castle, Pa., owns and operates Cascade Park, where the attendance last season was 250,000, all being patrons of the road. The company will not make improvements or secure additional attractions for next season. The company finds it more advantageous to operate its park for the reason that it has absolute control and can be more liberal in granting concessions. An admission of five cents is charged to the park, with 5 and 10 cents' admission to the attractions. The carousal and the roller coaster are the most remunerative attractions. The park is self-supporting. The company runs open cars and trailers especially for park traffic. The park manager is Mr. Perry Barga.

The Austin (Tex.) Electric Railway Co. owns Hyde Park, which it leases for the reason that the public thinks the railway company should provide free entertainments, whereas if others operate the park the people are willing to pay. A charge of from 10 to 25 cents, according to the attraction, is made. The company cannot operate Sundays on account of the location of the park, or it would be an unqualified success. As it is, the park is barely self-sustaining when leased. Novelties and Sunday crowds pay the best. For handling the traffic extra cars are run nights when the attendance is heaviest. The company does not expect to make any additions to the park this season.

The Olentangy Park Co., of Columbus, O., owns and operates Olentangy Park, theater and zoological garden, which serve to increase the street railway patronage appreciably, although the park company is entirely independent of the street railway companies. Last year the attendance at the park, etc., was 600,000, of which 500,000 were carried on the cars. This year it is proposed to install a giant circle swing, a palace of illusions, "House That Jack Built", "Old Mill", a big carousal and other attractions. The admission to the park is five cents; admission to the theater, 10, 20 and 30 cents. The park manager is Mr. J. W. Dusenbury.

The Colorado Springs & Interurban Railway Co., of Colorado Springs, Col., owns and operates Stratton Park, the principal entertainment features at which are band concerts and moving pictures. Last season the attendance at the park was 200,000, of which the cars carried 175,000 persons. The only charge is that for fare. To handle the traffic the company operates the tripper system, the cars running as often as needed, and they are then banked up for the rush home after the concert or moving pictures. There will be no additional features next season, and no improvements are contemplated. The manager of the park is Mr. C. Strubb.

The Kankakee (Ill.) Electric Railway Co. owns Electric Park, which it leases to show people to whom the company gives part of its car receipts and receives in return 300 free seats in the theater. The class of shows that pay the best are melodramas given by repertoire companies. The only charge is at the theater, where the prices are 10, 15, and 25 cents. In the seven weeks the theater was run last year there was an attendance of 30,000, all carried on the cars, principally at night. The company uses everything it has in the way of cars, and at times could use more. No improvements or changes are contemplated for next season. The managers report that the park and the entertainment show [illegible]

The Camden Interstate Railway Co., of Huntington, W. Va., owns three resorts: Cliffside Park, Boyd County, Ky.; Camden Park, Wayne County, W. Va.; Beechwood Park, Lawrence County, O. At Cliffside Park the company has a theater and finds it advantageous to lease it. The other parks have no theater and are not leased. There is no admission charged to any of the parks. The maintenance is charged to the railway operating account. The theater and the lunch stand at Cliffside Park are the only remunerative features. No additional attractions are contemplated this year. The lessee and manager of Cliffside Park is Mr. J. R. Gallick.

The Springfield (Mo.) Traction Co. has an arrangement with the owner of Doling's Park and Zoo, whereby the company pays part of the expense, leaving it to somebody else to manage the park. The attendance last season was 1,500 daily, of which the railway company carried 1,300. There is no admission at the gate, but the admission to the theater is 15 cents, and there is also a charge for other attractions. The park pays as a whole very well, the theater especially. There are no contemplated changes for next year. The traffic is cared for by means of extra cars during the season. The owner of the park is Mr. J. M. Doling; the manager is Mr. R. L. Doling.

The Roanoke (Va.) Railway & Electric Co. controls Mountain Park and Casino, the park being operated by the company and the Casino leased to what is known as the Wells Circuit, which provides the entertainments for a number of parks in the South. There is no charge for admission to the park; the admission to the Casino is 15 and 25 cents. Last season the attendance was about 500 per day, which was practically all carried on the cars. The company derives no revenue from the park, except from fares. The Casino draws the best and in the evening extra cars are put on to accommodate the traffic. The company will build a large dance pavilion for next season.

The Terre Haute (Ind.) Electric Co. last season had a casino, in which theatrical attractions were given, and a small park adjoining, in which practically no entertainments took place. The casino will be closed this season and a new park known as Lake View Park thrown open. The admission to the grounds will be free, and the usual prices will be charged to the attractions. The park has been leased, the railway company guaranteeing a weekly subscription. To care for the traffic the company will run as many extra cars as may be necessary. The lessee of the park is the Terre Haute Amusement Co., and the park manager is Mr. H. L. Breinig.

The Bangor, Hampden & Winterport Ry., of Bangor, Me., controls one park, known as Riverside Park, which it operates itself, believing that however few the attractions at the park, the patrons at least get a good ride for their money. A 10-cent fare is charged, which includes admission to the park, and by this means all the attendants are carried on the cars. Ordinarily the park traffic is easily handled by putting on 10 to 12 extra cars. The park a little more than pays for itself. The company does not contemplate improvements or additional attractions for next season. The park manager for the company is Mr. C. D. Stanford.

The Canton-Akron Railway Co., of Canton, O., controls two resorts known as Meyer's Lake and Springfield Lake. It operates the former and leases the latter. The attendance at both last season, all being carried on the cars, was 400,000. The admission to the parks is free, 5 and 10 cents' admission being charged to the various attractions. All the features pay, the boats being the most remunerative, and the parks are self-sustaining. Extra and special cars are run to care for the heavy park traffic. No improvements of consequence are noted for next season. The lessee of Springfield Lake is Mr. J. E. Hill.

The Bennington & Hoosick Valley Railway Co., of Hoosick Falls, N. Y., owns and manages Battle Field Park. Last season there was a large attendance, although there were no special attractions, and practically all who attended were carried on the company's cars. It is a popular place for excursions and picnic parties. The admission is free. The maintenance of the park is a charge on the railway traffic, wholly, there being no attractions for which admission could be charged. The manager for the company is Mr. E. H. Libby, superintendent. No extensive improvements are contemplated next season.

The Marlborough & Westborough Street Railway Co., of Westborough, Mass., owns Chauncey Park, which it leases. The attractions include a theater, to which the admission is 5 and 10

cents, and dancing, which is charged for at the rate of 5 cents per set. The admission to the park is free. No record was kept of the attendance last season, although it was large. The park is a charge upon the railway traffic. No improvements or new features are contemplated this season. Extra cars handle the extra traffic. The lessee of the park is Mr. James H. McGurn, and the managers are Mr. McGurn and Mr. H. C. Garfield.

The Ft. Wayne & Wabash Valley Traction Co., of Ft. Wayne, Ind., owns and operates Robison Park at Ft. Wayne; Boyd Park, between Peru and Wabash, Ind.; Spencer Park at Logansport, and Tecumseh Trail Park at La Fayette, Ind. This year the company purposes to install a Fig. 8 toboggan slide and a laughing gallery at Robison Park. There is no admission fee to the parks, and the admission to the theaters is 10, 15 or 25 cents. Vaudeville seems to take the best. The parks are about self-supporting. The traffic is taken care of by frequent car service on about two-minute headway.

The Pacific Electric Railway Co., of Los Angeles, Cal., while it does not operate any particular parks, has several resorts along the line which have been developed by private capital and which are excellent feeders for the company. The attendance at the beach resorts during the past year has been enormous. The two especial resorts in which the company is interested are Long Beach and East Lake Park. The approximate attendance last season was 3,000,000 people. To care for this traffic extra service is given on two or three-minute headway. The company contemplates no improvements this year.

The Frederick & Middletown Railway Co., of Frederick, Md., controls and operates a park at Braddock Heights. It finds it pays to operate the park, on account of the increased traffic due to free admission to the grounds and the attractions. Last year the company carried 40,000 passengers to the park. Dancing is one of the leading attractions and occasionally free entertainments are given. No improvements or additional attractions are contemplated for next year. The extra traffic is practically all at night, and extra cars handle it very comfortably.

The Montgomery (Ala.) Traction Co. last year established a pleasure resort at Pickett Spring, where one of the leading attractions is boating on the lake. This season, besides buying boats, a bowling alley, shooting gallery, merry-go-round and pool tables will be installed. The company purposes to retain the general control of the park, leasing a few privileges, only. Admission to the park is free, and the extra traffic is handled by extra cars. It being a new park, it cannot be stated whether it is self-supporting.

The Mobile (Ala.) Light & Railroad Co. owns and operates Monroe Park, and it contemplates the enlargement of the summer theater for next season, which will be the sixth season of summer opera. The admission to the park is free: the prices at the theater are 25 and 35 cents, and the admission to the laughing gallery is 10 cents. There are also a bowling alley, and a casino, where refreshments are sold. The casino pays best and the opera next, while the bowling alley and laughing gallery are also good drawing cards. The park is self-supporting, if the interest on the investment is excepted.

The Southern Light & Traction Co., of Natchez, Miss., owns and operates Concord Park, at which the leading attractions are base ball, horse racing and good vaudeville, these paying best in the order named. The price of admission to the park and the different attractions is from 10 to 50 cents, and the park just pays for itself. Last season the cars carried 5,000 persons to the park, that being the park attendance, of course, and extra cars and trailers were operated as required. There will be no additional improvements or attractions this year.

The Pittsburg, McKeesport & Connellsville Railway Co., of Connellsville, Pa., controls Olympia Park, near Connellsville, and leases it. The park is free to all, but the lessee charges for the amusement features. No improvements are contemplated for next season, except that the company will repair the walks and grounds. The road has a loop in the park and runs extra cars as needed. The park is self-supporting and is not a charge on the railway traffic. The lessee and manager is Mr. J. P. Harris, of Pittsburg.

The Western Ohio Railway Co., of Lima, O., controls McBeth Park, which it has heretofore operated, but which has been leased for the season of 1904. Last season 61,000 persons attended the park, of which 52,288 were carried on the company's cars. The attractions of the park include a theater. Admission to the park is free to patrons of the railway. The park has not been self-supporting, but a charge on the railway traffic. Special cars are run to accommodate the traffic. No changes or contemplated improvements are reported. The lessee of the park is Mr. J. Russ Smith.

The United Railways & Electric Co., of Baltimore, Md., owns and operates Gwynn Oak Park and Lakeside Park and contemplates making a number of improvements and providing additional attractions at both resorts for next season. Last season the attendance at each park aggregated 100,000, all carried on the cars. The company finds that park attractions pay, the carousal, perhaps, the best of all. Admission to the parks is free. The parks make money, as the manager expresses it. The traffic is handled by plenty of cars. The manager of the parks is Col. R. Hough.

The Concord Street Ry., of Concord, N. H., owns and operates Contoocock River Park. It is the north terminus of the line, being about one mile from Penacook village, or seven miles north of Concord. It is operated as an amusement park, and a steamboat line is operated upon the Contoocook River during the summer, in connection with the park. The park has a cafe, a dance hall, roller skating rink, open-air theater and a boat house. The park contains about 80 acres. This road is owned by the Boston & Maine Railroad Co.

The Berkshire Street Railway Co., of Pittsfield, Mass., owns and operates Berkshire Park, where free entertainments are given in the theater, and the admission to the park is free, also. Last season the cars carried approximately 100,000 fares to the park, the heavy traffic being handled by extra cars. The cost of maintaining the park is charged to traffic expense. No additional improvements or attractions are contemplated this coming season.

The Waterloo & Cedar Falls Rapid Transit Co., of Waterloo, Ia., owns and operates Sans Souci Park, the park being operated in conjunction with a summer hotel on the bank of the river. No admission is charged, hence the maintenance is a charge on the railway traffic. Band concerts and moving pictures are the most popular attractions in the park. There will be no improvements or additions this year. Extra cars care for the extra traffic. The manager of the park is Mr. C. D. Cass.

The Waupaca (Wis.) Electric Light & Railway Co. carried 25,000 persons last season to the Grand View Hotel, owned and managed by Mr. John D. Caughell, and to the Camp Cleghorn assembly grounds. Neither leasing nor operating these resorts, the company is put to no expense for their maintenance. When the traffic is heavy more cars are put on. It is estimated that 50,000 persons visit the resorts in question during the season on account of their natural attractions.

The Winnebago Traction Co., of Oshkosh, Wis., owns and operates Electric Park, where there was an attendance of 114,000 last season, all carried on the cars. The admission to the park is free. Bathing, boating, band concerts, electric fountain and minor attractions are provided and all are well patronized. The park is not quite self-sustaining, however. The traffic is handled by frequent service, the cars running in trains. Only a few minor improvements are contemplated this year.

The Kingston (N. Y.) Consolidated Railroad Co. owns and operates Kingston Point Park, for which the attractions for 1904 have been arranged. Last season the attendance at the park was 2,000,000, of which 500,000 were carried in the cars. No admission is charged, except on special occasions. The park is not self-supporting, but almost. The company prefers to manage it itself, so so as to keep the tone up to the standard.

The Wheeling (W. Va.) Traction Co. owns a picnic ground near Steubenville, on which are a bowling alley and a dancing pavilion. No entertainments are given by the company, but the grounds are thrown open for the general use of the public and picnic parties. No additional attractions are contemplated for next season. Mr. G. O. Nagle is general manager of the company.

The Grand Rapids, Grand Haven & Muskegon Railway Co., of Grand Rapids, Mich., owns and operates a pavilion at Fruitport, and also a bathing beach, bath houses and a pavilion at Highland Park, on the shore of Lake Michigan. The company sublets the lunch stand privileges. No charge is made to enter these parks.

The company does not contemplate any improvements or additional attractions for next season.

The Niagara, St. Catharines & Toronto Railway Co., of St. Catharines, Ont., owns Lakeside Park and leases certain privileges. For next season the company proposes to build a boat house and purchase some boats. The attendance last season was 200,000, of which 180,000 were carried on the cars. The park is self-supporting and not a charge on the railway traffic.

The Milford & Uxbridge Street Railway Co., of Milford, Mass., owns and operates Lake Nipmuc Park, and contemplates no additional improvements or attractions for next season. No admission is charged to the park, but five cents a set is charged for dancing and the admission to the theater is 5 or 10 cents, as the case may be.

The Stark Electric Railway Co., of Alliance, O., will open Lake Park this season for the first time, having leased it to the Lake Park Amusement Co. There is no admission charged to the park, but, of course, there will be a fee to see the attractions. The park manager is Mr. J. M. Blatt.

The Winona (Minn.) Railway & Light Co. owns and operates Bluff Side Park. It has no theater, but moving pictures, band concerts and the like draw well. No changes are contemplated this year, except that there will be a new park manager. Mr. A. C. Moser is general manager of the company.

The Syracuse (N. Y.) Rapid Transit Co. expects to make the same arrangements next season that it did last: At one end of the line, in the Valley Theater, there will be summer opera, and at the other end of the line, at Iron Pier Park, the company will have free vaudeville.

The Brantford (Ont.) Street Railway Co., which operated Mohawk Park a part of last season, intends to extend its track into the park this season and install a merry-go-round. No admission is charged to the park. The manager for the company is Mr. L. M. Swartz.

The Durango Railway & Realty Co., of Durango, Col., has purchased ground for a park, to be known as Animos Park, and set out some trees. Beyond this beginning, however, the company has not gone.

The Eastern Wisconsin Railway & Light Co., of Fond du Lac, Wis., which controls Lake Park and Van Dyne Park, reports that its park plans for 1904 have not been completed. The parks are self-supporting.

The Penobscot Central Ry., of Bangor, Me., runs to Beach Grove, which is owned and operated by private interests. The manager of the resort is Mr. F. A. Hunt. No contemplated improvements are reported.

The Atchison (Kan.) Railway, Light & Power Co. owns and operates Forest Park, where the attractions are music, moving pictures, vaudeville, base ball, dancing, etc. Everything is free except base ball. The park is self-supporting on account of the value of the stand privileges. Last season the cars carried 175,000 persons to the park, that being the approximate attendance. The company prefers to operate the park, believing that the standard of the attractions can be best conserved by so doing. To handle the heavy park traffic the number of cars are increased and a faster schedule adopted. The manager of the park is Mr. H. Tebbs.

The San Bernardino Valley Traction Co., of San Bernardino, Cal., owns and operates Urbita Hot Springs, which is not only self-supporting, but is a "money-maker" for the company. There is no admission charged to the grounds, but a charge of 5 cents is made for the merry-go-round, 25 cents for the baths and 25 cents per couple for dancing. All the attractions pay, the baths being the most remunerative. Last season the attendance was 75,000, of which 70,000 were carried on the cars. No additional improvements or attractions are contemplated for next season. To handle the traffic extra cars are run from San Bernardino, Redlands, Colton and Highlands. The manager of the resort is Mr. S. G. Randall.

The Cleveland & Southwestern Traction Co., of Cleveland, O., owns Puritas Springs Park, which it leases, and also runs to Chippewa Lake Park, which is owned by Messrs. Townsend & Hawley. The managements of both parks are going to put in a number of new attractions for next season. The company leases its park, because it nets it more money. Last season the company's cars carried [illegible] passengers to the parks. The admission to the grounds is free, and the various attractions, such as dancing and bowling, are the remunerative features. All the attractions pay, especially those named. To handle the traffic extra cars are run whenever necessary. The lessee and manager of Puritas Springs Park is Mr. J. E. Gooding, Middlefield, O.

The Oregon Water Power & Railway Co., of Portland, Ore., owns and operates Canemah Park, preferring to operate to better preserve order and maintain the park in such condition that it will be a desirable resort and attract the better classes. The privileges pay the expenses of the park, the most remunerative attractions being the pavilion and base ball. Last season the attendance was 50,000, of which the company's cars carried 40,000. The traffic is handled by means of plenty of motor cars with seating capacity for 56 persons each and double-truck trailers seating 75 persons each. No admission is charged to the park. There will be no improvements or additional attractions this year to speak of. The manager of the park is Mr. G. C. Field, assistant superintendent of the company.

Park Attractions.

Managers of parks and pleasure resorts where boating forms one of the chief diversions will be interested in the new catalog which has been issued by W. H. Mullins, of Salem, O., treating of stamped and embossed metal boats, it being Catalog No. 10. It contains 36 pages, 6 x 9 in., and is illustrated with 97 half-tone cuts showing the boats in use and otherwise, and on the cover is a handsome colored design which frames an idyllic boating scene. The Mullins boats are original in design, perfectly stiff, stanch and water-tight, of lightest draft, perfect model and practically non-sinkable and indestructible. They are called the most perfect pleasure and hunting boats ever devised, and it would pay park managers to investigate the claims set forth in this catalog.

Proposed Chautauqua for Plainfield, Ill.

The plans of Messrs. F. E. Fisher and H. A. Fisher, president and manager, respectively, of the Joliet, Plainfield & Aurora Ry., contemplate the establishment of a permanent Chautauqua resort at Plainfield, Ill., on the banks of the Du Page River, where there will be good boating and fishing, a commodious club house, tennis courts, golf links and other attractive features, and where a first-class hotel will be erected, in addition to a number of cottages. As soon as the line is completed from Plainfield to Aurora the matter will be pushed, and it is also proposed to put on a much faster service between Joliet and Plainfield and reduce the fare to make the trip popular.

Accidents.

February 21st a Winona (Minn.) Railway & Light Co. car and a Chicago, Milwaukee & St. Paul passenger train collided at Winona. The motorman was severely injured and the electric car was considerably damaged.

February 23rd there was a rear end collision between an electric and a steam train on the Broadway elevated road of the Brooklyn Rapid Transit Co's. line at Van Sicklen Ave., East New York, and six persons were badly injured.

February 28th a limited car and a special car of the Indianapolis Northern Traction Co. collided near Tipton. One passenger on the limited and a number of workmen who were on the special were injured.

The Electric Express Service.

"With the coming of the trolley car was created a transportation agency supplying the gap between the steam railway and the farmer's wagon. It is the electric express service. The cars are not decorated works of art, but they reach the farmer where he lives, put him in direct touch with the commercial world, carry for him to and from market, eliminate the question of bad weather and bad roads and put him on an equality in this respect with his urban neighbor. The express cars of this system cover all points within 75 miles of Detroit, agents and stations being within easy reach of all. The general distributing station is at Fifth and Congress, Detroit."—Extract from Detroit United Weekly, Issued by Detroit United Ry.

Handsome Convertible Cars for Hartford, Conn.

Among the most attractive appearing convertible cars ever built by the J. G. Brill Co. are two which were lately delivered to the Hartford, Manchester and Rockville Tramway Co., of Connecticut. Though this type of car is particularly adapted for city service, the populous district through which the 18-mile line of the tramway passes, necessitates frequent stops and a large number of cars operated on a schedule which calls for a comparatively short headway, and therefore the conditions are similar to those of city service. The company has 50 cars in use and does a thriving business in short hauls, and also carries many passengers to Hartford, the state capital, and one of the busiest manufacturing cities in New England. An attractive amusement park operated by the company adds largely to the business in summer.

The new cars will undoubtedly prove a valuable and popular acquisition to the equipment, as at any time they may be changed from closed to open, or vice versa. The illustration shows a car with a number of the sashes and panels raised into the roof pockets. With vestibules at either end and the car heated by electric heaters (one of which may be seen underneath a seat in the engraving), the car is ready for the severest winter weather. The flexible metal panels are composed of thin steel with air spaces between, which experience has proved a successful method of enabling the car to retain heat.

The length of the cars over end panels is 20 ft. 7 in. and over vestibules 30 ft.; from panels over vestibules 4 ft. 8½ in. Width over sills, including panels, 6 ft. 11¼ in. and over posts at belt 7 ft. 9 in.; sweep of posts 5 in.; height from the track to under side of foot of trolley base 10 ft. 9 in. From center to center of side posts is 2 ft. 7 in.; thickness of corner posts 3¾ in. and side posts 3⅜ in. The side sills are 5¼ x 6 in., plated on the outside by 6 x ⅝ in. steel, and end sills are 4¼ x 6 in. Six cane-upholstered, walk-over seats on each side, and single seats at the corners, accommodate 28 passengers. The interiors are finished in natural cherry with decorated birch ceilings, and the exteriors painted a rich dark-blue with gold striping and lettering. The track-scrapers, platform and conductor gongs, brake handles, draw-bars, sand boxes, angle-iron bumpers, and other patented specialties are of the builder's make. The cars are mounted on 21-E trucks, having a wheel base of 7 ft., 33-in. wheels, 3¾-in. axles and are equipped with two 25-h. p. motors.

BRILL CARS FOR HARTFORD, MANCHESTER & ROCKVILLE TRAMWAY CO.

Suit for Car License Fees.

February 23rd the supreme court of New Jersey dismissed the demurrer of the Jersey City & Bergen Street Railroad Co. and its lessors, the Consolidated Street Railroad Co. and the North Jersey Street Railroad Co., to the suit brought by Jersey City to recover $200,000 claimed to be due for car license fees which have not been paid since 1868. The suit will go to trial.

Two street car union members who took part in the disturbances during the strike on the Chicago City Railway Co. last November were indicted by the February grand jury at Chicago. About 25 indictments have been returned since December 1st, and all but one of the cases are pending. One has been tried and the accused convicted.

Financial.

The 1903 earnings of the Northern Texas Traction Co., of Ft. Worth, Tex., were $465,368; net earnings, $204,037. The gross earnings for January, 1904, were $37,880; net earnings, $2,828.

The earnings of the Columbus Railway & Light Co. for 1903 aggregated $1,500,000, an increase of $126,000 over 1902. For the six months ending Dec. 31, 1903, the gross receipts were $808,000.

The earnings of the Brooklyn Rapid Transit Co. for February increased $57,128, and from July 1st the increase in the gross earnings was $790,104.

The gross earnings of the Columbus, Delaware & Marion Electric Railway Co. for February were $8,737, an increase of $235 over January, 1904.

The financial statement of the Aurora, Elgin & Chicago Railway Co. for the eight months ending Jan. 31, 1904, shows a surplus in excess of bond interest, other interest and taxes of $34,366. The eight months covers the period of complete operation of the road.

The gross earnings of the electric railways in Canada last year amounted to $7,223,677, a gain of $737,239 over 1902. During the year 201 miles of road was built, the total mileage July 1, 1903, being 729 miles.

The annual report of the Indiana Union Traction Co. shows that the gross earnings for the last year were $1,118,952; operating expenses, $620,137; net earnings, $498,815; fixed charges, interest, taxes, licenses and dividends on preferred stock, $358,511; net income, $140,304.

The special meeting of the shareholders of the United Traction Co., Albany, N. Y., called for March 1st, to take action on a proposition to issue a mortgage of $6,500,000 upon the company's property and franchises, was adjourned until April 2nd.

The annual meeting of the Lake Street Elevated Railroad Co., Chicago, adjourned to March 3rd, was further adjourned until April 2nd. The time for receiving deposits of the road's securities under the reorganization plan has been further extended until April 5th.

The earnings of the Chicago & Milwaukee Electric Railway Co. for January were $8,175, against $5,464 for January, 1903. The gain is equal to 49.61 per cent. For February the gross amounted to $18,047, an increase of $7,403; operating expenses, $10,584, an increase of $4,767; net earnings $7,462, an increase of $2,636.

The Washington (D. C.), Alexandria & Mt. Vernon Railway Co's. gross earnings for 1903 amounted to $230,219; operating expenses, $139,700; net earnings, $90,518; surplus, $24,018, after paying a 2 per cent semi-annual dividend.

The Boston (Mass.) & Worcester Street Railway Co. reported for the six months ending Dec. 31, 1903, as follows: Gross earnings, $165,547; operating expenses, $80,715; net earnings, $84,331; interest (six months), $28,125; surplus, $56,706.

The Newton & Boston Street Railway Co., one of the Boston Suburban Electric Companies, recently petitioned the Massachusetts railroad commissioners for approval of a discontinuance of free transfers. It was stated that the company has been operating for 11½ years and paid no return on the investment; on the contrary, it has cost over $133,000 to keep the lines in operation during the past three years. Last year's gross deficit was $56,000, against $27,000 the preceding year. In 1898 the percentage of passengers riding on free transfers was 19.8; in 1903 it was 52.8 per cent.

The Waupaca (Wis.) Electric Light & Railway Co., which owns

and operates a five-mile street and interurban railway and an electric lighting plant at Waupaca, reported at its annual meeting as follows: Total income for 1903, $18,092; operating expenses, including taxes, insurance and maintenance account, $8,366; interest on bonded indebtedness, $2,040; net earnings, $7,687, or a little over 10 per cent on a capital of $75,000. The company has increased its capital to $125,000 and contemplates building extensions this spring. The officers were re-elected. Irving P. Lord is president and general manager.

SPRINGFIELD & XENIA TRACTION CO.

Plans have been completed for refinancing the Springfield & Xenia Traction Co. in the interest of bondholders. The bonded debt is about $500,000. It is proposed to issue to present bondholders 50 per cent in new bonds and 50 per cent in new stock, which will require a bond issue of $250,000. The total bond issue will be $300,000, leaving $50,000 to be sold for improvements. Before the plan can be put into effect the bondholders' committee will purchase the road at receiver's sale.

ST. LOUIS TRANSIT CO.

According to the annual report of the St Louis Transit Co. the earnings from operation and other income amounted to $7,295,847; operating expenses and taxes, $4,513,515; net earnings, $2,782,333; interest and rental, $2,845,120; deficit, $62,787. In 1902 there was a deficit of $268,083 and in 1901 a deficit of $525,630. The increase in earnings last year amounted to 13.07 per cent, while the increase in expenses amounted to 13.75 per cent. The increase in expenses is accounted for by the higher wages, increased cost of coal and higher prices for railway supplies. The increase in coal amounted to $99,575; the payroll increased $251,458. In balancing the damage claims of the past few years $97,000 was charged to "damage account," and a like ratio is to be so charged in the future. Taxes increased $33,747, the rate having been increased from $1.95 to $2.15 per hundred.

During the year the company carried 210,236,626 passengers, of which 63,090,679 were on transfers or passes. This compares with a total of 185,077,040 passengers in 1902 and 163,095,942 in 1901. Revenue passengers increased 12.46 per cent over 1902. During the year expenditures for necessary extensions and improvements aggregated $1,863,931. Contracts have been awarded for 450 new cars, 71 of which have been delivered, the rest to be delivered before the opening of the World's Fair. With its plans for concentrating the Exposition traffic the company expects to haul 60,000 passengers each way daily during the fair.

RUTLAND STREET RAILWAY CO.

The comparative statement of the Rutland (Vt.) Street Railway Co. for the six month ending December 31st follows:

	1902.	1903.	Increase.
Earnings from operation	$1,254,900	$1,320,480	$74,580
Net earnings	438,900	496,978	50,078
Total income	532,800	531,959	*841
Surplus	196,000	225,362	29,362

*Decrease.

LAKE SHORE ELECTRIC RY.

Following is the January statement of the Lake Shore Electric Railway Co., of Cleveland, O.:

	1903.	1904.	Decrease.
Earnings from operation	$36,988	$34,748	$2,240
Operating expenses	37,810	31,152	6,658
Net earnings	*822	3,596	4,418
Fixed charges	20,370	16,666	3,704
Deficit	21,193	13,070	8,123

*Deficit

The poor showing is accounted for by the floods at Tremont, mentioned in the "Review" for February. The company carried a total of [illegible] passengers in 1903.

SYRACUSE RAPID TRANSIT CO.

The Syracuse (N. Y.) Rapid Transit Co. reported for the seven months ending Jan. 31, 1904, as follows:

	1903.	1904.	Increase
Gross earnings	$433,109	$489,615	$56,506
Total net earnings	196,486	201,118	4,632
Surplus	63,311	68,117	4,806

The gross earnings for January of this year amounted to $67,171; net earnings, $24,630; surplus, $4,334.

TOLEDO RAILWAYS & LIGHT CO.

The Toledo Railways & Light Co. reported for January as follows:

	1903.	1904.	Increase.
Gross earnings	$125,493	$137,517	$12,024
Operating expenses	62,396	73,806	11,410
Net earnings	63,097	63,710	613
Fixed charges	39,458	41,312	1,854
Surplus	23,638	22,398	*1,240
Operating ratio	.4972	.5367	.0395

*Decrease.

The company was put to considerable extra expense on account of cold weather and floods.

LONDON STREET RAILWAY CO.

The London (Ont.) Street Railway Co. reported for 1903 as follows:

Earnings from operation	$172,085
Operating expenses	109,493
Net earnings	62,501
Net income	46,467
Dividends	26,906
Surplus	19,561

The total number of passengers carried was 4,375,075; transfers issued, 741,481; total mileage, 1,286,263 miles.

LOUISVILLE RAILWAY CO.

The statement of the Louisville Railway Co. for the year ending December 31st follows:

	1902.	1903.	Increase.
Earnings from operation	$1,771,887	$1,941,599	$169,712
Operating expenses	1,127,716	1,050,126	**77,590
Net earnings	644,171	891,473	247,302
Charges	333,880	*712,785	378,905
Net income	310,299	178,683	**131,616
Dividends	300,000	175,000	**125,000
Surplus	10,291	3,688	**6,603

*Includes taxes ($150,000), interest on debts and dividends on preferred stock ($482,785), depreciation on equipment ($50,000), and $30,000 set aside on account of judgment for back taxes. **Decrease.

DETROIT UNITED RY.

The Detroit United Ry. reported for January as follows:

	1903.	1904.	Decrease.
Earnings from operation	$312,984	$307,630	$5,354
Operating expenses	195,938	226,103	*30,165
Net income	117,046	81,527	35,519
Other income	8,161	3,810	4,351
Total income	125,207	85,337	39,870
Fixed charges	81,156	87,567	*6,411
Deficit	**44,051	2,730	*46,781

*Increase. **Surplus.

The heavy operating expenses were due to unusually severe weather conditions.

MONTREAL STREET RAILWAY CO.

The January snowstorms were estimated to cost the Montreal

Street Railway Co. nearly $25,000. Following is the company's statement for January:

	1903.	1904.	Increase.
Earnings from operation	$168,883	$182,386	$13,503
Miscellaneous earnings	3,260	1,322	*1,938
Total earnings	172,143	183,708	11,565
Operating expenses	110,611	131,487	20,876
Net earnings	61,532	52,221	*9,311
Fixed charges	16,516	16,482	*35
Net income	45,016	35,739	*9,276
Operating ratio	6540	7200	0660

*Decrease.

Interest on Montreal, Park & Island Railway Co. not included.

UTICA & MOHAWK VALLEY RY.

The Utica (N. Y.) & Mohawk Valley Railway Co. reported for the year ending December 31st as follows:

	1902.	1903.	Increase.
Earnings from operation	$141,331	$170,349	$29,018
Operating expenses	94,194	113,350	19,156
Net earnings	47,137	56,999	9,862
Other income	679	1,006	327
Charges	37,099	40,589	3,490
Surplus	10,716	17,416	6,700

The assets of the company are $7,959,032, including cost of road and equipment, $5,404,381; capital, $2,500,000; funded debt, $2,700,000; loans and bills payable, $2,239,879; profit and loss surplus, $361,696.

ELGIN, AURORA & SOUTHERN.

The statement of the Elgin, Aurora & Southern Traction Co. for January follows:

	1903.	1904.	Increase.
Earnings from operation	$33,254	$34,694	$1,440
Operating expenses	21,301	22,309	1,008
Net earnings	11,953	12,385	432
Charges	9,216	9,256	40
Net income	2,736	3,129	393
For seven months:			
Earnings from operation	$257,131	$276,955	$19,824
Operating expenses	147,012	162,339	15,327
Net earnings	110,120	114,616	4,496
Charges	63,514	64,374	860
Net income	46,606	50,242	3,636

Operating expenses include an accident appropriation equal to 2 per cent of gross receipts. Bonds purchased and held in sinking fund, $37,000.

INTERURBAN STREET RAILWAY CO.

Following are the comparative statements of the Interurban Street Railway Co. (N. Y.) for the quarter and six months ending December 31st:

QUARTER.

	1902.	1903.	Increase.
Earnings from operation	$5,500,061	$5,565,368	$65,306
Operating expenses	3,090,151	3,016,018	*74,132
Net earnings	2,409,910	2,549,349	139,439
Miscellaneous income	297,942	359,032	61,090
Gross income	2,707,852	2,908,382	200,529
Deductions	2,924,882	3,012,673	87,791
Deficit	217,029	104,291	112,737

*Decrease.

SIX MONTHS.

	1902.	1903.	Increase.
Earnings from operation	$10,871,752	$11,135,580	$263,827
Operating expenses	5,826,173	5,777,619	*48,554
Net earnings	5,045,578	5,357,960	312,382
Miscellaneous income	723,868	729,257	5,388
Gross income	5,769,447	6,087,218	317,771
Deductions	5,840,166	6,028,133	188,026
Surplus	**70,659	59,085	129,744

*Decrease. **Deficit.

CINCINNATI, NEWPORT & COVINGTON.

Following is the statement of the Cincinnati, Newport & Covington Light & Traction Co. for the year ending December 31st.

	1902.	1903.	Increase.
Gross receipts	$1,103,995	$1,224,352	$120,357
Operating expenses	442,153	499,888	57,735
Damages, taxes, rents, etc.	168,290	201,073	32,783
Total expenses	610,444	700,961	90,517
Net earnings	493,550	523,390	29,840
Fixed charges	255,873	252,760	*3,113
Net profit	237,677	270,630	32,953
Operating ratio	.4005	.4082	.0077
Same, including damages, etc.	.5529	.5725	.0196

Statement for January:

	1903.	1904.	Increase.
Gross receipts	$94,212	$99,320	$5,108
Operating expenses	40,098	42,993	1,995
Damages, taxes, rents, etc.	16,939	16,906	*33
Total expenses	57,037	59,899	1,962
Net earnings	36,275	39,421	3,146
Fixed charges	20,986	21,412	426
Net profit	15,288	18,009	2,721
Operating ratio	.4351	.4328	*.0023
Same, including damages, etc.	.6149	.6030	*.0119

*Decrease.

UNITED RAILWAYS & ELECTRIC CO.

The annual report of the United Railways & Electric Co., of Baltimore, for the year 1903 shows the gross earnings of owned and leased lines to have been $5,480,630, an increase of $439,354 over 1902; operating expenses, including insurance, $2,554,241, an increase of $302,108; fixed charges, $2,708,030, an increase of $70,914; net income from operation, $218,359, an increase of $66,332; other income, $90,374; total carried to surplus, $308,733; previously credited to surplus, $333,439; applied to reconstruction of tracks during the year, $424,313; balance, $217,858.

The earnings from operation of the Baltimore, Sparrows Point & Chesapeake Railway Co's. system amounted to $133,034; operating expenses, taxes and insurance, $53,735; fixed charges, $32,446; net income, $46,853; average surplus per month, $5,857.

The car miles run on the entire United Railways system amounted to 24,665,973; total number of revenue passengers, 110,235,977; number of transfers, 42,788,205. The operating ratio was 46.60 per cent.

From April to December the expenses were increased about $15,000 per month by advances in cost of coal and wages of motormen and conductors. The bonds of the Baltimore, Sparrows Point & Chesapeake Railway Co. have not been disposed of, so the United company has not entirely relieved itself from floating debt.

During 1903 the company did a great deal of reconstruction work on its city lines, and made extensive changes on other lines. The Annex power house, Pratt St., with its four 3,000-h. p. engines and generators, was completed, as were the sub-stations on Druid Hill Ave. and Nunnery lane. These sub-stations have, respectively, 2,000 h. p. and 7,000 h. p. The company removed from the subway district 365,513 ft. of overhead feeders.

The company paid for the maintenance of city parks $348,986. The total taxes paid amounted to over 15 per cent upon the net earnings of the city and county lines.

Accompanying the report is a postscript reciting facts in connection with the recent fire, such as a renewal of the arrangement with the Baltimore & Ohio R. R. for current from its power house pending repairs to the Pratt St. power house, and resumption of operation of the Preston St. power house, which, together with the Light St. and Falls road houses and the alternating machinery in the new Pratt St. power house, are now furnishing current to the system. While the original Pratt St. house was considerably damaged, also the lighter machinery therein, the three large tower engines and generators escaped with but little injury. Owing to the company's transmission lines throughout the subway district, which embraces

the burned district, having been placed in the subways, the damage was almost entirely confined to the destruction of poles and trolley wires.

NORTHERN OHIO TRACTION & LIGHT CO.

The 1903 report of the president of the Northern Ohio Traction & Light Co., Mr. H. A. Everett, was submitted to the stockholders at the annual meeting Jan. 16, 1904. It shows very gratifying results, especially in the lighting department, where the total gross revenue increased 19.4 per cent over 1902, and this in spite of the sharp competition in Akron, O., where the natural and artificial gas companies furnish gas to consumers at considerably reduced price from any other city. Following is a statement of the company's earnings for the year ending December 31st:

	1902.	1903	Increase.
Gross from all sources	$745,044	$882,276	$137,232
Operating expenses	410,793	482,575	71,782
Fixed charges	205,068	268,132	63,064
Railway gross earnings	653,567	773,035	119,468
Lighting gross revenue	91,477	109,241	17,764

The net income for 1903 was $131,569. The gross earnings of the railway department show an increase over 1902 of 18.3 per cent. The company's total bonded indebtedness is $7,500,000; this includes $260,000 of 4 per cent bonds in its treasury, which may be sold when additional funds are required.

The total mileage is 100.35 miles, as against 98.78 miles for 1902, the additional mileage covering an extension to Barberton and an extension of the Silver Lake line. An addition was made to the Cuyahoga Falls power house during the year by the installation of one 1,000-h. p. engine and a 500-kw. generator. Extensive repairs were made on the city's lines in Akron and on the A. B. C. division, a total of 15,640 ties having been renewed upon the latter line, and the line was reballasted. Grading has been completed and material purchased for a second track of 2½ miles on private right of way on this division.

There has also been completed what is known as the new "Gorge Bridge" over the Cuyahoga River in Cuyahoga Falls. This bridge, including the approaches, is about 3,300 ft. long and eliminates a number of dangerous grades and curves.

The company during the early part of 1903 bought 1,011 acres of coal property in Buffalo township, Noble County, for $38,007. It was purchased as an investment and to protect the company against shortage or advance in the price of coal. At the Akron power house a storage house for coal has been constructed, having a capacity of about 2,500 tons. Bottom dump cars are used. Considerable rolling stock was purchased last year also. The company has 370 stockholders of record.

Following is the comparative statement of the company for January:

	1903.	1904.	Increase.
Gross earnings	$58,787	$59,607	$820
Operating expenses	34,844	37,098	2,254
Net earnings	23,943	22,509	*1,434
Fixed charges	20,966	22,466	1,500
Surplus	2,977	42	*2,935
Operating ratio	.5927	.6224	.0297

*Decrease

There was a great deal of bad weather in January.

For the first 28 days of February the earnings from operation show a loss of $125 from February of last year. The miscellaneous earnings, however, show a gain of $1,551. The gain in light earnings should bring this up to $2,500 for the month. The passenger earnings in February were $44,728, compared with $43,176 for February of last year.

The Cooper Union, of New York City, after a legal fight lasting several years, has received in the state supreme court judgment in the sum of $130,000 against the Manhattan Railway Co., for damage to the institute building. It was claimed that the structure was weakened by the installation of the elevated road.

High Speed Cars for the Joliet, Plainfield & Aurora.

The American Car Co., of St. Louis, has lately finished four large combination passenger and smoking cars for the Fisher Construction Co. to be used on the line between Joliet and Aurora—one of the links of the extensive system connecting the important cities to the south and west of Chicago. Joliet is one of the most important railway centers in the state. The cars are built for high-speed service and are mounted on Brill 27-E trucks, capable of a speed rivaling that of the steam railroads.

As shown in the illustration, the cars have straight sides and are vestibuled at both ends, and although mounted on high speed trucks the arrangement is such that only single platform steps are required, the step being 17¾ in. from the rail and 14½ in. from step to platform. The cars seat fifty passengers, the capacity of the smoking compartment being twenty. The seats have high backs, are upholstered in leather and are 36 in. long. The aisles are 21½ in. wide, and the interior finish is quartered oak with ceilings of the same. Large plate glass windows are arranged for the lower sash to drop into window pockets, the upper sash being stationary. A toilet room of the standard character is situated at the partition between the passenger and smoking compartments and parcel racks on either side run the entire length of the car. The trim throughout is solid bronze.

AMERICAN CAR CO. HIGH SPEED CARS.

The length of the cars over end panels is 36 ft. and the length over crown pieces 46 ft. From panel over crown piece is 5 ft. and width over sills 8 ft. 8 in.; width over posts 8 ft. 9¼ in. From center to center of posts 2 ft. 8 in.; side sills are 5 by 8 in. of long leaf yellow pine, plated with ¾ by 8 in. steel. The end sills are 5 x 7 in. of white oak. Thickness of corner posts 3¾ in. and of side posts 3 in. The trucks have a wheel base of 6 ft., 33-in. wheels, and are equipped with two 38-h. p. motors each. The side frames are solid forged and the transoms are double bracketed with forged brackets made from single billets, an exceedingly substantial construction characteristic of the entire truck. The platform knees are reinforced with angle iron and angle iron bumpers mounted on the ends, and folding gates are provided at the entrances. The sand boxes and gongs, as well as the bumpers and gates, are of the Brill patented make.

The Mississippi Valley Traction Co. inaugurated a freight service between Moline and Watertown, Ill., last month, using combination cars. The rate for baggage freight is 25 cents for 100 lb. or less and 10 cents for every 100 lb. in excess of the amount.

A motorman employed by the Union Railway Co., of New York, was overcome by the cold February 20th and became unconscious. His hand was frozen to the controller handle. The car, which was going at full speed, was stopped by the conductor pulling the trolley pole from the wire.

To avoid delays in case of accident, the Georgia Railway & Electric Co., of Atlanta, has installed a new telephone system by which cars are directed and the train dispatcher notified when trouble arises or wrecks occur. There are 30 telephones in all, one being located at every junction point in the city and three on each of the suburban lines.

Street Railway Legislation for 1903.

Pennsylvania.

POWER TO CONTRACT AS TO USE OF POLES, ELECTRICAL CURRENT, AND OTHER SYSTEMS

No. 41 of the Laws of Pennsylvania of 1903 states that, Whereas, The multiplying of lines of poles and conduits and different systems of wires for conducting currents of electricity along the various roads and streets of this commonwealth is a source of annoyance and danger to the public, and of interference with the proper exercise of municipal functions; therefore, Section 1. Be it enacted, etc., That it shall and may be lawful for corporations, for what purpose soever formed, and lawfully using electrical current, within this commonwealth, to enter into contracts with each other for use of the same poles, wires and conduits, or for the purchase and sale of electrical current, or for the lease and operation of each others' systems, upon such terms and conditions as they may agree upon: Provided, That nothing in this act contained shall be construed to give to any company any rights to erect or maintain poles, wires or conduits upon any street or road not already so occupied, unless the consent of the local authorities shall have been first obtained.

Tennessee.

AUTHORIZES STEAM RAILROADS TO ADOPT ELECTRICITY AS MOTIVE POWER.

Chapter 59 of the Acts of Tennessee of 1903 provides that any company now or hereafter authorized to operate a railroad by steam, be empowered to adopt electricity as its motive power, whether such railroad be wholly or only partly in the state of Tennessee.

AUTHORIZES ELECTRIC RAILWAY COMPANIES TO OWN PARKS AND EXTEND TRACKS TO SAME.

Chapter 321 of the Acts of Tennessee of 1903 authorizes all electric railway companies chartered or operating under the laws of the state to purchase, own, and control public or private parks and to establish such rules for the use and government of the same as will not be inconsistent or contrary to the laws of the state. It further enacts that said electric railway companies may extend their tracks, and for this purpose, may acquire rights of way, by contract or condemnation, in manner and form as now prescribed by law, providing for the organization of such companies.

AUTHORITY TO ENGAGE IN ELECTRIC LIGHT, ETC., BUSINESS.

Chapter 406 of the Acts of Tennessee of 1903 provides that sections 6 and 13 of the Act entitled, "An Act to provide for the organization of corporations," approved March 23, 1875, being chapter 142 of the Acts of 1875, be so amended as that railroad and railway companies constructing, owning and operating with electricity "intersuburban" railroads, and street railroad companies, shall have and be invested with the following additional rights and powers, to-wit: To manufacture, generate and distribute electric light, electric heat and electric power for the purpose of supplying themselves and others; to construct, equip and own factories, plants, machinery and all appliances for the manufacture, generation and distribution of electric light, power and heat; to acquire, by purchase, lease or other lawful contract, electric plants, factories, machinery, equipments, and appliances, and rights, easements, licenses and franchises, necessary or convenient to manufacture, generate, distribute and sell electric light, power and heat; to supply and sell to others electric light, power and heat; to acquire, by purchase, lease or other lawful contract, water power, riparian and water rights, together with all such licenses and franchises, easements and privileges attached to, necessary or convenient to operate and use the same; and to have and possess all such other powers as shall be necessary to execute and perform the powers hereinbefore granted. But it is further enacted that whenever any railroad company or any street railroad company shall, under the authority of this act, acquire, by purchase, lease or other lawful contract, electric light and electric light and power, properties and franchises, and shall supply and sell to others light, heat or power, it shall pay all such privilege taxes as shall be levied and imposed on electric light and electric light and power companies.

Texas.

WHEN ELECTRIC CARS TO HAVE VESTIBULES.

Chapter CXII of the General Laws of Texas of 1903 makes it unlawful for any corporation or receiver operating a line of electric street railway in the state to require or permit the operation upon its lines of any electric car, other than train cars attached to motor cars, during the periods beginning November 15 and ending March 15 of each year, unless the forward end of such car is provided with a screen or vestibule which shall fully protect the motorman or other person directing the motive power by which such car is propelled from wind and storm. Provided, that when excursionists are visiting any city, summer or open cars without such vestibule or screen may be operated as specials in addition to regular service.

AUTHORITY FOR FORMATION OF INTERURBAN RAILWAYS.

Chapter CXXIX of the General Laws of Texas of 1903 amends article 642 of the revised civil statutes as heretofore amended, and which states the purposes for which private corporations may be formed, by adding thereto subdivision 61 to read: The construction, acquiring, maintaining and operating lines of electric railway between any cities and towns in this state for the transportation of freight or passengers, and may also construct, own and operate union depots, but no electric railway incorporated under this subdivision shall ever be exempt from the payment of assessments that may be legally levied or assessed against it for street improvements. Corporations created under this subdivision shall be and are authorized to exercise the right of eminent domain for the purpose of acquiring right of way upon which to construct their railway lines and sites for depots and power plants, upon the same conditions and in the same manner as railroad corporations are now required to do under the laws of this state; provided, that the electric railways incorporated under provisions of this act which shall engage in transporting freight shall be subject to the control of the railroad commission.

AUTHORIZES SALE OF ELECTRIC LIGHT AND POWER, ETC.

Chapter XLIV of the General Laws of Texas of 1903 amends subdivision 21 of article 642 of the revised civil statutes so as to provide that corporations may be organized for the purpose of constructing or acquiring, with power to maintain and operate, street railways and suburban railways and belt lines of railways within and near cities and towns for the transportation of freight and passengers, with power also to construct, own and operate union depots; and any such company using electricity as the motive power for the operation of its lines, shall have the right and authority to supply and sell electric light and power to the public and municipalities. But no street railway company shall ever be exempted from the payment of assessments that may legally be levied or charged against it for street improvements, and for the establishment of companies to buy, own, sell and convey right of way upon which to construct railroads; provided that all street and suburban railways engaged in transporting freight shall be subject to the control of the railroad commission. Any corporation here-

tofore organized under the general laws of the state and which now owns or operates with electric power any street or suburban railway within the state is authorized to supply and sell electric light and power to the public or to municipalities, and to acquire or otherwise provide the necessary appliances therefor; and may, by proceeding in the manner provided by existing laws, amend its articles of incorporation so as to expressly include such authority.

HALF-FARE PROVISION FOR CHILDREN AND STUDENTS.

Chapter CXVI of the General Laws of Texas of 1903 provides that all persons or corporations owning or operating street railways in or upon the public streets of any town or city in the state of not less than 40,000 inhabitants are required to carry children of the age of twelve years or less at and for one-half the charge or fare regularly collected by such persons or corporation for the transportation of adult persons; provided, that this act shall not apply to street cars carrying children or students to and from schools, colleges, or other institutions of learning, situated at a distance of one mile or more beyond the limits of the incorporated city or town from which said cars run. All such persons or corporations owning or operating street railways, shall sell or provide for the sale of tickets in lots of twenty, each good for one trip over the line or lines owned or operated by such person or corporation, at and for one-half the regular fare or charge collected for the transportation of adult persons, to students not more than seventeen years of age in actual attendance upon any academic public or private school, of grades not higher than the grades of the public high schools of the state, situated within or adjacent to the town or city in which such street railway is located. Such tickets are required to be sold only upon the presentation by the student desiring to purchase the same of the written certificate of the principal of the school upon which he is in attendance, showing that he is not more than seventeen years of age, is in regular attendance upon such school, and is within the grades hereinbefore provided. Such tickets are not required to be sold to such students, and shall not be used except during the months of the year when such schools are in actual session, and such students shall be transported at half fare only upon the presentation of such tickets. All such persons or corporations are required to transport children of the age of five years or less, when attended by a passenger of above said age, free of charge. All such persons or corporations are required to accord to all passengers referred to above the same rights as to the use of transfers issued by their own or other lines as are or may be accorded to passengers paying full fare. Any persons who shall misrepresent the age or grade of any person for the purpose of securing the reduced fare provided for shall upon conviction be adjudged guilty of a misdemeanor, and be fined not less than $25 nor more than $100.

Virginia.

TITLE OF ACT REGULATING GRANTING OF FRANCHISES.

Chapter 138 of the Acts of Assembly of Virginia of 1903 is entitled "An Act regulating the grant of franchises, et cetera, by cities and towns, and providing for the advertisement thereof and the public reception of bids therefor, and providing for the enforcement of the obligations of the grantees, grantors or owners of franchises, and providing penalties for the usurpation of or violation of the terms and provisions of franchises."

MOTOR CARS TO HAVE VESTIBULED FRONTS.

Chapter 218 of the Acts of Assembly of Virginia of 1903 amends a former statute on the subject so that all urban, interurban, and suburban electric railway companies are required to use vestibuled fronts on all motor cars run, operated or transported by them on their lines during the months of November, December, January, February, March, and April of each year; provided, that such vestibuled fronts need not be used on open summer cars run, operated or transported by them, during the months of November and April; and provided, that said companies shall not be required to close the sides of said vestibules, and any such company refusing or failing to comply with said requirement shall be subject to a fine of not less than $10 nor more than $100 for each offense.

Washington.

RELATING TO ELECTRIC RAILROADS AND RAILWAYS.

Chapter 175 of the Session Laws of the State of Washington of 1903 provides that the legislative authority of the city or town having control of any public street or road, or, where such street or road is not within the limits of any incorporated city or town, then the board of county commissioners of the county wherein such road or street is situated, may grant authority for the construction, maintenance and operation of electric railroads or railways upon, over, along and across any such public street or road, prescribing the terms and conditions thereof. On application being made to the board of county commissioners for such authority, it shall fix a time and place for hearing the same, and cause public notice thereof to be given, at the expense of the applicant, by posting notices in three public places in the county seat, and in at least one conspicuous place on the road or street or part thereof for which application is made at least thirty days before the day fixed for such hearing, and by publishing a like notice three times in some newspaper, the last publication to be at least five days before the day fixed for such hearing. In case any such railroad or railway is or shall be located in part on private right of way, the owner thereof shall have the right to construct and operate the same across any county road or county street which intersects such private right of way, if such crossing is so constructed and maintained as to do no unnecessary damage: Provided, That any person or corporation constructing such crossing or operating such railroad or railway on or along such county road or county street shall be liable to the county for all necessary expense incurred in restoring the same to a suitable condition for travel.

Every corporation incorporated under the laws of this or any other state or territory and doing business in this state for the purpose of operating railroads or railways by electric power, shall have the right to appropriate real estate and other property for right of way or for any corporate purpose, in the same manner and under the same procedure as is now or may hereafter be provided by law in the case of ordinary railroad corporations: Provided, That such right of eminent domain shall not be exercised with respect to any public road or street until the location of the electric railroad or railway thereon has been authorized in accordance with section one of this act.

Any corporation incorporated under the laws of this or any other state or territory for the purpose of constructing, owning or operating railroads or railways by electric power may lease or purchase and operate (except in cases where such lease or purchase is prohibited by the constitution of this state) the whole or any part of the electric railroad or electric railway, of any other corporation, together with the franchises, powers, immunities and all other property or appurtenances: Provided, That such lease or purchase is consented to by stockholders of record holding at least two-thirds in amount of the stock of the lessor or grantor corporation; and all such leases and purchases heretofore made or entered into by consent of stockholders as aforesaid are for all intents and purposes hereby ratified and confirmed, saving, however, any vested rights of private parties.

An Attractive Booklet.

The Northern Texas Traction Co., of Fort Worth, Tex., has issued an exceedingly attractive booklet of 24 pages, with illuminated covers, illustrating and describing the interurban line between Dallas and Fort Worth. The publication, which is of a convenient pocket size, contains among other interesting data the interurban time card, points for the guidance of passengers, details of some of the advantages to those living along the line, a map of the company's lines and numerous half-tone views, artistically assembled, showing scenes en route, principal buildings, special cars, Lake Erie at Handley and other points of interest.

DO assist ladies and children on and off the car at all times.—Buzzard's Bay Philosophy.

Modern Methods of Ballasting.

The accompanying illustrations show a method of ballast distribution on a large western system of railway which has been in use for many years and has proven very satisfactory. The material used is a fine grade of sandstone gravel ballast, the boulders and coarse stones being crushed as they come from the pit and then mixed with the fine gravel as the cars are loaded, so that the entire contents of the cars can be used and will run freely.

FIG. 1—LIGHT RUN OF BALLAST ON C., R. I. & P. SYSTEM. TWO CARLOADS DISTRIBUTED OVER [illegible] FT. OF TRACK.

The cars used are of the hopper-bottom, center-dumping type, entirely automatic in action, self-cleaning, and requiring no shoveling. The contents of these cars can be distributed over any given surface required, the flow of material into the track being regulated to a nicety, and either large or small quantities deposited as desired.

FIG. 2—HEAVY RUN OF BALLAST ON C., R. I. & P. SYSTEM. THIRTY-FIVE CARLOADS DISTRIBUTED OVER 2000 FT.

The rapidity of this work may be indicated by a statement from the train crew consisting of three men handling a train of 35 cars. They state that they have been able to unload this train, containing about 1,050 cu. yd. of gravel, distributing same over a distance of about 3,000 ft., making a double run, in just 36 minutes.

A great advantage offered by this method of distribution, in addition to dispensing entirely with shoveling, is that the spreader car clears and flanges the rails at the same time, allowing fastest trains to immediately follow the ballast train.

For street railway and interurban construction and maintenance a special car has been designed which is convertible from a center-dump ballast car into an ordinary flat car, having no sides, but having stake pockets so that stakes can be used and the car utilized for hauling rails, ties, bridge timber and all kinds of construction material.

FIG. 3—PLOW CAR DISTRIBUTING BALLAST AND FLANGING TRACK ON C., R. I. & P. SYSTEM.

This car is changeable from a flat car to a center-dump ballast car in 15 minutes, and does the same work as described and illustrated herewith. These cars have been found very well adapted for rapid interurban construction, showing great savings in time, labor and material.

Further information relative to either of above types of cars will be furnished by the builder, the Rodger Ballast Car Co., Chicago.

Baltimore Fire Through a Camera.

This is the title of a collection of photographs which show the principal ruins of the great Baltimore fire of February 7th, 8th and 9th last, and which have been bound in pamphlet form and have been sent by the Baltimore Car Wheel Co. to its customers and other friends with the compliments of the company. The views were taken by Jack Hamment, a well-known newspaper artist and war correspondent, and the compilation was designed and published by the A. B. Benesch Co. for the Illustrated Press Syndicate, of New York City. The series of views, which are half-tones, is prefaced by a brief description of the fire by the author, who also points to several salutary lessons which may be drawn from the disaster. The views are so excellent that the reader really becomes a spectator, as the author intends. As will be remembered, the flames destroyed nearly 40 city squares, including about 2,000 buildings. The album, as it may properly be called, contains 28 views 6 x 8 in., including that on the cover; 8 large photographs, 6 x 15½ in., and 8 views 3 x 4 in. in size. There is also a map showing the burned district, and a portrait of the author in war-correspondent costume. The whole is printed on heavy, embossed paper.

The Schenectady Railway Co. will install a telephone system on its Troy and Albany lines. Each car will be equipped with a telephone and in case of accident or delay all that will be necessary will be to attach a hook to each of the telephone wires alongside the track and connection may be made with headquarters.

Detroit United Railway's Large Snow Plows.

We present herewith illustrations showing the large snow plows which were effectively employed by the Detroit United Ry. on its Rapid Ry., Flint, Pontiac, Orchard Lake and Wyandotte divisions during the past winter, the photographs being taken immediately after one of the recent big storms. These plows were designed

SNOW PLOW CLEARING SECTION OF TRACK

by Mr. J. Kerwin, the superintendent of tracks, and were built at the company's track department shops. By referring to the illustrations, it will be noted that there are two vertical air cylinders in front of the vestibule connected by a large bar, and it will be further seen that the plow is connected to this bar by means of rods with turn-buckle adjustment, the object of the turn-buckle being to enable the plow to be adjusted so that only half its weight rests on the track. The plow when fully hoisted from the track by the air is about six inches from the rails. The rear part of the side bar which a part of the plow frame is pivoted near the middle of the car.

The side wings are about 18 ft. long and are pressed outward by a wheel located at the rear of the vestibule, having an outward movement of about 8 ft. There is a rudder on the nose of the plow for taking the snow from the double strip between the two tracks, and it can be set to the right or the left by a lever on the top of the plow. All gates and highway crossings on the line are marked by means of posts and when the operator of the plow comes to one of these markers he raises the plow about two inches, and when he is sure that he is on the crossing he drops it immediately upon the rail. The boxes that are shown on the back of the car contain sand and salt. One of the photographs shows one of the plows clearing a track on the Pontiac division, where the snow was about three feet deep.

Each car and plow combined weighs about 24 tons. Each is equipped with four G. E. 57 motors and an air compressor. These cars are also used as locomotives for hauling heavy freight.

Warren, Cortland & Jefferson Ry.

The Warren, Cortland & Jefferson Traction Co., of Cortland, O., is one of the newest interurban propositions in that state. It was promoted by Mr. C. G. Phillips, the general superintendent of the company, who obtained for the road a private right of way 30 ft. in width for the entire distance of 40 miles. A local bond issue of $100,000 was disposed of at par along the line among the farmers and the citizens in the villages through which the road will pass. The road will start from Warren, where it connects with the Pennsylvania & Mahoning Valley Railway Co., and run in a northerly direction, passing through a number of villages with populations ranging from 500 to 1,500, it being a fine farming section. Twenty miles from Warren it crosses the Cleveland & Sharon Traction Co., and at the northerly terminus it connects with the Ohio & Pennsylvania Traction Co., which 10 miles further on enters Ashtabula. For a distance of 30 miles there is no steam road within 10 miles of the new line on one side, nor within 8 miles on the other. At the termini it will draw from Warren and Niles, and from Jefferson and Ashtabula, and it will do all kinds of freight hauling as well as passenger traffic. All the franchises have been secured and the bonds are practically sold. It is expected that the road will be in operation by September 1st next. It will be built on steam road lines by the Eastern Construction Co. A park will be established near Middlefield, O. The president of the company is Mr. B. F. French; secretary and treasurer, Mr. W. C. Pomeroy.

Berlin Passenger Traffic.

Mr. Frank H. Mason, consul-general at Berlin, Germany, writes that most of the Berlin city lines are the property of the Grosse Berliner Strassenbahn-Gesellschaft, which carried last year 316,000,000 passengers, an increase of 18,000,000 over the previous year. It received as fares 28,903,833 marks ($6,879,722), an average, including commutation and all other tickets, of 2.17 cents per fare. Within the city limits the uniform fare for any distance is 10 pfennigs (2.5 cents), but there are no transfers issued. From the central portions of the city to the suburbs the fare is 2.5, 4 and 5 cents, according to distance, with a slight discount for commutation tickets. Out of a total city and suburban population of 2,500,000 the company's lines carry an average of 865,000 passengers per day.

The electric elevated and underground railway carried 29,473,355 passengers, the receipts being 3,557,785 marks ($846,752), or an average of 3 cents for each person.

SNOW PLOWS OF THE DETROIT UNITED RY.

The Canton-Akron Railway Co. has adopted the plan of having the employes meet with the officials once a month for the purpose of discussing matters pertaining to the operation of the system.

Beginning March 1st about 900 employes of the Interborough Rapid Transit Co., New York, who are employed on the elevated division, receive an advance in wages of 10 cents per day for one hour less work than formerly.


ELECTRIC RAILWAYS
IN
OHIO
SCALE
COMPILED
by the
ARNOLD ELECTRIC POWER STATION CO.
Engineers. Contractors.
CHICAGO.
MICHIGAN
LAKE ERIE
TOLEDO
CLEVELAND
COLUMBUS
DAYTON
CINCINNATI
SPRINGFIELD
ZANESVILLE
NEWARK
AKRON
CANTON
YOUNGSTOWN
MANSFIELD
LIMA
SANDUSKY
MARBLEHEAD
LORAIN
ELYRIA
NORWALK
FREMONT
TIFFIN
FINDLAY
BUCYRUS
MARION
DELAWARE
MARYSVILLE
URBANA
PIQUA
TROY
SIDNEY
HAMILTON
PORTSMOUTH
CHILLICOTHE
LANCASTER
CIRCLEVILLE
WASHINGTON
GREENFIELD
HILLSBORO
PAINESVILLE
ASHTABULA
CONNEAUT
NEWCASTLE
SHARON
STEUBENVILLE
MARIETTA
PARKERSBURG
GALLIPOLIS
IRONTON
ASHLAND
COVINGTON
NEWPORT
RICHMOND
FORT WAYNE

The Latest Ohio Electric Railway Map.

On the opposite page is reproduced the latest map showing the electric railway systems of Ohio. This map was compiled by the Arnold Electric Power Station Co., of Chicago. It is far more complete than any Ohio map which has been published and shows more interurban systems in operation, under construction or proposed. The bulk of the information from which it was made up was authorized by the companies and has been verified.

Of the systems shown one which calls for especial attention is that of the Scioto Valley Traction Co., which is practically completed between Columbus, Lancaster and Circleville, and will be in operation by or before the middle of April. This will be the first third-rail road operated in Ohio. Since the map was compiled word has come to hand that the Marion, Bucyrus & Tiffin Traction Co. will be financed by the Municipal Bond & Securities Co., of Cincinnati, and the line will be built this season. The Newark-Zanesville division of the Columbus, Buckeye Lake & Newark Traction Co. has been completed and the road turned over to the company. It is now in operation. The Cincinnati, Milford & Loveland Traction Co's. line between Cincinnati and Milford was opened to traffic, also.

Following are the companies which already operate in Ohio, or are building their systems, or propose to build in the near future, the attached numerals corresponding to the numbers given on the map:

1 Barnesville & Woodsfield Electric Railway Co.
2 Buckeye Traction Co.
3 Camden Interstate Railway Co.
4 Canton-Akron Railway Co.
5 Canton-New Philadelphia Railway Co.
6 Cincinnati & Columbus Traction Co.
7 Cincinnati, Dayton & Toledo Traction Co.
8 Cincinnati, Georgetown & Portsmouth Railroad Co.
9 Cincinnati, Lawrenceburg & Aurora Electric Railway Co.
10 Cincinnati Interurban Co.
11 Cincinnati, Milford & Loveland Traction Co.
12 Cleveland, Chardon & Meadville Railway Co.
13 Cleveland, Painesville & Ashtabula Railroad Co.
14 Cleveland, Painesville & Eastern Railroad Co.
15 Cleveland & Sharon Traction Co.
16 Cleveland & Southwestern Traction Co.
17 Columbus, Buckeye Lake & Newark Traction Co.
18 Columbus, Delaware & Marion Electric Railroad Co.
19 Columbus, Grove City & Southwestern Railway Co.
20 Columbus, London & Springfield Railway Co.
21 Columbus, Marysville & Bellefontaine Railway Co.
22 Columbus, New Albany & Johnstown Traction Co.
23 Conneaut & Erie Traction Co.
24 Conneaut & Southeastern Railway Co.
25 Dayton, Covington & Piqua Traction Co.
26 Dayton, Germantown & Middletown Traction Co.
27 Dayton & Kenton Traction Co.
28 Dayton & Muncie Traction Co.
29 Dayton & Northern Traction Co.
30 Dayton & Troy Electric Railway Co.
31 Dayton & Western Traction Co.
32 Dayton & Xenia Transit Co.
33 Dayton, Springfield & Urbana Electric Railway Co.
34 Delaware & Magnetic Springs Railway Co.
35 Eastern Indiana Traction Co.
36 Eastern Ohio Traction Co.
37 Fairfield Traction Co.
38 Felicity & Bethel Railroad Co.
39 Fort Wayne & Northeastern Traction Co.
40 Fort Wayne, Van Wert & Lima Traction Co.
41 Hamilton, Eaton & Richmond Traction Co.
42 Hocking Valley Railway Co.
43 Indiana & Ohio Air Line Traction Co.
44 Indianapolis & Cincinnati Traction Co.
45 Interurban Railway & Terminal Co.
46 Lake Erie, Bowling Green & Napoleon Railway Co.
47 Lake Erie & Southern Traction Co.
48 Lake Shore Electric Railway Co.
49 Lebanon & Franklin Traction Co.
50 Lorain Street Railway Co.
51 Mansfield & Eastern Traction Co.
52 Maumee Valley Railways & Light Co.
53 Mt. Vernon Electric Railway Co.
54 Muncie & Portland Traction Co.
55 Northern Ohio Traction & Light Co.
56 Ohio & Indiana Railway Co.
57 Ohio & Michigan Traction Co.
58 Ohio Northern Traction Co.
59 Ohio River & Columbus Traction Co.
60 Ohio River Electric Railway & Power Co.
61 Ohio River & Western Railway Co.
62 Parkersburg & Marietta Interurban Railway Co.
63 Pennsylvania & Mahoning Valley Railway Co.
64 Pennsylvania & Ohio Railway Co.
65 People's Gas & Electric Co.
66 People's Rapid Transit Railway Co.
67 Perry Electric Railway, Light & Power Co.
68 Salem & Eastern Electric Railway Co.
69 Sandusky, Monroeville, Bellevue & Norwalk Railway Co.
70 Sandusky, Southwestern Railway Co.
71 Scioto Valley Traction Co.
72 Springfield, Troy & Piqua Electric Co.
73 Springfield & Washington Traction Co.
74 Springfield & Xenia Traction Co.
75 Stark Electric Railway Co.
76 Steubenville, Mingo & Ohio Valley Traction Co.
77 Steubenville Traction & Light Co.
78 Tiffin, Fostoria & Eastern Electric Railway Co.
79 Tiffin & Port Clinton Railway Co.
80 Toledo, Bowling Green & Southern Traction Co.
81 Toledo & Chicago Interurban Railway Co.
82 Toledo, Columbus & Cincinnati Railway Co.
83 Toledo, Fostoria & Findlay Railway Co.
84 Toledo & Ft. Wayne Electric Co.
85 Toledo & Indiana Railway Co.
86 Toledo & Monroe Railway Co.
87 Toledo & Norwalk Electric Railway Co.
88 Toledo, Port Clinton & Lakeside Railway Co.
89 Toledo & Western Railway Co.
90 Tuscarawas Traction Co.
91 United Electric Co.
92 Urbana, Mechanicsburg & Columbus Electric Railway Co.
93 Warren, Cortland & Jefferson Traction Co.
94 Western Ohio Railway Co.
95 Wooster & Mansfield Railway Co.
96 Youngstown & Sharon Street Railway Co.
97 Zanesville, Adamsville & Coshocton Railway Co.
98 Zanesville & Southern Ohio Railway Co.
99 Ohio Central Traction Co.
100 Portsmouth Street Railroad Co.
101 Youngstown & Southern Traction Co.
102 Consolidated Co.
103 Cleveland, Ashland & Mansfield Electric Railway Co.
104 Cleveland, Wooster, Mt. Vernon & Columbus Railway Co.
105 Mansfield, Mt. Gilead & Delaware Electric Railway Co.
106 Mansfield & Mt. Vernon Railway Co.
107 Bucyrus, Upper Sandusky & Lima Traction Co.
108 Miami & Lake Erie Canal Transportation Co.
109 East Liverpool & Wellsville Street Railway Co.
110 Steubenville & Wheeling Traction Co.
111 Gallipolis-Point Pleasant Ry.

A. S. R. A. Executive Committee Meeting.

Eight members of the executive committee of the American Street Railway Association, including President Ely, met at the Waldorf-Astoria, New York City, February 29th and March 1st, and discussed, among other things, the next meeting place of the Association. A number of cities were considered, but no definite decision was reached. Matters progressed so far, however, that an announcement may be looked for very soon.

The Cincinnati Street Railway Co. has refused to carry letter carriers for the old contract price of $6,000 per annum, and has demanded $15,000 to renew the contract. The government is experimenting with a system of supplying tickets to carriers.

Single Phase Railroads.*

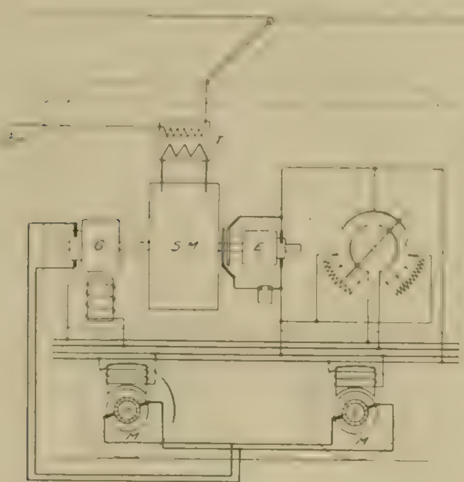
BY W. A. BLANCK.

The present activity in the evolution of the single phase railway motor gives new interest to the problem of developing and perfecting all the details of the single phase system and the consideration of the fundamental characteristics of the motors, some details in the construction of the line, and a noticeable decrease in the cost of a typical line with high voltage trolleys and static transformer stations will be the subject of this paper.

The first question of importance is the development of a single phase alternating current motor which will operate satisfactorily under the conditions imposed by railroad service. A short account of the present state of the art follows.

Synchronous Motor.

Since the synchronous motor requires a separately excited field, has no starting torque and cannot be run at variable speed its direct application in railway traction is impossible. It has been proposed by Ward Leonard to use the synchronous motor in combination with a direct current generator, the latter to furnish direct current



LEONARD SYSTEM.

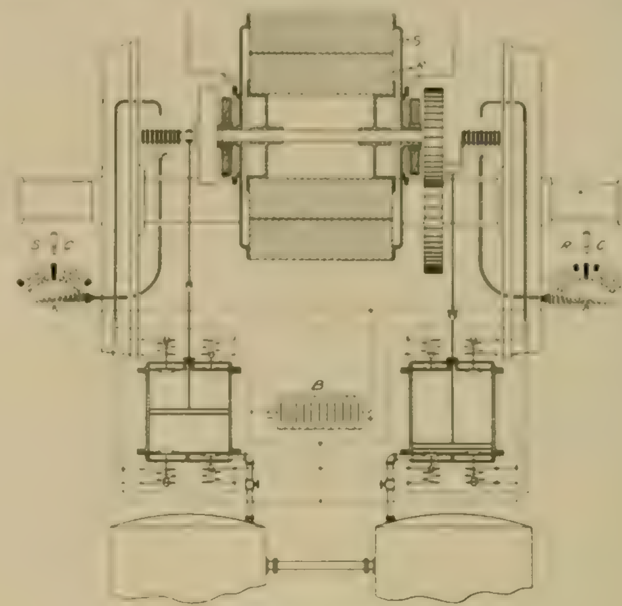
to the standard axle motors, as shown in the illustration which is lettered so as to be self explanatory.

Induction Motor.

The induction motor shows the same peculiarity in respect to starting and speed control as the synchronous motor, but to overcome these B. J. Arnold proposes a suitable combination of the induction motor with a mechanical storage battery consisting of an air compressor and tank. The general arrangement of this scheme is shown herewith. Both parts of the motor are free to rotate and maintain a constant relative speed. The rotor is geared to the axle and also connected to one air cylinder. The stator is connected to a second air cylinder in which the air is compressed when the car is running at less than full speed. At full speed the stator is at rest and no compression work is done. By admitting air to this cylinder and rotating the stator in the same direction as the rotor the car can be run above synchronous speed. This combination with the induction motor continually running makes it possible to store energy when the car is coasting or at rest and to utilize this energy during acceleration. It also permits of the operation of the car by compressed air alone for a limited period.

Series Motor.

The alternating current series motor, as proposed by Lamme and Finzi, made by the Westinghouse company, possesses all the characteristics of a direct current series motor and is directly applicable to railroad work. As shown in the accompanying illustration the current passes in series through the field and armature, the latter being of the drum type with commutator. As the direction of rotation in the ordinary direct current motor is not dependent on the direction of the current, it is seen that this will operate with alternating as well as with direct current. Since the series commutator motor cannot be operated at high voltage, it is necessary to use



ARNOLD SYSTEM.

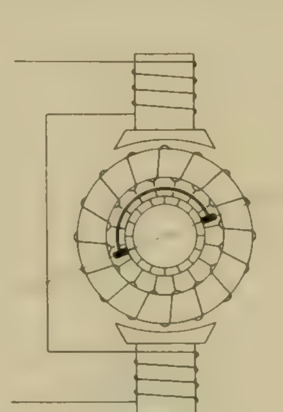
a step-down transformer in connection with a high tension trolley circuit, thus increasing the weight of the car equipment.

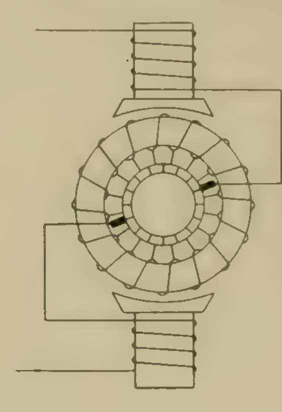
Repulsion Induction Motor.

The repulsion induction motor developed by Steinmetz and Schuler, made by the General Electric Co., shows about the same performance as the series motor and can be fed directly from the high tension trolley since, as indicated in the illustration, the armature is independent of the field. The current is induced in the armature by transformer action and can be of any desired voltage. The brushes are short circuited and are placed at an angle that will give best running conditions.

Repulsion Series Motor.

The repulsion series motor developed by Winter and Eichberg, and built by the Union Electric Co., of Berlin, Germany, is similar to the repulsion induction motor with the addition of a second set





LAMME-FINZI SYSTEM. STEINMETZ-SCHULER SYSTEM.

of brushes displaced 90° from the short circuited brushes, as shown herewith. Through these brushes current is supplied by a series transformer for the purpose of decreasing the sparking at less than synchronous speed and at the same time of raising the power factor nearly to unity.

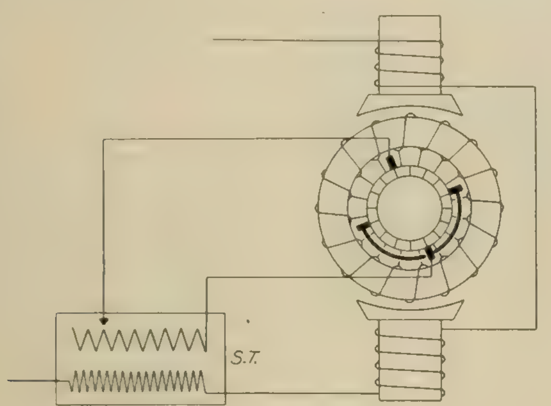
Controllers, Car Wiring, etc.

In general, the operation of the last three motors is effected by master controllers operating suitable contactors. Induction regula-

*Abstract of a Paper Read Before the Cincinnati Branch of the American Institute of Electrical Engineers.

tors are used in all three cases to secure the voltage variation necessary for speed control, thus avoiding the losses consequent to the rheostatic control of the direct current system. To avoid danger from the high potential used it is necessary that the car wiring should be in metallic conduit. This should be connected to the trucks so that any defects in the insulation of the circuit will result in tripping the automatic circuit breakers. The steps and hand rails should also be insulated to guard passengers from shocks which might result from wet weather or the car standing on a dirty rail.

On account of the serious results which would follow the slipping of the trolley pole, so common in the present system, a suitable bow should be used instead. This bow should be of such a length that no manipulation will be necessary in reversing the car. It should be mounted on a well-insulated platform which also supports the spring necessary to maintain the pressure between the bow



WINTER-EICHBERG SYSTEM.

and the trolley wire. A small air cylinder mounted on the same platform, operated by compressed air from the brake system, should be so connected as to draw the bow down on the roof of the car when necessary. The contact part of the bow can be made either of soft copper or aluminum and the necessary lubrication accomplished by grease applied in a slot extending the length of the bow. The bow trolley used on the Valtelina road in Italy, with a working pressure of 3,000 volts, consists of copper cylinders rolling in insulated ball bearings. Brushes take the current from these cylinders to the steel tubes carrying the contact piece.

Trolley Line Construction.

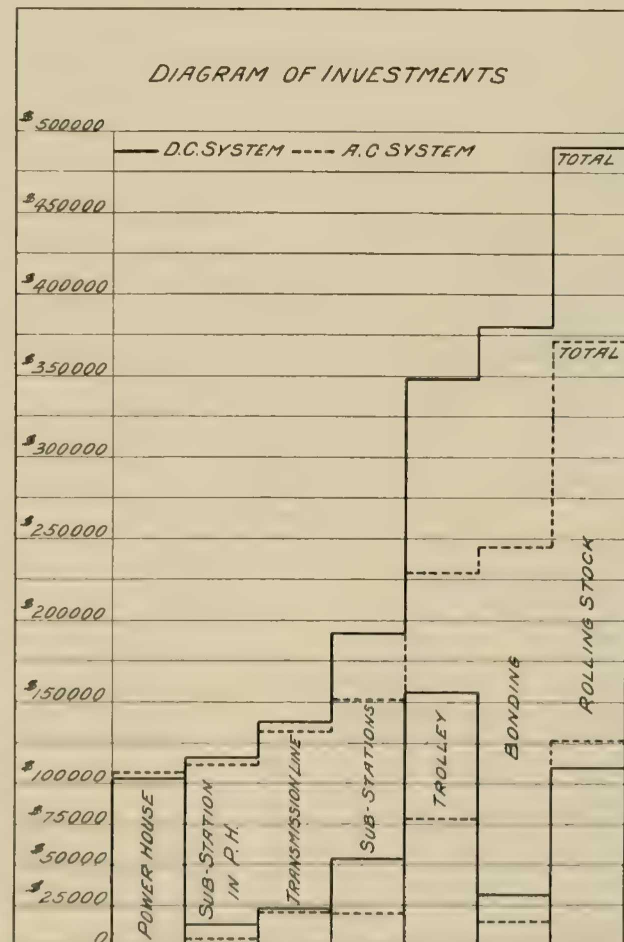
Great care must be given to the construction of a high tension trolley line in order to avoid damage to life and property, but there is no reason why these lines should not be made as safe as the high tension distributing systems of lighting companies now so common on public properties. It is of first importance to provide such a hanger as shall readily withstand the working pressure of the system and can be easily replaced in case of defect. The construction used on the Lansing-St. Johns road, in Michigan, was illustrated in the "Review" for January 20, 1904, page 47. This hanger consists of a special high tension glass insulator fastened to the span wire in the usual way. The working conductor is carried by an iron pin inserted in a wooden sleeve on which a thread is turned to fit the glass of the insulator. A thin lead bushing allows the insulator to be firmly clamped by the malleable iron support, thus preventing the hanger from jarring loose.

In public highways the working conductor may be supported at intervals of about 10 ft. from steel wires so that in case of a break the ends of the wire cannot reach the ground or injure passersby. This construction also increases the carrying capacity of the trolley with but slightly greater investment. In regard to rail return, with the proposed frequency of 25 cycles per second and the small current required at the higher voltage, this portion of the loss will be even smaller than in direct current work, and in general it will be sufficient to bond only one rail. This leaves the other rail free for the purpose of block signals, and further the evils of electrolysis are entirely absent with the alternating system.

In order to consider more in detail the relative merits of alternating and direct current systems of distribution, parallel computations may be made for the case of a 60 mile single track interurban road. We will assume the power house to be located at the center of the line and to contain one sub-station, and that the four remaining sub-stations are located at equal intervals on the line, although the alternating current system would not require so many sub-stations. The schedule proposed consists of five local cars having one hour headway, one express car making the round trip in three hours, and one freight and baggage car making the trip between the terminals in about eight hours. The average power required by the various cars will be as follows:

	Weight in tons.	Schedule speed in m. p. h.	Watt hours per ton mile.	Kw. hours per trip.	Average power in kilowatts.
Local car........	30	25	80	144	60
Express car......	35	42.8	110	231	165
Freight car.......	30	12.5	70	126	25

With the proposed schedule the average load on all five sub-stations would be about 500 kw., or 100 kw. per sub-station, while the maximum load per sub-station is 450 kw. under present conditions of starting. With proper momentary overload allowance there will be required one 300-kw. rotary converter per sub-station in the direct current system and in the alternating system a static transformer of 200 kw. per sub-station will be ample. The maximum load at the power house would be 800 kw. and two 400-kw. units will suffice, omitting reserve capacity for the purpose of this comparative study.



For the transmission systems in both cases step-up transformers would raise the total generator output to the high transmission voltage and a step-down transformer would be used in the power house as well as in all sub-stations, in order to avoid special switch arrangements. For the three phase transmission line of the d. c. system three No. 6 wires are assumed and for the single phase transmission lines, two No. 4 wires, costing respectively $10,000 and $11,500.

For the direct current system it is assumed the maximum drop of

a car starting at the maximum distance from sub-station would be approximately 200 volts, or about 30 per cent. The [illegible] re- quire two No. 0000 trolley wires and No. 0000 feeder between sub-stations and [illegible] feeders for the stub ends. The cost of this copper would be about $95,000.

For the alternating current system the size of the trolley has been determined from mechanical rather than from electrical considerations as No. 00 grooved wire for the whole line. The cost of copper in this case would be $21,500. Assuming the power factor as 80 per cent, the maximum drop under the same conditions mentioned above will be 190 volts between sub-stations, or 6¼ per cent, and 380 volts on stub ends, or 12½ per cent, showing considerable advantage in favor of this system.

While at the present time the alternating current motor weighs somewhat more than the direct current motor and operates at a slightly lower efficiency, these points are more than overbalanced by the small percentage of loss in the a. c. distributing system, and it is safe to assume that in the near future these characteristics as to weight and efficiency will soon equal those of the direct-current motor.

An idea of the relative investments for the two systems may be best obtained by reference to the cost of the various items, as shown in the accompanying diagram. These are as follows:

	D. C. system.	A. C. system
Power House	$103,000	$106,500
Sub-station in power house	12,600	4,600
Transmission line	22,500	20,500
Sub-stations	54,000	20,000
Trolley line and feeder	156,000	78,000
Bonding	32,000	16,000
Rolling Stock	110,000	126,000
Total	$490,100	$371,600

This gives, as the cost per mile of the d. c. system, $8,168, and for the a. c. system $6,193, or a saving of $1,955 in favor of the latter system; in other words, the cost of the direct current system is 32 per cent more than that of the alternating current system, a very favorable showing for the first year that this apparatus has been on the market.

With the alternating current motor thus far perfected and the large number of propositions whose realization is conditioned upon a cheaper electrical equipment, nothing can hinder the very wide adoption of this system.

Test of Fresh's Emergency Brake.

Mr. Henry Fresh, inventor of Fresh's emergency car brake, which is manufactured by the Emergency Car Brake Co., of Cumberland, Md., recently made a test of his improved brakes on the La Fayette (Ind.) Street Ry. This company operates five lines, on three of which are very long and steep grades, making an effective emergency brake a necessity. The Fresh brake was applied to one of this company's cars and tested on wet and icy rails. Stops were made in 30 to 40 ft. applying the emergency only. As many as 30 stops were made with one set of felts and the management of the railway company is greatly pleased with the demonstration and has expressed its perfect willingness to make demonstrations for the benefit of others interested. Twenty-four sets are to be delivered immediately, and 20 more at an early date.

Chicago City Ry. Franchise.

The Chicago city council has extended the temporary franchise of the Chicago City Railway Co., which expired February 29th, to Jan. 1, 1905, with the reserved right by the city to terminate this extension at any time on the recommendation of the mayor. The council amended the franchise ordinance, providing for a license fee to be paid the city of $100 per car for every car used, irrespective of mileage. The ordinance also gives the company the right to construct a temporary overhead trolley line in Wabash Ave. from 18th St. north around the Wabash Ave. cable loop and back to 18th St.

The Chicago & Milwaukee Electric Railway Co. has purchased 12 new electric cars costing $9,000 apiece.

Millard B. Hereley.

Until less than five years ago Mr. Millard B. Hereley, who was recently appointed general superintendent of the Chicago Union Traction Co., had no knowledge whatever of street railroad affairs. After leaving the Marengo (Ill.) high school he read law in the office of a local attorney and, having been admitted to the bar, later removed to Chicago to begin the practice of law. In a comparatively short time, his predilection and capacity for politics being very marked, he was elected to the state senate, and upon his retirement from the senate he was made a special agent of the United States Treasury Department. Incidentally, he was engaged with his brother in the hay, grain and feed business, which venture prospered until a series of fires destroyed their elevators and warehouses.

M. B. HERELEY

Shortly after Mr. J. M. Roach became president of the Union Traction Co. he secured the services of Mr. Hereley and, a little more than three years ago, gave him the position of traffic manager. Mr. Hereley brought to his new task the experience which he had gained as United States Treasury agent and was thereby enabled to get at the bottom of things and lay bare hidden causes of troublesome conditions with a completeness and accuracy of analysis which was at once recognized by his employers. The number and extent of his reports were so formidable, and his recommendations so positive and excellent, that the president called him into his office one day last fall and notified him that as it seemed desirable to adopt a good many of the plans laid down in Mr. Hereley's reports, it devolved upon Mr. Hereley to make the recommendations practical; and he was thereupon appointed general superintendent.

Mr. Hereley works with unflagging energy 15 hours a day, his iron constitution enabling him to disregard ordinary physical limitations. During the recent February storms Mr. Hereley rode for 62 consecutive hours with the snow-plow gang, personally directing the work of clearing the tracks. A broadly democratic treatment of employes is a characteristic of Mr. Hereley's method, and he holds that the humblest employe is as much entitled to a careful hearing as is the superintendent.

Personal.

Mr. Philetus W. Gates and Mr. Henry W. Hoyt, respectively general superintendent and second vice-president of the Allis-Chalmers Co., are about to retire from active participation in the management of that company.

Mr. Gates was president and Mr. Hoyt secretary and general manager of Gates Iron Works for fifteen years prior to the incorporation of Allis-Chalmers Co., in 1901. They have been prominently connected with the manufacturing interests of Chicago and have taken an active part in all of the manufacturers' associations. The late P. W. Gates (father of Philetus W. Gates) was the pioneer manufacturer of Chicago and the region west of the Alleghenies, having established his business in 1842. From 1861 to 1871 the Eagle Works Manufacturing Co., of which he was president, employed about one thousand men, and in those days was a noteworthy industry. In 1871 the Eagle Works Manufacturing Co. went out of existence and from it were organized Gates Iron Works and Fraser & Chalmers, each taking a portion of the business. Both of these companies in turn were taken over by the Allis-Chalmers Co. in 1901. Messrs. Hoyt and Gates, after a well-earned vacation spent in traveling, will re-engage in business in Chicago.

For a long time the Indianapolis & Northwestern Traction Co. has been robbed of copper wire, and February 20th detectives arrested two of the thieves, one a lineman in the employ of the company. Three junk dealers were arrested for receiving the stolen wire.

The Roberts & Abbott Co.

The Roberts & Abbott Co., of Cleveland, O., has been organized to take over the engineering business of E. P. Roberts & Co. and W. H. Abbott. Messrs. Roberts and Abbott have long been regarded as important factors in electric interurban work, having designed and constructed a number of the leading roads in the country.

E. P. Roberts, M. E., was graduated at the Stevens Institute of Technology in 1877, after which he worked in three machine shops, first as lathe hand and later as draftsman, and then became superintendent of a general machine shop. In 1880 he became assistant engineer of the United States Electric Co., under Mr. Hiram S. Maxim, the chief electrical engineer, and afterward occupied the same position under Mr. Edward Weston. Later he was appointed shop superintendent of the American Electric Co., of New York; next he was chief engineer on the Pacific coast for a Boston syndicate, and then assistant engineer of the Swan Lamp Co., of Boston, under Mr. William Stanley. He next became erecting engineer for the Rocky Mountain Brush-Swan Co., after which he designed and constructed a power house for the Cheyenne Electric Light Co., becoming manager of that company and also of the Cheyenne Gas Co., at the same time being vice-president of the Ft. Collins Electric Light Co., and consulting engineer for other properties.


E. P. ROBERTS.


W. H. ABBOTT.

Mr. Roberts was then appointed Associate Professor of Electrical Engineering in Cornell University. Later he returned to commercial work, and became manager of the Swan Lamp Manufacturing Co., Cleveland, O. In 1893 he formed the engineering firm of E. P. Roberts & Co., which has had a very successful career. One of the most recent roads for which E. P. Roberts & Co. had the entire engineering is the Muncie, Hartford & Ft. Wayne Ry., which was described and illustrated in the "Review" for December, 1903.

Mr. Roberts is a member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the Cleveland Electric Club, the Cleveland Chamber of Commerce and other societies.

W. H. Abbott, E. E., first took up electrical work as a student apprentice in the works of the Ft. Wayne (Ind.) Electric Co. After two years, during which he worked in nearly every department of the large factory, he entered the University of Chicago, from which he was graduated with the degree of Bachelor of Science. He took a post graduate course at the Ecole Internationale des Electriciens, Paris, France. Returning to America, he was appointed superintendent of the Ocean City (N. J.) Street Railway & Electric Light Co., and later entered the service of the Ft. Wayne Electric Co. as construction engineer. When the Siemens & Halske Electric Co., of America, passed into the control of former Ft. Wayne interests, he was placed in charge of all outside construction and erection work. He next became sales agent for the Stanley Electric Manufacturing Co., of Pittsfield, Mass., and was then employed by the Pomeroy syndicate to construct part of the Cleveland & Southwestern Traction Co. system. Following this he became the consulting engineer for the Pomeroy-Mandelbaum syndicate which built the following roads, for all of which he was consulted and for most of which he had the entire mechanical and electrical engineering: Cleveland & Southwestern Traction Co., Ohio Central Traction Co., Western Ohio Railway Co., Southern Ohio Traction Co., Aurora, Elgin & Chicago Railway Co. Mr. Abbott was also the pioneer in the United States in the introduction of the steam turbine in street railway use.

A partial list of the work in which Mr. Roberts and Mr. Abbott have been closely associated in an engineering capacity includes 98 railways, 71 central stations for the distribution of electric light and power, heat and water, 136 isolated plants, public buildings, office buildings, factories, etc., and 21 manufacturing plants.

Knox Engineering Co. Contracts.

The Knox Engineering Co., of Chicago, reports that it has a number of large contracts on hand, among the more important work in which it is employed being the building of an interurban line for the Knox Construction Co. from Green Bay to Kaukauna, Wis., and it is expected that this road will be opened for traffic on or before June 1, 1904. Besides building a large power house at Green Bay, and constructing the track and overhead system, sub-stations and car barns, the company will rebuild a portion of the Green Bay city lines. The company is also surveying a route for a 38-mile line which will run from Green Bay to Manitowoc.

The Knox Engineering Co. is also engineer for the Stark Electric Railway Co., of Alliance, O., which operates a line from Canton to Sebring, and now has under construction a 10-mile extension from Sebring to Salem, O.

In Chicago, the Knox company is rewiring the main power station of the South Side Elevated Railroad Co. This is a complicated and difficult piece of work, as the electrical conductors must be kept alive for the operation of the system during the reconstruction period.

The Knox company began about the middle of last summer on the Metropolitan Railway Co's. system at Oklahoma City, and is designing a power station and interurban line between Oklahoma City and Guthrie. The company is also handling the engineering and preliminary work for a number of large interurban railway and lighting systems which will be built during the next two seasons.

Underground Cables in the Baltimore Fire.

The Baltimore fire has been the unfortunate means of settling many disputed points for the engineers of this country, and it has, among other points, emphasized most forcibly, in the minds of interested observers, the superiority of underground cables for electrical transmission of power, as compared with old overhead methods.

The Standard Underground Cable Co. has installed during the last few years in Baltimore many miles of underground cable in the Municipal Subway for the Western Union and Baltimore & Ohio Telegraph companies, the Maryland Telephone Co., the City Fire and Police Departments and the United Railways & Electric Co. The main conduit lines run the entire length of the burned district and the manhole covers were in many cases covered with piles of hot brick and stone to a depth of twenty feet.

In spite of the intense heat, there is, so far as is known, not a single instance of trouble on the cables in manholes or subway except where exposed ends of cables were destroyed the fire, and the cable system is in perfect condition today. Two three-conductor cables installed for the United Railways & Electric Co. over a year ago and which terminated in the new and unburned portion of the Pratt St. power house, extended the entire length of the burned district, and were carrying current to the sub-station at 13,000 volts, the second day after the fire, without any interruption to service.

This record compared with the ruin of overhead construction which was universal certainly gives food for thought to all users of wire.

The Freeport-Dixon Electric Railway Co. has retained the Arnold Electric Power Station Co., of Chicago, to make the preliminary plans for its proposed road. The line will consist of about 35 miles of single track, and will connect Freeport and Dixon, Ill. Mr. O. T. Smith, of Freeport, is president of the company, Mr. W. A. Hance is vice-president, and Mr. T. W. Sieke, secretary and treasurer.

Personal.

MR. LOUIS F. DRAKE has resigned as secretary and treasurer of the Sheboygan (Wis.) Railway Light & Power Co.

MR. T. W. BERRY has resigned as secretary of the Topeka (Kan.) Railway Co., to engage in business in Chicago.

HON. W. W. GRIEST has been elected president of the Lancaster County Railway & Light Co., vice Mr. William B. Given, resigned.

MR. GEORGE J. MAROTT, of Indianapolis, has been elected president of the Kokomo, Marion & Western Traction Co., vice Mr. Henry D. Thomas, deceased.

MR. R. E. DANFORTH, formerly assistant general manager, has been appointed general manager of the Rochester Railway Co., to succeed Mr. T. J. Nicholl, resigned.

MR. J. C. GILLETTE has been appointed master mechanic of the Columbus, Delaware & Marion Electric Railroad Co., to succeed Mr G. G. Crane, who recently resigned.

MR. FRANK G. KELLEY has been chosen secretary of the Topeka (Kan.) Railway Co., vice Mr. T. W. Berry, resigned. Mr. Kelley is also treasurer of the company.

MR. W. ROBERTS, master mechanic of the Northern Ohio Traction & Light Co., has been appointed superintendent of motive power of the company, vice Mr. T. W. Shelton, resigned.

MR. GODFREY MORGAN has resigned as superintendent of the railway department of the Youngstown-Sharon Railway & Light Co. The retiring superintendent was presented a diamond ring by the employes.

MR. CLARENCE O. SCRANTON has been appointed auditor of the Stark Electric Railway Co., of Alliance, O. He was formerly auditor, and later passenger agent, of the Lake Erie, Alliance & Wheeling Railroad Co.

MR. T. J. NICHOLL resigned as vice-president and general manager of the Rochester Railway Co. January 1st, on account of ill-health. He is now abroad, where he will remain indefinitely, or until he recovers his health.

MR. HENRY J. DAVIES, secretary of the Cleveland Electric Railway Co., fell on a slippery sidewalk late in February and fractured his right arm. Both bones of the forearm were fractured and the ligaments painfully strained.

THE CHICAGO CITY RAILWAY CO. has elected Mr. Lawrence A. Young first vice-president to succeed Mr. Joseph Leiter, and Mr. A. W. Goodrich second vice-president, to succeed Mr. George T. Smith. Other officers were re-elected.

MR. GUY H. CARLTON, of Boston, Mass., has been appointed auditor of the Youngstown & Southern Traction Co. Heretofore the duties have been assumed by Mr. John H. Ruhlman, who is also secretary, treasurer and general manager.

MR. FRANK B. LEE has resigned as superintendent of the Portland & Brunswick (Me.) Street Ry., to assist in the construction of the Newport & Providence (R. I.) Railway Co's. system, of which Hon. George E. Macomber is the projector.

MR. W. W. WHEATLEY, until recently general manager of the Public Service Corporation of New Jersey, has gone to the city of Mexico to assume charge of the electric railways there. He was at one time superintendent of the Brooklyn Rapid Transit Co.

MR. WILLIAM BARCLAY PARSONS, chief engineer of the New York Rapid Transit Commission, has been chosen in London, Eng., to act with Sir John Wolfe Barry and Sir Benjamin Baker as technical adviser to the Royal Commission on London Traffic.

MR. C. O. HUDSON has resigned as master mechanic of the Canton-Akron Railway Co., which position he held 2½ years, to go to Boston, Mass., where he was previously located. His employes presented him a substantial sum of money as a token of esteem.

MR. G. J. A. PAUL has been appointed superintendent of railways for the Youngstown-Sharon Railway & Light Co., to succeed Mr. Godfrey Morgan, resigned. Mr. Paul resigned as secretary, treasurer and manager of the People's Light & Railway Co., of Streator, Ill., to go to Youngstown.

CAPTAIN L. C. HANNA, brother of the late Senator Hanna, was elected a director of the Cleveland Electric Railway Co., at a special meeting February 23rd, to fill the vacancy caused by the death of his brother. At the same meeting appropriate resolutions on the death of Mr. Hanna were adopted.

MR. GEORGE E. HENRY has been appointed general manager of the Vincennes (Ind.) Street Railway Co. He was for 18 years connected with the Hudnut hominy mills, which were later taken over by the American Hominy Co. Mr. B. C. Hudnut, former owner of the mills, is president of the Vincennes Street Railway Co.

MR. W. A. M'WHORTER was appointed master mechanic of the Birmingham (Ala.) Railway Light & Power Co., January 1st, to succeed Mr. F. W. Heber, resigned. Mr. McWhorter was born in Georgia. He was employed in the shops of the Georgia Railway & Electric Co., of Atlanta, 10 years prior to 1900, rising from laborer to foreman. He next became master mechanic of the Savannah (Ga.) Electric Co., where he remained until 1903, when he returned to Atlanta as superintendent of the shops there.

MR. WILLIAM D. RAY on March 1st severed his connection with the Westinghouse Traction Brake Co. as its central states representative, to enter the steam specialty market. He will represent several well-known manufacturers in the sale of high-grade steam specialties, with headquarters at Room 312 Electric Building, Cleveland, O.

MR. F. E. FISHER, whose resignation as general manager of the Chicago & Joliet Electric Railway Co. was mentioned in the "Review" for February, was surprised by about 75 conductors, motormen and other employes of the company at his home in Joliet shortly after midnight, Februray 25th, and presented a gold watch and chain and an Elks' charm.

MR. CHARLES B. HOLDREGE, having been appointed general sales agent for the Franklin Manufacturing Co., the Franklin Railway Supply Co., and the Franklin Machine & Tool Co., has opened an office in Room 309 Western Union Building, Chicago, Ill., where he will be found until May 1st, at which date he will remove to the new Railway Exchange Building, Jackson Boulevard and Michigan Ave., Chicago.

MR. W. K. PALMER, M. E., has announced the removal of his engineering office, Mar. 1, 1904, to Suite 402, the Lyceum Building, Kansas City, Mo. He was formerly in the New York Life Building. Mr. Palmer makes a specialty of designing and constructing electric railways, lighting systems, power plants, manufacturing establishments, heating, ventilating and refrigerating installations, special machinery and all classes of mechanical and electrical appliances. In his new offices, which afford special facilities, and with a corps of experienced assistant engineers, he is enabled to promptly prepare plans, specifications, estimates and reports, and thoroughly supervise engineering construction of all classes.

CAPT. ROBERT M'CULLOCH, who since Sept. 1, 1899, has been general manager of the Chicago City Railway Co., was, Mar. 8, 1904, elected a director of the United Railways Co. and of the St. Louis Transit Co., and a few days later was elected vice-president and general manager of the St. Louis Transit Co. by the directors. Captain McCulloch will relinquish his duties in Chicago and assume charge in St. Louis within 30 days.

Captain McCulloch was born in Rockbridge County, Va., and was educated at Lexington, Va. He was a Confederate soldier and served in the Army of Northern Virginia during the Civil War, and in 1869 removed to St. Louis. He first entered street railway service, in which practically his whole business life has been spent, in 1871, when he became superintendent of the Bellefontaine Railway Co., of St. Louis, afterwards serving as secretary, vice-president and general manager of the company. In 1889 he was elected vice-president and general manager of the National Railway Co., an Illinois corporation of which Mr. D. G. Hamilton, now president of the Chicago City railway, was president and which controlled seven street railway companies operating in the city of St. Louis. Captain McCulloch remained in this position until 1899, when he resigned to become manager of the Chicago City.

Captain McCulloch has been one of the active supporters of the American Street Railway Association, serving as vice-president in 1889-90, as president in 1896-97 and as a member of the executive committee in 1897-98.

In returning to his old home Captain McCulloch takes with him the best wishes of the host of new friends that he has made in Chicago.

The Chicago Union Traction Co's. one-story brick car barn at Northwestern Ave. and West Division St., Chicago, was destroyed by fire March 20th, together with 100 cars. The loss was placed at $100,000. The fire caught from a stove in the sand room. Five men were injured.

Obituary.

MR. JESSE JOSEPH, formerly manager of the Montreal Street Railway Co., died suddenly February 24th, aged 84 years.

MR. HENRY D. THOMAS, president of the Kokomo, Marion & Western Traction Co., which is building a line between Marion and Kokomo, Ind., died suddenly February 17th of heart disease. Early in the winter Mr. O. V. Darby, of Kokomo, the first president of the company, whom Mr. Thomas succeeded, died suddenly while on a business trip to Chicago.

MR. JOHN B. O'HARA, of the editorial staff of the Street Railway Journal, died March 13th at his home at Rochester, N. Y. He was 38 years old. Less than a month ago Mr. O'Hara went to Rochester to bury his wife, who died in New York, and while there he became ill. Death was due to heart failure. Mr. O'Hara was formerly with the Western Electrician of Chicago.

MR. GEORGE FREDERICK GILBERT, general sales agent for the H. W. Johns-Manville Co. for northern and western New York, died of typhoid fever January 12th at St. Mary's Hospital, Rochester, N. Y. He was a resident of Lakeville, N. Y., and for several years was engaged in the produce business. He was postmaster of Lakeville for four years under President Cleveland. In 1896 he became connected with the H. W. Johns-Manville Co. In addition to being the company's general sales agent, he also represented it in connection with work for the government.

MR. WILLIAM A. M'GUIRE, for 20 years president of the McGuire Manufacturing Co., of Chicago, Ill., died at one o'clock Monday morning, February 29th, of pneumonia. He was taken sick the Wednesday preceding. Mr. McGuire was born in Niagara-on-the-Lake, Ont., nearly 64 years ago, and had lived in Chicago about 42 years. He was prominently identified with railroad work as a manufacturer of trucks, snow plows, sweepers and numerous other devices, most which were made under his own patents, of which he had been granted 47 in the United States alone. His most prominent invention was the "Star" grain door, which is used on freight cars. About 20 years ago Mr. McGuire, together with Mr. W. J. Cooke, the vice-president and treasurer, organized the McGuire Manufacturing Co., and the last business act of his life was the consolidation of that company and the Globe Iron Works, of Chicago, which was effected the first of the year, the new company being known as the McGuire-Cummings Manufacturing Co. Mr. McGuire had arranged to take a year's rest from active business life when he caught a heavy cold, which resulted in his death. He formed many warm, lasting friendships during his lifetime, and was noted as a man of strictest integrity and business ability of a high order.

New Publications.

New state map of the West Virginia Geological Survey. Published under the direction of I. C. White, state geologist. According to a circular sent out by the Survey Office at Morgantown, W. Va., this is the only map of the state ever issued in which the topographic base has any claims to accuracy, since in all areas covered by the United States survey sheets they have been utilized by pantographic reproduction to the scale of the map (8 miles to the inch), and hence the mountain ranges (shown by contours of 2,000, 3,000 and 4,000 ft. above tide) are correctly placed, as well as the rivers, principal streams, cities and towns of the state. The name of every mine shipping coal is printed on the margin of the map by counties and a corresponding number gives its exact location. The areas of the great coal formations are shown by separate shadings, and the oil and gas pools are indicated by striking characters, while every railroad in operation up to January 1, 1904, as well as those under construction, are given as accurately as possible. The anticlinal lines have not been placed on the map, as it is hardly possible to accurately indicate them until the United States Geological Survey Topographic maps are published next year. The price of the map is 50 cents. Advance payment is required.

Other publications of the Survey will be sent postpaid on receipt of price, as follows: Vol. 1, "Oil and Gas," 392 pp. (less than 100 copies remain unsold), $2.00. Vol. 2, "Coal," 725 pp., paper binding, $1.50; cloth, $2.00. Bulletin No. 1, "Bibliography of West Virginia." By Prof. S. B. Brown, 45 pp., 10 cts.

The Indiana Railway Co. has raised its rates 20 per cent.

Interchangeable Mileage System.

February 29th a new electric railway association was formed at Dayton, O., to be known as the Ohio Interurban Railroad Association, having for its object the conservation of mutual interests, and it is intended to embrace all lines in Ohio and eastern Indiana. One of the principal topics for discussion at the preliminary meeting was an interchangeable mileage system and a committee was appointed to formulate a plan for such a system, to be reported to the association.

Officers were chosen as follows: President, H. P. Clegg, vice-president and general manager of the Dayton & Troy Electric Railway Co.; vice-president, E. C. Spring, superintendent of the Dayton, Covington & Piqua Traction Co.; secretary-treasurer, J. H. Merrill, assistant general manager of the Western Ohio Railway Co.; executive committee, E. B. Gunn, J. A. Boyer, R. E. DeWeese, H. Fravel and A. W. Anderson.

Plans for New Subway in New York.

Officials of the Metropolitan Street Railway Co. have announced to the Rapid Transit Commissioners that the company is ready to build another subway system to connect its 300 miles of surface lines, practically encircling Manhattan Island from Harlem to the Battery. The plans provide for subways on both sides of the city to tap such arteries as the Grand Central Station, the Brooklyn Bridge, the ferry terminals at the Battery, the tunnels under the North River, and the new Pennsylvania R. R. station at 32nd St. The company's subway and surface lines would be operated as a single system, a single fare of five cents to be charged. The estimated cost of the work is $20,000,000. The northern terminus would be near Third Ave. and 138th St., in the Bronx.

Council Bluffs, Tabor & Southern Ry.

The Iowa legislature recently passed a bill granting to the Council Bluffs, Tabor & Southern Electric Railway Co. a right of way through the grounds of the Iowa School for the Deaf. The company will erect a station in the vicinity of the school for the benefit of the inmates. The company proposes to build about 105 miles of track, including 75 miles between the terminals at Council Bluffs and Langdon, Mo., and a belt line in Council Bluffs. Going south from Council Bluffs the stations on the proposed line will be Island Park, Henton's Station, Pacific City, Hillsdale, Tabor, Camp Creek, Sidney, Riverton and Nickerson, Ia., Deats, Rockport and Langdon, Mo.

The main power house will be at Tabor and there will be substations every 16 miles, or at Council Bluffs, Iowa School for the Deaf, Glenwood, Tabor, Sidney and Rockport. The cities and towns which will be tributary to the line number nearly a score. Almost the entire right of way has been secured and franchises granted at the principal points.

Freight Road for Greeley, Col.

The Greeley & Northern Railway & Utility Co., which was incorporated Jan. 28, 1904, with a capital of $1,000,000, proposes to build 110 miles of electric road having Greeley, Col., for a center. One line is to run from Greeley to Idaho Creek, a distance of 35 miles southwest, to connect with the Burlington & Missouri R. R.; another line will run northwest to Wellington, and another northeast to the Crow Creek district. The line is intended principally for freight business, and it will run through a very rich agricultural section. The survey is being made.

The directors and incorporators of the company are: George J. Spear, Charles H. Ramsay and Edward J. Decker, of Greeley; George H. Sethman and William Wilson, of Denver. A. Riley, of Greeley, is secretary.

The Cincinnati, Georgetown & Portsmouth Railroad Co. has put into service an electric locomotive, the first to be employed upon a railroad in that section of the country. It is used for switching and freight purposes in Cincinnati.

Allis-Chalmers Co. Broadens Its Scope.

The Allis-Chalmers Co. recently announced that it has extended the scope of its manufactures to embrace steam turbines, hydraulic and electrical machinery and gas engines. It has become connected with and forms a part of the Steam Turbine Advisory Syndicate of England, which includes besides the Allis-Chalmers Co., the Yarrow Shipbuilding Co., the Tweedie (Vulcan) Shipbuilding Co., Willans & Robinson, English engineers and engine builders, and Mr. Fullager, formerly chief engineer of the Parsons Steam Turbine Co., and now consulting engineer for the Steam Turbine Advisory Syndicate. The turbine which the syndicate handles is of the horizontal type, and it is stated to equal in efficiency and economy the best makes of the Parsons and Curtis types.

The Allis-Chalmers Co. is prepared to build turbines of 500 kw., 750 kw., 1,000 kw., 1,500 kw. and 5,000 kw., and can, if required, build up to units of 10,000 kw. The largest size that has been built of any type of turbine is 5,000 kw. The company's license from the Steam Turbine Advisory Syndicate concedes to it all of the United States, Canada and Mexico, with equal rights and privileges in South America, and rights to do business elsewhere in the Western hemisphere, both land and marine.

The Allis-Chalmers Co. has concluded arrangements with Escher-Wyss & Co., of Zurich, Switzerland, whereby it becomes the sole licensee in the Western hemisphere for their well-known hydraulic machinery, several types of which have been installed at the Niagara Falls plant of the Cataract Construction Co., aggregating 85,000 h. p.

The Allis-Chalmers Co. has also bought the American patents, and has become the sole licensee for the Western hemisphere of the Nurnberg Machine Co., Nurnberg, Germany, for its gas engines, and the company is prepared to make gas engines up to any required horse power. At present it builds gas engines from 250 h. p. to 1,500 h. p., suitable for consumer gas or taking waste gas from blast furnaces and utilizing it with economy and efficiency. Nurnberg engines of 1,500 h. p. are in operation in Germany, and it was after two years' investigation by its engineering staff that the Allis-Chalmers Co. selected the Nurnberg and engaged in its manufacture. It is designed as a prime mover, either for blowing engines in blast furnaces, or for directly connected dynamos, or any other purpose where power is required.

The Allis-Chalmers Co. has engaged in the manufacture of generators, motors and electrical apparatus in all its branches for stationary and railroad work, power house installation for transportation purposes and electric lighting.

The Bullock Electric Manufacturing Co., of Cincinnati, O., having been consolidated with, and now forming a part of, the Allis-Chalmers Co., this arrangement will give the Allis-Chalmers Co. all the facilities of a well-equipped electrical plant, the Bullock plant being the third largest of its kind in the world. The company feels that it can now safely claim that it "owns the four powers", embracing steam turbines, reciprocating steam engines, gas engines and hydraulic turbines.

The business of the Bullock company will be conducted as heretofore under the form of the new Bullock Electric Manufacturing Co., organized under the laws of Ohio, with Mr. George Bullock, president, Mr. Joseph S. Neave, vice-president, and all the present officers of the Bullock Electric Manufacturing Co., of New Jersey. The Bullock Electric Manufacturing Co's. plant, in East Norwood, O., is the largest plant for the manufacture of electrical apparatus with the exception of those of the General Electric and Westinghouse companies. It has been constructed with the view of manufacturing not only the smaller electrical machinery, but also the largest that can be manufactured in any plant in the world. The company has built the largest 60-cycle, direct connected generator that has ever been made and this machine has been installed at the Cincinnati Gas & Electric Co's. plant. It has built the largest synchronous motor sets and the largest induction motors that have ever been built, and has also put in some of the largest plants that have ever been established for water power development on the Pacific coast.

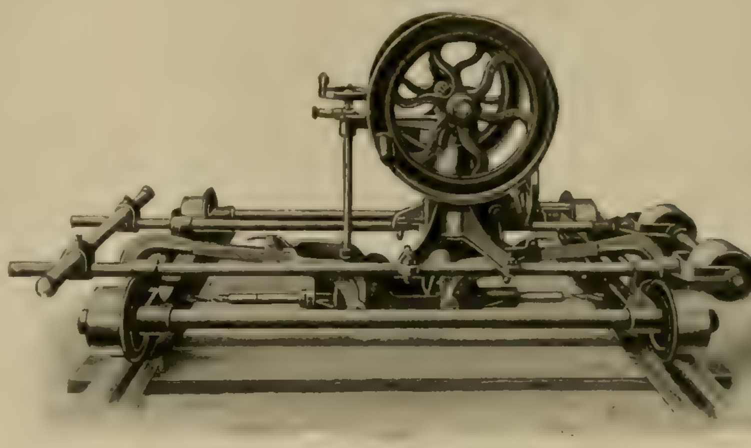
The Bullock company has also developed a full line of street car motors, and extensive additions to its shops are now being constructed which will add another large shop to the East Norwood plant, the new building to contain about 40,000 sq. ft. of space.

This combination of industries will enable either plant to bid upon complete power plants, whether driven by steam, water power or gas, and supply not only the prime movers, but a complete outfit of electrical apparatus from generators to motors, either for factory, street car or interurban work, as well as large electrical locomotives which will take the place of steam locomotives.

Cleveland Track-Drilling Machine.

The accompanying illustration shows the latest improved drilling machine which is made by the Ludlow Supply Co., of Cleveland, O. It will drill either rail without turning and it can be lowered so as to drill within 1¾ in. of the base of a 10-in. girder rail; when raised to the highest point the bottom of the drill will stand 2 in. above the top of the rail. With the roll-off attachment two men can remove it from the track in a few seconds.

It is especially adapted for drilling for tie rods, as no squaring or center punching is required; after drilling one hole, by reversing the motion, it will drill the opposite hole in line with the first.



IMPROVED "CLEVELAND" TRACK DRILL.

This saves not only considerable time, but insures it being perfectly done.

Ball bearings are used on the spindle, which makes it practically frictionless. All gears and bearings are covered so as to prevent sand or dirt from getting into them.

There is a gage on the side of the machine by which the height of the drill point can be adjusted and by means of a worm and gear the drill can be raised from the lowest to the highest point in 10 seconds. Every machine is equipped with an automatic feed that will operate with the drill in either direction, or if desired, it can be instantly changed to hand feed. It requires but two men to operate by hand power and but one with electric power. Motors are connected with rheostat, switch, etc., ready for operation and enclosed in a box for protection from the weather.

The machine as now constructed will do any work from a 60 lb. T-rail to a 10-inch girder. It is of the best material and workmanship.

Will Build Road at Once.

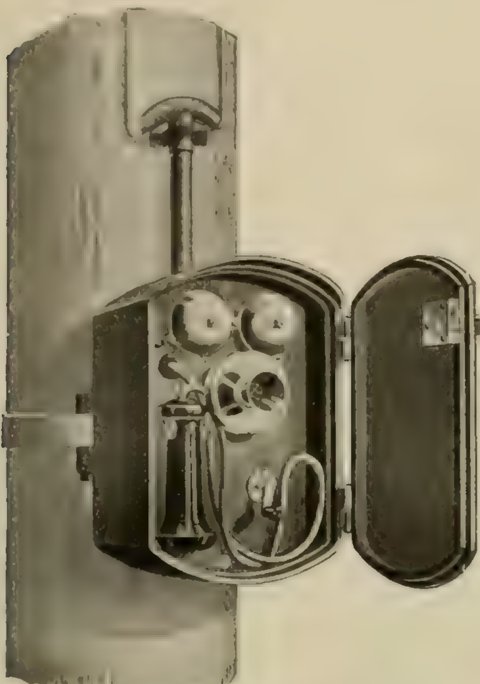
The Pittsburg, Etna & Butler Street Railway Co., of Pittsburg, Pa., will begin the construction of an electric line from Pittsburg to Butler as soon as the weather will permit. This company was formerly known as the Pine Creek Street Railway Co. The president is Charles Gibson, jr., and the secretary and treasurer is Weaver H. Rogers. The engineers in charge of the work are Browne & Layton, of No. 413 Fourth Ave., Pittsburg, Pa.

A bill has been introduced in the General Assembly of New York to create a local board of railroad commissioners for Greater New York.

New Railway Telephones.

A new line of telephone apparatus especially adapted to meet the conditions existing on street railway lines and interurban roads has been recently perfected and placed on the market by the Mayer & Englund Co. of Philadelphia, and two of the principal types of these telephones are illustrated herewith.

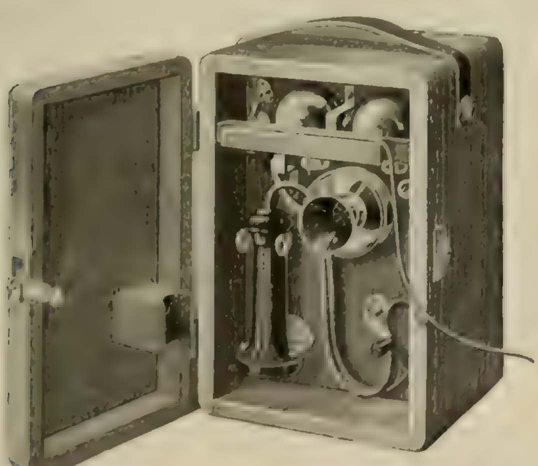
The first illustration shows an iron box telephone to be attached to either iron or wood poles. The outer case is made of malleable



POLE TELEPHONE.

iron with door equipped with a Yale lock, the whole apparatus being entirely weather proof.

All of the working parts of this telephone, including batteries for the local circuit, are attached to one back board which is held in place in the iron box by two screws. This greatly facilitates the work of inspection and repairs, as by removal of the two screws the entire mechanism can be taken out, leaving the empty iron



PORTABLE CAR TELEPHONE.

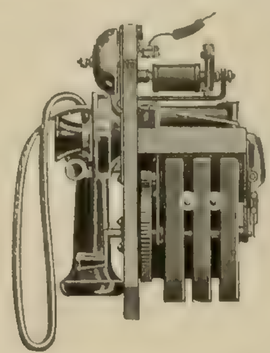
case on the pole. As all the inside parts of the telephone are interchangeable, the entire telephone system can easily be kept in good condition, by having one or more extra sets of parts on hand mounted on one board.

The other illustration shows a portable car telephone. The inside arrangement of the details of this instrument, which are all mounted on one board, as well as the operating parts themselves, are precisely the same as in the pole telephone, the only difference being that this outfit is installed in an oak box with leather carrying strap.

This instrument is equipped with 10 to 20 ft. of cord, at the end of which is attached a plug which is inserted in a specially designed jack box.

These jack boxes are made of malleable iron and are entirely weatherproof, and under all ordinary conditions are also tamper proof. Jack boxes may be installed on poles along the line of the road each half mile or so, and communication had with the central office by plugging in at these points. The length of the cord will allow the motorman to leave the instrument in the vestibule of the car, so that the instrument need not be exposed in

JACK BOX.



DETAILS ON BOARD.

stormy weather while it is being used, the vestibule being virtually a telephone booth.

All of these instruments are made with standard long distance transmitters, bipolar receivers and full size hooks with ample contact surfaces. Although both of the instruments illustrated are compact, they do not contain any miniature parts, everything being full standard size, and therefore conveniently and quickly renewed. The generators are ordinarily wound for 40,000 ohms, and the ringers for 1,000 ohms.

The Mayer & Englund Co. has already sold a large number of these instruments which are in use at the present time, and reported to be giving perfect satisfaction.

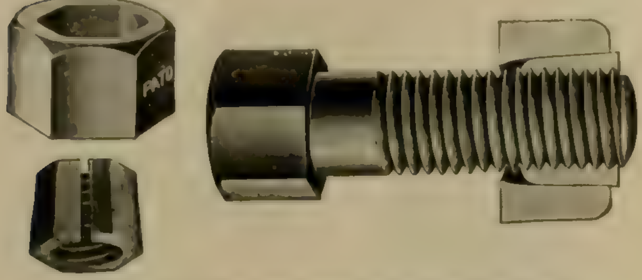
McGuire-Cummings Manufacturing Co.

January 1st last the McGuire Manufacturing Co. and the Globe Iron Works, both of Chicago, were consolidated as the McGuire-Cummings Manufacturing Co., and officers were chosen as follows: President and treasurer, J. J. Cummings; vice-president, W. J. Cooke; secretary, F. Byrne. Mr. Cummings has been the president of the Globe Iron Works for the past two years, while Messrs. Cooke and Byrne were formerly vice-president and secretary, respectively, of the McGuire Manufacturing Co. The consolidation was effected for the purpose of increasing the facilities of both companies, and it is planned to erect another large shop on the grounds of the old McGuire Manufacturing Co., to take care of the increased business already in sight. The McGuire Manufacturing Co. has had a world-wide reputation for a good many years. The Globe Iron Works, although a younger concern, has built up an enviable business in metal work during the past four years, the business of 1903 exceeding $300,000. Mr. Cummings, the president of the new company, is not quite 29 years old, but he possesses business ability which augurs well for the new regime. B. F. Stewart has been retained as sales manager for the company, and William E. Bee is superintendent of the plant.

It is stated that the Lake Shore Electric Railway Co. has arranged to have meals served on board its "limited" cars which run between Cleveland and Toledo, O.

The Columbia Lock Nut.

We present herewith illustrations of the Columbia lock nut which is made by the Columbia Nut & Bolt Co., 130 Knowlton St., Bridgeport, Conn., the proprietor. This is an improved nut especially adapted for street railway purposes for use on cars and



"COLUMBIA" LOCK NUT SEPARATE AND ON BOLT

trucks, axles, air compressors, power transmitters and all kinds of machinery where a secure fastening is required.

This lock nut has been on the market quite a while, although it is comparatively new to the street railway trade. It is successfully used on many steam roads which have found it to be a practicable lock nut.

As shown by the two smaller illustrations, the nut consists of an inner and outer part, which when assembled form a unit. The device is really a combination of three mechanical powers—the wedge, the screw and the lever—although only in two parts. It is declared to be a positive lock nut that will remain indefinitely where placed.

Following are some of the advantages claimed for it: It automatically fastens both bolt and nut absolutely; it is a binding lock nut of immense power, and the greater the strain the firmer its grip; it does not injure the bolt and will not work loose, or slack back; it requires less length of bolt than two nuts, or a nut and cotter; it costs less than two nuts and is a better fastening; it never diminishes its grip in consequence of the expansion and contraction of metals; every Columbia lock nut is guaranteed.

The company is desirous of sending one or more of these lock nuts free as samples, believing that a trial will convince the user of the validity of the claims made.

Managers and Salesmen in Convention.

A convention of branch managers, department managers and salesmen of the H. W. Johns-Manville Co. was held from February 15th to February 20th, inclusive, there being two sessions, one held at Hartford, Conn., and the other at 100 William St., New York City. The delegates first met at Hartford, where they were the guests of the Johns-Pratt Co., manufacturer of the Sachs "Noark" fuse and other electrical goods for which the Johns-Manville Co. is the sole agent.

The object of the convention was to bring all branches into closer touch with each other and to give opportunity for a general discussion of the varied lines made and handled by the company. The Hartford program included an address of welcome by Mr. E. B. Hatch, president of the Johns-Pratt Co., a general explanation of the plan of meeting, an address on the objects and purposes of the Convention and the discussion of the general topics, "Installation," "Fuses," and "Commercial Matters Concerning Insulation and Fuse; also Steam Packing Discussion."

The New York meeting was mainly devoted to papers on various subjects pertaining to the business. Mr. H. W. Hart, advertising manager for the company, read a paper on "Advertising" which ought to be in the hands of all manufacturers and supplymen.

The announcement is made that the entire line of the Buffalo, Dunkirk & Western R. R. will be in operation by or before October 1st next. It will be double tracked from Buffalo to Angola and will extend over 82 miles of track.

E. Keeler Co. Water-Tube Boiler.

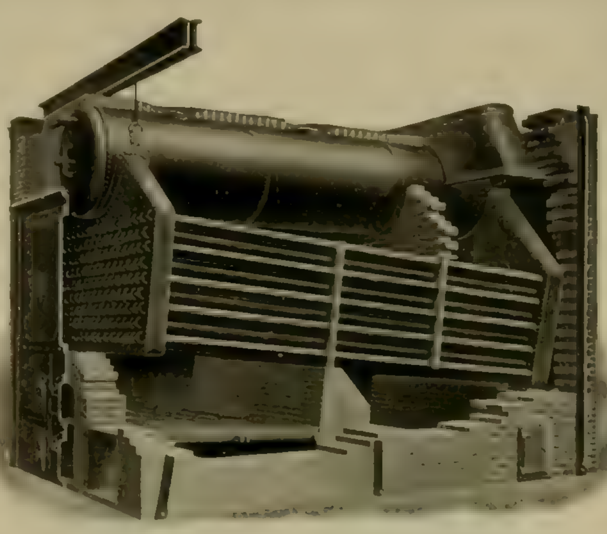
The Keeler water-tube boiler which is shown in the accompanying illustration is of the box header type, having a horizontal steam and water drum. The steam outlet is placed in the center of the drum, where it is removed from the rapid upward rush of water and steam coming from the front header, and is provided with a large-sized dry pipe or separator, which practically insures dry steam. The added flexibility resulting from the long rear header allows for expansion and contraction of the tubes without bringing undue strains on the seams connecting the drum and headers.

The tubes are straight and inclined one inch to the foot. The headers are eight inches deep inside, all open, thus allowing for unimpeded circulation. The throat covers one-half of the circumference of the drum, which is reinforced at this point by three bridges of plate and by the throat flanges. All drums above 36 in. in diameter have triple-riveted double butt-strapped straight seams. In this construction, there being nothing to impede the rapid circulation of the heated water up through the front header and the cooler water down through the rear header and up through the tubes, the circulation ought to be such as to recommend the boiler for economy and durability.

In construction, the wrapper sheet is flanged, instead of the large header plate, this being a process which has been patented by the E. Keeler Co. This method obviates strains. The boiler is wrought steel throughout, no cast iron or cast steel being used except for the handhole plates. All the handhole plates are faced in a special machine, perfectly true, and the joint with the header packed with a special rubber composition or metallic gasket.

The feed pipe entering the front drum head is carried back into a mud drum of ample size. The temperature of the water and steam in the drum at this point are sufficient to cause a deposit of nearly all of the scale-producing matter, the purified water going out at the top and front end of the mud drum, while the impurities are deposited in the mud drum, where they settle and are blown off at the back. A blow-off pipe is connected to the back end of the mud drum and extended through the rear head of the steam and water drums, whence it can be connected to the main blow-off pipe or left with a separate outlet so the character of the impurities in the feed water can be determined.

The front end of the boiler is hung from two heavy channels which rest on wall plates. The rear header rests on expansion plates,



KEELER WATER-TUBE BOILER.

thus giving a perfectly flexible setting unaffected by expansion or contraction. The front is of sheet steel, with heavy cast-iron doors and frames, and is sectional so that mechanical stokers can be installed without change in construction. The rear header is completely enclosed, thus doing away with large loss by radiation. An angle-iron frame and sheet-steel tube door is provided for the rear setting wall. Heavy cast-iron side cleaning doors are provided and the cleaning openings so arranged that no cold air is admitted, while if desired the holes in the staybolts are made large enough for the use of a steam blower in front.

These boilers are built in units from 50 to 675 h. p., and also in special sizes to suit space conditions. The standard boilers are built for a working pressure of 150 lb., but if desired can be built for any pressure up to 250 lb. The grate surface is carefully proportioned and air space regulated by the class of fuel to be burned.

The factory and main office of the E. Keeler Co. is at Williamsport, Pa., and the company has branch offices at Boston, New York, Philadelphia, Pittsburg and Chicago.

Closed Cars for Little Rock, Ark.

The accompanying illustration shows a type of car, a number of which were recently furnished the Little Rock Traction & Electric Co. by the St. Louis Car Co. These cars are very neat in appearance, and are 39 ft. 4 in. long over all, the length of body being 28 ft. and the length of vestibule 5 ft. The vestibules have double doors on one side and the opposite sides are closed with drop sash.

The seating capacity of these cars is 40 passengers, there being six St. Louis Car Co. reversible seats placed transversely in the cars and four longitudinal end seats, the latter seating four persons each.

ST. LOUIS CAR CO. CAR FOR LITTLE ROCK.

The upper sash of these cars are stationary and the lower sash are arranged to drop.

The cars are also equipped with St. Louis Car Co. arc headlights, sand boxes and automatic twin door handles.

Cedar Poles, Ties and Fence Posts.

The past winter has been unpropitious for getting out cedar for poles, ties and fence posts, especially in Michigan, where the heavy snow falls have served to hamper the woodsmen. Nevertheless, the well-known firm of W. C. Sterling & Son, of Monroe, Mich., who have been in the cedar business a quarter of a century, during which time they have furnished poles, ties, etc., to a large number of railways, state that they are prepared to execute all orders promptly, in view of the fact that they always have on hand at least 150,000 cedar ties, as well as a correspondingly large stock of poles and fence posts. The railroad companies have had a good deal of trouble moving cars and it will take them some time to get cars moving in good shape this spring, so it is suggested that orders be placed early to insure early deliveries.

Messrs. Sterling & Son placed on the market about three years ago their "Special A" cedar ties for electric railways, which have proven to be good sellers, as well as being very satisfactory ties for that class of railroad work. They furnished a large number of "Special A" ties last year and have already booked numerous contracts for this year. In fact, they state that the spring season has opened most auspiciously.

The Cleveland Electric Railway Co. has adopted the rule for its Wilson Ave. line that the cars will make all stops at cross streets at the near side of the street, instead of at the far side.

Detroit, Monroe & Toledo Short Line.

Mr. A. W. Bishop, of Racine, Wis., a stockholder of the Detroit, Monroe & Toledo Short Line Co., is authority for the statement that the most of the right of way has been purchased and the road partly constructed, and that it will be in operation on or before May 15, 1904. The road will be 56 miles long, of steam road construction, rock ballasted, and will have no curves of any account. All bridges will be of steel. Mr. Mathew Slush, of Mt. Clemens, Mich., has been elected president and Mr. Charles R. Hannan, of Council Bluffs, Ia., secretary.

Track Appliances.

The Buda Foundry & Manufacturing Co. and the Paige Iron Works, which are under one management, devote their attention to the manufacture of improved appliances for use in the track work of steam and electric railways.

A well defined object will be found in each appliance, either to reduce cost of construction, cost of operation, or to increase safety. In some lines all these desirable features are combined. Several of their devices are well known, having been in use for many years. Improvements to these are frequently being made; new devices, after careful tests, are being brought out; and large shops, new machinery especially designed for their work, selected material, skilled labor, and long experience enable the production of reliable appliances at favorable prices.

Reliance is placed upon the merit of the appliances and the good work performed by them, to increase the demand. Believing that every railway officer desires to use the most economical devices, but will prefer himself to decide that question by test and comparison, and that the only conclusive proof of merit must be a practical trial, the practice is to send a sample of any of the appliances for examination and trial, only asking in return that proper consideration be given to workmanship and quality of material, as well as a comparison of improvements with any similar appliances.

The principal items in a list of the products of these companies are: Buda cars, Paulus track drills, Buda track drills, Wilson drills, Buda side track derails, cattle guards, rail benders of roller and Jim Crow patterns, crossing gates, track gages and levels, car replacers, Buda friction and ratchet jacks, crossing derails, special work.

Van Dorn Draft-Rigging.

Among recent patents are two which have been granted for railway draft-rigging which has been invented by William T. Van Dorn, of Chicago, proprietor of the Van Dorn Coupler Co. The invention for which he received a patent last January is designed to provide a draft-rigging adapted to be secured to the bolster or the under-timbers of the car frame and so constructed as to enable it to be connected with the car in such a manner as to preclude the possibility of contact with or injury to the motor, and also to afford the greatest possible amplitude of oscillation in the draw-head and draft-iron, both laterally and vertically.

The draft-rigging for which a patent was granted to Mr. Van Dorn in February has for its object a construction adapted to afford a maximum lateral swing of the draw-head and draft-rigging, which are held rigidly in alignment laterally with each other, and at the same time afford as much vertical play or swing as possible for the draw-head, thereby obviating the stresses brought to bear upon such constructions both in rounding curves and in moving over uneven and improperly ballasted tracks.

A bill recently introduced in the New York General Assembly provides that there shall be an assistant conductor for each cable or trolley car in cities of the first class between the hours of 4:30 and 7:30 p. m., who shall be stationed on the rear platform and have sole charge of taking on and letting off of passengers.

Electric Dump Car with Side Discharge.

The accompanying illustration shows an electric dump car with automatic side discharge which has been designed and built by the John A. Mead Manufacturing Co., 11 Broadway, New York, for handling coal and similar heavy materials, or for any purpose to which such a car would naturally be put. The general dimensions of this car are as follows: Length over all, 12 ft.; length at top, 8 ft.; width at top, 5 ft. 9 in.; height of top above rail, 4 ft. 6 in.

Each car is equipped with two trucks and an 8 h. p. motor is

ELECTRIC DUMP CAR

attached to each truck, a total of 16 h. p. The gage is 24 in., and the car will run around a curve of 15 ft. radius. The capacity of each car in cubic feet is 100 tons. These cars are built for either third-rail or overhead trolley use, and the substantial character of the work done by the Mead company is a sufficient guarantee of the durable qualities of this product.

Consolidated Traction Co. Plans.

At a meeting of the directors of the Consolidated Traction Co., February 25th, a contract was signed with Westinghouse, Church, Kerr & Co., to design, construct and install the electric and mechanical equipment for the Consolidated Traction Co's. road between Indianapolis and Crawfordsville, Ind., the engineering work to begin as soon as the weather permits and the work of building the power house at Crawfordsville to begin the middle of March. The traction company has been working about eight months on grading, culverts, bridges and fences and has practically completed this part of the line. Although not fully decided, it was thought that the third rail system would be adopted. The road will run over a private right of way for the entire distance of 43 miles, with only slight grades. There are 62 road crossings and only one railroad crossing. The principal towns through which the line will pass are Clermont, Brownsburg, Pittsboro, Lizton, Raintown, Jamestown, New Ross and Limmsburg. It is the intention to pay considerable attention to freight business.

Advertising Literature.

THE AMERICAN STEEL & WIRE CO., of Chicago, has issued a four-page bulletin for January, 1904, treating of "Telegraph and Telephone Wire".

THE BULLOCK ELECTRIC MANUFACTURING CO., of Cincinnati, O., has issued Bulletin No. 1,002A (supersedes No. 1,002), "Bullock Type 'N' Motors; Direct Current Multipolar."

THE LUMEN BEARING CO., of Buffalo, N. Y., chose for the illustration which adorns its monthly calendar for March, G. Rosati's famous painting, "In the Orient". It is beautifully colored and makes a very attractive ornament for the desk, either at home or at the office.

THE ELECTRIC STORAGE BATTERY CO., of Philadelphia, has issued Bulletin No. 81 of the series pertaining to the application of storage batteries to railway plants, the subject being, "The Installation of 'Chloride Accumulators' for the San Francisco, Oakland & San Jose Railway Co."

THE MAYER & ENGLUND CO., of Philadelphia, in the Keystone Traveler for February says: "We are not sending any valentine to our customers, but we are offering them a chance to make a selection for bearing metal railway supplies which will mean more than love. Business is business."

THE WESTINGHOUSE ELECTRIC & MANUFACTURING CO., of Pittsburg, Pa., has issued Circular No. 1,061 (superseding edition of March, 1903), on "Westinghouse Automobile Charging Outfits". Also Folder No. 4,006 (superseding edition of September, 1902), on "Auxiliary Apparatus for Railway Equipments."

THE UNDER-FEED STOKER CO. OF AMERICA, Marquette Building, Chicago, in the Publicity Magazine for February illustrates the boiler room of the Portland (Me.) Street Railway Co., which is equipped with Jones stokers, and also the internally-fired section of the Toronto Railway Co's. boiler room similarly equipped. Each month the magazine makes references to like installations of Jones stokers in street railway plants, emphasizing graphically the increasing adoption of the Under-Feed Stoker Co's. apparatus in this field.

THE J. G. BRILL CO., of Philadelphia, has just issued a new pamphlet, 12 pages, 6 x 9 in., treating of "Electric Sprinkling Cars", employing gravity and power distribution of water. The pamphlet is illustrated and the text pays especial attention to the needs of managers and the large variety of conditions which govern the adoption of cars of this character. The company builds sprinkling cars with tanks of any desired size, although its standard tanks have capacities of 2,480, 3,225 and 4,000 gallons. The cylindrical form of tank is used, because of obvious advantages over straight-side construction.

THE JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J., publishes in March Graphite several interesting views showing structural work which has been protected by the use of Dixon's silica-graphite paint. Among others are shown a viaduct and a bridge on the Bangor & Aroostook R. R., Houlton, Me.; part of Building 127, U. S. Navy Yard, Brooklyn; the new Hotel Astor, New York City; Keith's new theater, Philadelphia; the new 71st Regiment armory, New York; the Hotel Belvidere, Baltimore; the Wilmington Malleable Iron Co's. plant at South Wilmington, Del., and the Philadelphia Rapid Transit Co's. smoke stack at West Philadelphia, Pa. The company also issues a folder treating of a handy package for the pocket or tool bag, containing Dixon's graphite pipe joint compound. This "handy package" is a collapsible tube.

THE GENERAL ELECTRIC CO. has issued the following publications: Bulletin No. 4,359 (supersedes No. 4,305), "The Series Alternating System of Arc Lighting". Bulletin No. 4,360, "Cable Terminals and Contact Nuts". Bulletin No. 4,361, "The GE-70 Motor". Bulletin No. 4,362, "Carrier Bus Arc Panels". Bulletin No. 4,363 (supersedes No. 4,263), "Type B Indicators for Direct Current Service". Bulletin No. 4,364 (supersedes No. 4,118), "The Series Incandescent System; the Constant Current Transformer". Bulletin No. 4,365, "Line Drop Compensators Type V for Alternating Current Circuits". Bulletin No. 4,366 (supersedes No. 4,282), "Thomson Polyphase Recording Wattmeters". Errata to accompany Bulletin No. 4,346, Page 4, regarding prices of regulators, an additional charge being made for bevel gear controlled regulators.

THE NATIONAL ELECTRIC CO., of Milwaukee, Wis., has issued Catalog No. 60, 40 pages, 6 x 9 in., treating of "Alternating Current Machinery for Lighting, Power and Railway Service." Aside from the typographical excellence of this catalog, it will appeal to those interested by reason of the clear, concise manner in which the claims of the company are set forth. The illustrations are exceptionally good, also. It specifically treats of the revolving field type of alternator, a line of which has been developed by this company up to 1,500 kw. capacity, the machines representing the latest development of engineering design, while both the mechanical and electrical features have been given careful attention. The catalog also contains drawings and data relating to belt driven, direct coupled and engine type alternators. There is a list of electrical apparatus made by the company and the company's guarantee is also incorporated in the catalog.

THE BARBOUR-STOCKWELL CO., 205 Broadway, Cambridgeport, Mass., maker of girder and T-rail special work of every description, has just issued a new catalog treating of special work for street railways, in which numerous illustrations serve to adequately tell the story, without the reader having to wade through a

lot of tiresome descriptive matter. The views are all half tones and show switches, mates and frogs with hardened steel centers, curves, crossings, turnouts and cross connections, the Lorenz switch stand, low target stand, steam railroad crossings, sections of groove and T-rails, T-rail guard sections, and other specialties for which the company is well and favorably known. The details are shown so clearly that they recommend themselves, and it would be to the advantage of all interested in work of this character to send for this catalog. It is nicely printed on enameled paper, the pages, which are loosely bound, being 7¾ x 10¼ in. in size.

Trade Notes.

CAMERON & CO., bankers, of 31 State St., Boston, Mass., announce that they are prepared to purchase entire issues of electric railway bonds and they invite correspondence upon the subject. They have special facilities for handling transactions of that character.

BARRON G. COLLIER, 114 Fifth Ave., New York City, who has made a study of street car advertising for the last 15 years, represents the advertising interests of the street railways in nearly 300 cities of the United States, and practically controls the street car advertising in the principal cities in the south, ranging from Baltimore, Md., to San Antonio, Tex.

THE FARR & FOSTER CO., 186 E. Jackson Boulevard, Chicago, has announced that beginning February 20th the name of that corporation was changed to the Farr & Baylies Co. Mr. R. N. Baylies continues as president, and Mr. Eugene H. Farr as secretary and manager, while Mr. Fred N. Baylies has been elected vice-president and treasurer, Mr. Foster retiring.

THE GREEN FUEL ECONOMIZER CO., 1053 Exchange Building, Boston, Mass., recently received an order from the Boston & Worcester Street Railway Co. for an additional Green economizer for its plant at Framingham, Mass. A contract was also received from the Groton & Stonington Street Railway Co. for a Green fuel economizer to be installed in its new station at Mystic, Conn.

THE BULLOCK ELECTRIC MANUFACTURING CO., of Cincinnati, O., advises us that as the recent fire at Baltimore destroyed the offices of the district manager of the company in that city, temporary quarters have been secured at 303 Cortlandt St., Baltimore, where all inquiries should be addressed. The office is working with a full force and is prepared to promptly care for all new business.

THE GOLD CAR HEATING & LIGHTING CO. has removed its offices to the Whitehall Buildnig, 17 Battery Place, New York, to which all mail should be addressed. The Gold company announces that it has recently made an arrangement with Mr. T. A. Edison and his company by which it will have the exclusive sale in the United States of the Edison storage battery for car lighting purposes.

THE BURT MANUFACTURING CO., Akron, O., reports the receipt recently of the following orders: The Jones & Laughlin Steel Co., one 30-in. exhaust head for its Pittsburg plant; the American Shipbuilding Co., a second order for Cross oil filters for its yards at Lorain, O.; from Paris, France, a large cable order for Cross oil filters; from a large plate glass factory at Alexandria, Ind., an order for three 16-in. exhaust heads.

THE WASHINGTON CO., 39 Cortlandt St., New York City, reports the closing of a contract with the Chambersburg & Gettysburg Street Railway Co. for the complete installation of its new power plant at Chambersburg, Pa. The equipment includes Franklin water-tube boilers, Hamilton-Corliss engine and feed water pumps, heater, piping, etc. The Washington Co. also reports the sale of Franklin water-tube boilers for the Rialto Building, San Francisco, Cal.

THE ELECTRIC STORAGE BATTERY CO., of Philadelphia, reports the recent receipt of the following contracts for "Chloride Accumulator" regulating batteries: North Shore Railroad Co., San Francisco, two batteries of 846 kw. and 975 kw., respectively; Bay City (Mich.) Traction & Electric Co., one battery of 288 kw. capacity; the Northwestern Fuel Co., Superior, Wis., one battery of 677 kw. capacity; the Bartlett Illuminating Co., for the Saginaw (Mich.) Traction Co., one battery of 200 kw. capacity.

THE NATIONAL ELECTRIC CO., successor to the Christensen Engineering Co., manufacturer of air-brake and electrical machinery, has just removed its executive offices and engineering department to its new building located at the works at Milwaukee, Wis. The building is constructed of cement blocks 2 ft. long by 1 ft. high and is 100 ft. long by 66½ ft. wide. Extensions and improvements are also being made in the shops to supply the necessary facilities for handling the company's constantly growing business.

THE UNDER-FEED STOKER CO. OF AMERICA, Marquette Building, Chicago, advises us of the recent receipt of the fourth order for Jones stokers from the St. Louis & Suburban Railway Co. These four orders, which were received within the past six months, provide for the entire equipment of the railway company's power plant, aggregating in the neighborhood of 8,000 h. p. The work is to be undertaken immediately in preparation for the anticipated heavy increase in business in consequence of the Louisiana Purchase Exposition.

THE H. W. JOHNS-MANVILLE CO., 100 William St., New York City, has placed a new fire-proofing material on the market known as "Ceilinite". It is designed especially for fire proofing the ceilings in electric cars, for which purpose it is being used by the Interborough Rapid Transit Co. and the Pennsylvania Railroad Co. It is made from specially prepared asbestos in pieces ⅛ in. to ⅜ in. thick, 36 in. wide and about 50 ft. long. "Ceilinite" may be used at every point where a flexible fire proof barrier is required. Samples may be obtained upon request.

THE PETTIBONE BROS. MANUFACTURING CO., of Cincinnati, O., recently received an order from Shanghai, China, for a complete outfit of regalia supplies for a Masonic lodge which has been organized under dispensation granted under the Massachusetts (U. S. A.) Masonic Constitution. The Pettibone company was organized in 1872 and does a business amounting to hundreds of thousands of dollars per annum in the United States, Canada, Mexico, South and Central America, the West Indies, Europe and, in fact, throughout the civilized world.

THE DUPLEX HEADLIGHT CO., of Cleveland, O., has been organized by Mr. J. Herricht, electrical and mechanical engineer, for the manufacture of a line of entirely new types of incandescent and arc headlights. Mr. Herricht, who was formerly connected with the Globe Electric Manufacturing Co., of Cleveland, and who invented the Globe incandescent and arc headlights, is the president and general manager of the new company. Messrs. C. A. Schettler & Co., 30 S. Water St., Cleveland, will have sole charge of the sales and distributing departments of the Duplex Headlight Co.

THE PAIGE IRON WORKS, of Chicago, which is the switch and crossing department of the Buda Foundry & Manufacturing Co., will hereafter be represented on the road by Mr. W. H. Bloss, who recently resigned as chief engineer of the Indiana Union Traction Co., as mentioned in the "Review" for February. Mr. Bloss will look after the outside matters which were heretofore cared for by Mr. E. S. Nethercut, chief engineer of the Paige Iron Works. Mr. Nethercut has been with the company more than 12 years. He will in the future direct the sales from the Chicago office and superintend the engineering work of the company.

W. H. COVERDALE & CO. have been incorporated to do a general engineering and contracting business, with offices at No. 66 Broadway, New York City. Their organization includes engineers of experience in all matters relating to the design and construction of steam and electric railroads, lighting and power plants, coal and ore-handling machinery, etc. Mr. Coverdale was for many years in the engineering department of the Pennsylvania R. R. lines west of Pittsburg, and was track elevation engineer of that company in Chicago during 1898-99. He was also prominently identified with the construction of the Westinghouse shops at East Pittsburg, and for the last three years has been civil engineer for a New York firm of engineers and contractors.

THE ECLIPSE MANUFACTURING CO., of Detroit, Mich., which makes a ball-bearing trolley base, has secured a long-term lease of the Boydell Building, Detroit, and with added capital and a new company begins the spring season auspiciously. The Detroit United Ry., after carefully testing the Eclipse trolley base, has placed good orders with the company. This base, besides being ball-bearing, is very compact and is especially serviceable at depressions under railroad bridges where grade crossings have been

[illegible] The company is capitalized at [illegible] but [illegible] increased. The officers are: [illegible] Kennath, vice-president, [illegible] Piper, secretary-treasurer, Henry C. Hayes, of Dexter, [illegible]. It is [illegible] the company to do general machine shop work.

THE NATIONAL ELECTRIC CO., successor to the [illegible] Engineering Co., Milwaukee, will exhibit its electrical and air brake apparatus at the St. Louis Fair. Part of its electrical exhibit will include a 1,500-kw. alternating current generator. This unit will be in operation at the central power station, furnishing power for various purposes. In addition, a number of smaller alternating and direct current machines will be exhibited at this space, including a complete exhibit of the Christensen air brake equipment, so well known in the street railway field.

ONE OF THE MOST interesting features of the new plant now being erected by the B. F. Sturtevant Co., at Hyde Park, Mass., is an elaborate testing plate for its engines. With an output of a thousand engines or more per year this is the essential climax of a careful system of manufacture and testing. The plate, or more properly the plates, will be supported upon a series of heavy parallel walls between which steam and exhaust pipes are carried so that at almost any point in the entire area of the floor, measuring about 30 ft. by 60 ft., steam and exhaust connections may be made to any engine. Testing facilities will be provided, and a transfer crane over-head will make it very simple to locate or remove the engine. The same crane will transport them to the packing department, and thence load them directly upon cars which traverse the end of the building.

MESSRS. D. H. BURNHAM & CO., architects, removed their offices on March 15th from No. 1142 Rookery Building, Chicago, to No. 1417 Railway Exchange Building, corner of Jackson and Michigan Boulevards, Chicago.

Street Railway Patents.

Furnished by Ralph Sturtevant Warfield, 800 H Street, N. W., Washington, D. C., to whom letters for information may be addressed.

Issued Feb. 16, 1904:

752,277, Brake Beam. H. T. Anderson, Avalon, Pa.

752,308, Railway Truck. Arnold Stucki, Allegheny, Pa.

752,309, Metallic Car. Arnold Stucki, Allegheny, Pa.

752,312, Railway Construction. Wales Terrell, Ansonia, Conn.

752,315, Draft Rigging. William T. Van Dorn, Chicago, Ill.

752,337, Draft Rigging. Richard D. Gallagher, jr., New York City.

752,374, Automatic Check for Trolley Cords. S. J. Buckland, Springfield, Mass.

752,428, Guard Rail. D. F. Vaughan, Haddonfield, N. J.

752,437, Overhead Trolley Guide. Charles W. Burkhead, Madisonville, O.

752,508, Bolster. A. B. Bellows, Pittsburg, Pa.

752,515, Draft Rigging. C. P. Byrnes, Sewickley, Pa.

752,605, Coupling and Buffer. John Thomas, Balham, England.

Issued Feb. 23, 1904:

752,663, Railway Switch. Joseph T. Evans, Alliance, Neb.

752,673, Car Wheel. Levi Hayne, Schenectady, N. Y.

752,678, Track Laying Apparatus. George F. H. Hicks, Chicago, Ill.

752,685, Under-framing for Cars. George I. King, Middletown, Pa.

752,689, Electrically-Propelled Vehicle. Louis Krieger, Courbevoie, France.

752,718, Railway Switch. Wilber K. Smith, Denver, Col.

752,719, Signaling System for Electric Railways. Harry B. Snell, Cement City, Mich.

752,737, Trolley. Thomas F. Wetton, Newark, O.

752,753, Tie. Arthur M. Bowman, Bellevue, Pa.

752,759, Coupling. Joseph L. Crisler, Perth, Kan.

752,785, Railroad Construction. William Lay, Keowee township, Garfield County, Okla.

752,796, Dust-Guard for Car Windows. Boothe Niblack, Virgil, Ga.

752,799, Truck. William G. Price, Kingston, N. Y.

752,812, Electric Block Signal System. Charles W. S. Turner, Mountville, Va.

752,839, System of Electric Train Lighting. D. C. Henry, Denver, Col.

752,855, Car Coupling. Carl A. Olson, St. Francis, Minn.

752,861, Vestibule for Cars. Michael Power, Toronto, Can.

752,875, Car Stop. Harman Warsbing, Dayton, O.

752,877, Railway Brake Head and Shoe. Charles W. Armbrust, Chicago, Ill.

752,878, Track Joint. Jack Armitage, North Tonawanda, N. Y.

752,946, Car Truck. John C. Barber, Chicago, Ill.

752,967, Brake. Jesse A. Field, Dunkirk, N. Y.

752,984, Brake. Knuth & Read, Oswego, Ill.

752,997, Grip Wheel. Harlan F. Ong, Wendling, Ore.

753,004, Brake Shoe. Fitz W. Sargent, Mahwah, N. J.

753,044, Car-Window Guard. Albert D. Cooke, Philadelphia, Pa.

753,112, Bolster. James S. Andrews, St. Louis, Mo.

753,157, Railway Block System. Joseph Morton, New Westminster, Can.

Issued Mar. 1, 1904:

753,220, Cattle Guard. Thomas J. Bailie and Samuel Anderson, Ottawa, Can.

753,307, Chair and Tie. J. J. Phillips, Womelsdorf, W. Va.

753,345, Automatic Release for Trolleys. A. C. Wolfe, Pittsburg, Pa.

753,387, Signaling System. John C. Gleason, Springfield, O.

753,395, Rail Joint. Percy Holbrook, New York City.

753,434, Rail Joint. Benton C. Rowell, Chicago, Ill.

753,441, Rail Joint. John M. Staples, Philadelphia, Pa.

753,454, Draft Rigging. Edwin C. Washburn, Minneapolis, Minn.

753,502, Cross-Tie. Messrs. Leeking and Hartman, Lancaster, Pa.

753,536, Contact Device for Electric Railways. Henri Berthoud, Neuchatel, Switzerland.

753,542, Trolley. A. C. Calderwood, Gloversville, N. Y.

753,545, Car Seat. Eugene Chamberlain, Brooklyn, N. Y.

753,552, Trolley. William A. Daggett, Vineland, N. J.

753,554, Trolley. Arthur S. Deem, Reading, Pa.

753,583, Under-framing for Cars. George I. King, Middletown, Pa.

753,617, Trolley-Replacer. Francis A. Nolan, St. Paul, Minn.

753,625, Car Truck. William G. Price, New York City.

753,627, Car Truck. William G. Price, New York City.

753,666, Railway Signal. Tony Brück, New York City.

753,759, Rail Bond. Edward G. Thomas, Cambridge, Mass.

753,766, Side Bearing Truck. John C. Wands, St. Louis, Mo.

753,767, Side Bearing Truck. John C. Wands, St. Louis, Mo.

753,802, Combined Third and Traction Rail and Switching System. Edmund C. Morgan, Chicago, Ill.

753,803, Combined Third and Traction Rail. Edmund C. Morgan, Chicago, Ill.

Issued Mar. 8, 1904:

753,839, Trolley Wire Finder. William Barnhurst, Dallas, Tex.

753,874, Rail Joint. James R. Gilbert, Kissimee, Fla.

753,898, Brake. Joseph A. and Charles Mays, Philadelphia, Pa.

753,925, Electric Railway Motor. Robert Siegfried, Pittsburg, Pa.

753,929, Brake. Harry A. Spiller, Boston, Mass.

753,934, Beam for Cars. Messrs. Sullivan & Renshaw, Chicago, Ill.

753,937, Railway Switch. Frederick Uhtbrock, New York City.

753,938, Railway Car. Cornelius Vanderbilt, New York City.

754,025, Tie Plate. A. St. Pierre, Rivieres Trois Pistoles, Can.

754,027, Car Truck. Henry Tesseyman, Dayton, O.

754,045, Car Truck. Henry C. Buhoup, Chicago, Ill.

754,169, Means for Operating Track Switches. William D. Simpson, Columbia, S. C.

754,181, Emergency Brake. M. Woltz, Wilkins township, Allegheny Co., Pa.

754,184, Automatic Brake. David L. Ainsley, Lemont, Pa.

754,193, Car Brake. Henry T. Brown, Wilkinsburg, Pa.

754,197, Rail Support. Julien Chappius, Bienne, Switzerland.

754,279, Rail Joint Fastening. Warren H. Case, Mount Vernon, O.

754,327, Braking Mechanism. John B. Mahana, Tacoma, Wash.

754,352, Car Coupling. Vaclav Simecek, Praha, Tex.

754,362, Signaling System. Henry Bezer, Westfield, N. J.

154,387, Car Coupling. Stephen B. Price, Eagle Mills, Ky.

754,392, Automatic Railway Switch. William C. Sayrs, Wilmington, O.

754,396, Overhead Track System. George F. Steedman, St. Louis, Mo.

STREET RAILWAY REVIEW

Vol. XIV APRIL 20, 1904 No. 4

Some Operating Data from the Concord & Manchester Branch of the Boston & Maine R. R., Concord, N. H.

Car Dispatching on the Electric Branches — Method of Collecting and Registering Fares — Design and Equipment of Standard Cars.

The Boston & Maine R. R. owns and operates the street railway systems of Concord, N. H., and also the electric interurban road from Concord to Manchester. As might be imagined, this close alliance between the steam railroad and the electric railway properties has given rise to many practices on the latter adopted from steam railroad experience, and several of which, it is believed, will be of especial interest in view of the fact that so much is being said at the present time about the adaptability of common steam railroad practices to electric railway work.

The street railway system of Concord comprises 12 miles and serves the principal streets and suburbs of this enterprising little city. The interurban line between Concord and Manchester is about 18 miles long and is a single track road mostly on private right of way, built as closely as possible to steam railroad standards. The rails are relaying rails taken from the steam road, and weigh 76 lb. to the yard. The track is laid with Weber joints on chestnut and white oak ties with 2 ft. or more of gravel under the entire track bed. The bridges are of the most substantial construction and are strong enough to carry ordinary trains drawn by steam locomotives. Small culverts, generally of east iron pipe, were put in at frequent intervals to insure good drainage, and the roadbed is ditched according to the Boston & Maine standard construction. Curves are elevated for speeds of 30 miles an hour.

An interesting feature is found at a point near Bow Junction, where the electric railway crosses a long bridge in conjunction with the steam railroad. The rails for the electric railway on this bridge are laid closely adjoining the steam railroad rails, on a gauntlet track, so that, although the electric cars do not use the same rails as the steam trains, they use practically the same track-way. At both ends of the bridge where the two sets of rails conjoin are interlocking and derailing switches, so arranged as to make a collision between an electric car and a steam train impossible. Following steam railroad practice, this arrangement is such that the setting of the signal for one line opens derailing switches on the other line so that if the signal is disobeyed the offending motorman or engineer will run his car or train off the main track onto the ground, and out of the way of the one which has the right of way.

The city system of Concord, known as the Concord Street Ry., operates about 29 cars, and the Concord & Manchester branch about 16 cars. The city system is operated in connection with the interurban branch, and both systems take power partly from small generating plants owned by the Concord Street Ry., but principally from a sub-station at Hooksett, which is supplied with current from the high tension transmission lines of the Manchester (N. H.) Traction, Light & Power Co.

FIG. 1 SEMAPHORES PROTECTING APPROACH TO BRIDGE.

Perhaps the most striking features of these properties are the method of dispatching cars, the method of collecting fares, and the type of car used, all of which are interesting examples of steam railroad practices modified to suit electric railway conditions. All of these features are described in the following contributions from Mr. H. A. Albin, superintendent of the electric branches of the Boston & Maine R. R.; Mr. F. E. Brown, assistant general passenger agent; and Mr. E. T. Millar, chief draughtsman of the Boston & Maine R. R.

Car Dispatching on the Electric Branches of the Boston & Maine R. R.

BY H. A. ALBIN, SUPERINTENDENT.

As regards the dispatching of cars, the systems, the Concord Street Railway and Concord & Manchester Electric Branch of the Boston & Maine, are operated together. For their entire length both lines are provided with a telephone system with a central station and switchboard at the dispatcher's office, which is a room ad-

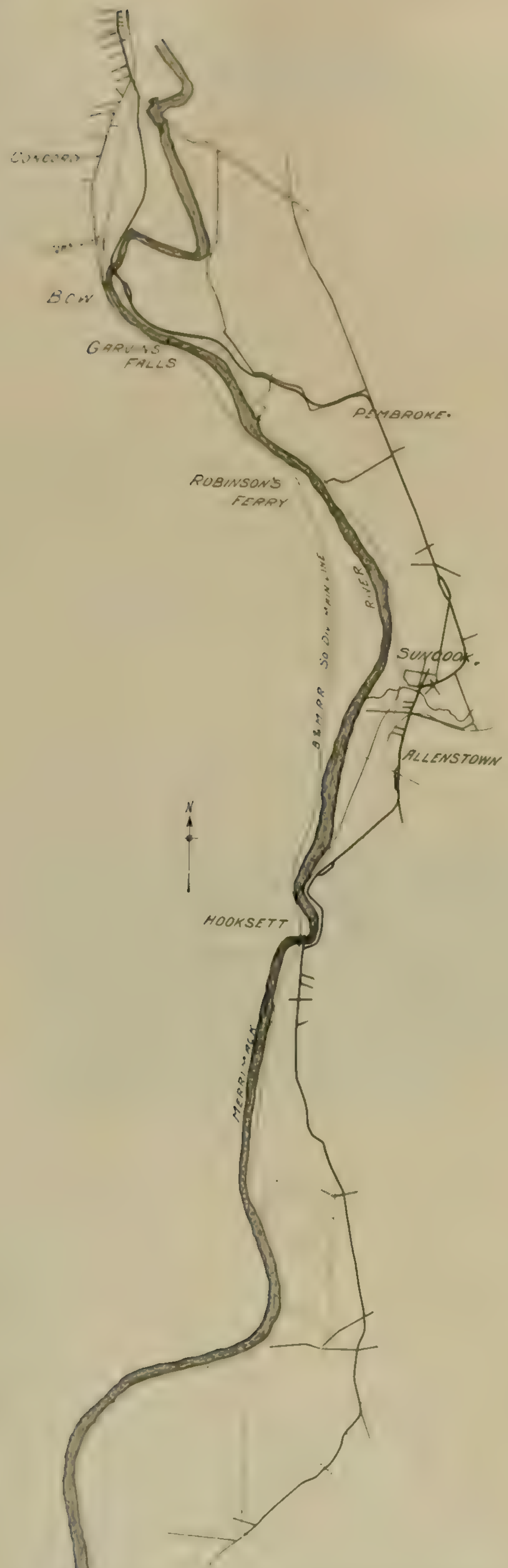


FIG. 2 CONCORD-MANCHESTER INTERURBAN BOSTON & MAINE R. R.

joining our waiting station at Concord. There are telephones in booths built for that purpose at each siding, also at our car barns, waiting stations, power houses and different offices. The telephone system is installed and maintained by the New England Telephone Co. For this purpose are used the regular long distance wall sets. At the dispatcher's office, where the telephone switchboard is located, one dispatcher is on duty the entire day or at all times when the cars are out on the road.

FIG. 3 BRIDGE WITH STONE ABUTMENTS

Regular time-tables are drawn up each spring and fall, showing the regular cars out on the road, the car runs, and the crews. These, of course, show the time each car run leaves each siding. They also indicate whether or not this car meets a car at this siding, and also the number of the car run which it meets. This simply shows the regular service throughout the day. Copies of these time-tables are in the hands of the dispatchers, also in the hands of every motorman and conductor, foreman of tracks, etc. Besides a telephone in each of the booths along the track, we have installed a register, built by the Egry Autographic Register Co., of Dayton, Ohio. This is made up with three rolls of train orders, constructed in such a way that the conductor, in writing his train order, makes two carbon copies, one being retained in the register, and the other to be given to his motorman. This register is also installed in the dispatcher's office, this particular one having two rolls, one for the dispatcher's record and the other is retained in the machine. These can only be taken out by the use of a key, which is only given to some authorized person.

FIG. 4 DEEP ROCK CUT

Every car, regular or special, before leaving the car barn, must

FIG. 5. SWITCH TOWER AT APPROACH TO BRIDGE.

FIG. 6. DERAIL AT APPROACH TO BRIDGE.

FIG. 7—BRIDGE USED JOINTLY BY STEAM AND ELECTRIC ROADS.

call the dispatcher's office for orders, that the dispatcher may know that the car is going out on the road. The conductor must call up at each siding where he does not meet a car, and at each terminus or other point where he changes the direction of his car, that the dispatcher may be able to give him any orders should he so desire. He must also call up the dispatcher immediately after putting up his car, that the dispatcher may know that it is off the road and in the car barn. Motormen are held equally responsible to know that their conductor has called up, and also to know the orders the conductor has received before leaving any of the above-mentioned points.

In taking orders, the dispatcher gives the conductor the orders, and the conductor writes the orders on blank forms, which are found

BOSTON & MAINE R. R.
..C. & M. ELECTRIC BRANCH..
AUTOGRAPHIC TRAIN ORDER.

REWRITE NO

Supt.'s Office............190......

Form A. *Siding ....Direction ....*

Time.....................M. Run No. ....

Motorman *Conductor*

FIG. 8. TRAIN ORDER BLANK.

in the register provided for that purpose. The conductor then reads the orders back to the dispatcher, and the dispatcher answers "all right". The conductor then signs the orders, turns a crank, which releases the original order and also a carbon copy. The carbon copy is handed to the motorman and the conductor retains the original. Motormen must read the orders, and if they are not plain, ask the conductor to explain them. The dispatcher, at the time of giving the order, writes the same on his blank, turning the crank releases it for reference, and as stated before, he has a carbon copy locked up inside, as does the conductor at the siding.

Every car, regular or special, before leaving the car barn, must display colored signals. For day service we use a tin marker about 6 x 8 in., painted on one side green and on the other side red. For night service we use regular marker lanterns with two lenses on opposite sides, one lens green and the other lens red. One signal is placed on each end of each car during the entire time it is out on the road. A car displaying green on both ends indicates that it is running by itself according to the time-table, and that no

BOSTON & MAINE RAILROAD.
Concord & Manchester Electric Branch.

Conductor Date

Crew No. Car No.

Conductors will report below when held by any other car two minutes or over after time to leave.

	SIDING	DIRECTION	ARR.	LEFT

Took Car Run No. at M. Left at M.
Took Car Run No. at M. Left at M.
Took Car Run No. at M. Left at M.
Took Car Run No. at M. Left at M.
Took Car Run No. at M. Left at M.
Took Car Run No. at M. Left at M.
Took Car Run No. at M. Left at M.

Remarks.

FIG. 9—CONDUCTOR'S DELAY SLIP.

car is following on that regular time. A car displaying red on both ends shows that there is a car following, on the same time, and having same rights, which car should not be over two minutes behind the first; therefore, should we run two or more cars on the

same time (closely following each other), the forward car or cars would carry red and the rear car only would carry green. It makes no difference whether the forward car is a special or the other car is a special. A car arriving at a siding and scheduled to meet at that siding, must watch the car coming in the opposite direction and notice the color of the signals displayed. If this approaching car displays green on both ends, as it passes the carried on both ends of the cars that they meet. Regular cars are run wholly by the printed time-tables, which, as I have already stated, are furnished to each motorman and conductor. Special cars which are run on the time of regular cars are simply run out behind the regular car (or ahead of it, as the case may be), the forward car carrying red and the rear car carrying green as far as the cars are run together. As the conductors have orders to call

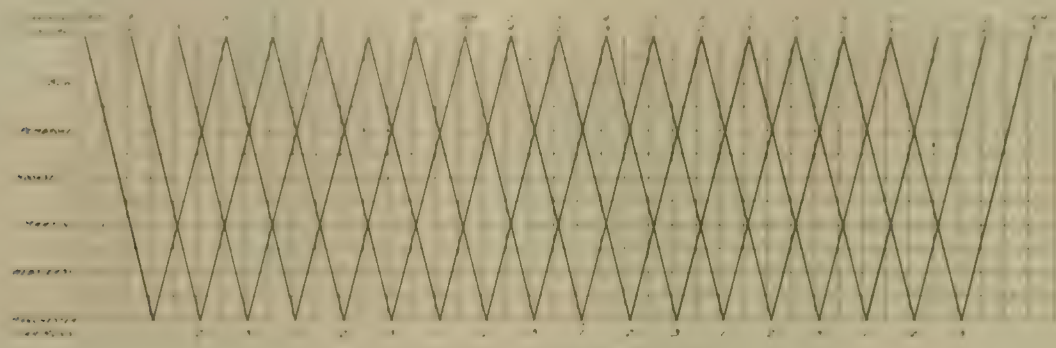


FIG. 10.—SCHEDULE OF WINTER RUNS

waiting car, it gives the waiting car the right to proceed to the next siding, but should it carry red on both ends, the waiting car would have no right to proceed and must wait for a car carrying green. therefore, green signifies right to the next siding, while red gives the waiting car no right to proceed. In case the approaching car is carrying red and passes a waiting car, and in two minutes the car which is supposed to be following does not appear, the conductor of the waiting car must call the dispatcher's office to learn if the car just passed is displaying the right colors, and to ascertain if the dispatcher has heard from the following car, or get any orders he wishes to give. Should a car pass displaying improper signals, for instance, red on one end and green on the other, or the absence of signals, it gives a car no right to proceed, but the conductor must immediately call the dispatcher and find out which signal is right and get orders before he can proceed.

the dispatcher at each siding where they do not meet a car, the first car over the road and the last car over the road of each day will call the dispatcher at all the sidings. This, of course, is a check on our telephone system, as to whether it is working properly or not; also, it does not allow the conductor to run on his own responsibility. Special cars not run on regular time are run wholly by the dispatcher, that is, the dispatcher gives the conductor at the car barn certain orders before he goes out on the road. This conductor will go as far as he has orders to go and then call the dispatcher for further orders and the dispatcher is alone held responsible to see that this extra car does not run in such a way as to interfere with the regular service.

In case the telephones on the line are out of order, the conductors of regular cars must go strictly according to their time-tables and expect to meet at sidings indicated as meeting points on the time-

FIG. 11. FOUR-CAR TRAIN OPERATED BY MULTIPLE UNIT CONTROL SYSTEM

What has been said so far in regard to a car, is the same in regard to two or more cars coupled together, running as a train. Our cars are equipped with the General Electric multiple unit control, and during summer months we use this to quite an extent. When two or more cars are coupled together in this way in a train, the signals are displayed, one on the forward end of the forward car, and the other on the rear end of the rear car.

Conductors and motormen are held equally responsible to know that they are carrying the right colors, also to notice the colors

table. Conductors running special cars, in this case, on arriving at a siding where the dispatcher has given him orders to call up, must wait on that siding until some regular car comes along and either precede or follow the regular car on its regular time-table. In case a conductor of a regular car arrives at a regular meeting place, according to his time-table, and the car he should meet at that place does not arrive, and the telephone is out of order, he will then be obliged to wait there until he hears from the late car, and then only proceed by instructions from some official or responsible per-

son of authority. Regular cars must not leave any siding before their scheduled time to leave that siding. This gives the dispatcher a chance to run extra cars, knowing just how far he can run the extra car before it meets a regular. The dispatcher, in giving orders for running extra cars, gives what we call a time limit order, that is, he gives the special car an order to run to a certain siding until a certain time. If the conductor of the extra is unable to reach that siding by that time, he must either stop at a siding this side, or if he is very near that siding, can flag his car to that siding. In case that we know of the extra having to be run in time the dispatcher gives a fixed meeting point for opposing cars. Each order must be given in the same words to all persons directly affected by it. The orders in this case must be in the hands of regular car crews (directly affected) before they can be given to the extra crew. In case a car is disabled or delayed on the road for any reason, so as to be unable to proceed, the conductor must first protect his car from both directions by flagging, and then go back to the nearest telephone from which the dispatcher can be notified. In case a car is disabled on the road and is, by any means, got to a siding and set off, simply to clear the main line, this car must, in all cases, display red signals from both ends while standing on the siding, which will give the passing car no right, and oblige the conductor of the same to call the dispatcher's office for orders. When a car following is stopped by a flag for a disabled car, it must protect itself from any cars in the rear and proceed at the rate of not over three miles an hour to the disabled car.

Form 5309 9-4-03-1m

BOSTON & MAINE RAILROAD.

C. & M. ELECTRIC BRANCH.

PLACEMENT OF CARS.

Date

Car No				on No. 1 car run.
"				" 2 "
"				" 3 "
"				" 4 "
"				" 5 "
"				" 6 "
"				" 7 "
"				" 8 "
"				" 9 "
"				" 10 "
"				" 11 "
"				" 12 "
Car No.				on extra.
"				"
"				"
"				"
"				"
"				"
"				"
"				"
"				"
"				"

Foreman

FIG. 12—RECORD FOR CAR ASSIGNMENTS.

FIG. 13—EXTERIOR VIEW OF SUB-STATION.

In order to keep our cars on time, a special delay slip (Fig. 9) has been printed and furnished the conductors. This slip also shows the time worked by the conductor and therefore the crew, and the number of the car run upon which he worked. If a conductor reaches a siding where he should meet, and if in two minutes after the time to leave that siding, the expected car does not appear, he must fill out this slip, giving the name of the siding, the direction in which he is proceeding, the time he arrived, and after the late car passes, the time he left that siding. The conductors understand that if they are caught neglecting to properly fill out this blank, when occasion requires, that they will be very severely disciplined. After receiving this blank in the office, we can at once ascertain what car delayed another, and ask the conductor who caused the delay for an explanation.

Any applicant for a position as motorman or conductor, before his application is considered, is required to pass the physical examination required on the Boston & Maine system, and he is obliged to have a watch suitable to the requirements of the Boston & Maine Railroad, and after being placed in service each employe must compare his watch with the clock furnished by the company, designated as standard time, before starting out on each day's work. Therefore, there is little variation in the time of the watches of employes.

FIG. 11—STORAGE BATTERY ROOM.

The dispatcher is also furnished with a chart showing the car runs for the entire day. The horizontal lines show locations of sid-

ings and the perpendicular lines show the hours, etc. Of course, where the [illegible], reading horizontally, shows the [illegible] and perpendicularly shows the time of meeting. The dispatcher keeps a train sheet, noting on this sheet the times and positions of the different cars when they call for orders. Each order the dispatcher gives is numbered and dated the day that it is given, and also shows the time. The numbers begin with one at 12:00 o'clock midnight and are consecutive throughout the day. The dispatcher gives each conductor the number and he records the same on his order

FIG. 15. VIEWS OF TRACK AND OVERHEAD WORK.

blank when he takes the order, therefore the conductors' numbers are not consecutive.

Between Concord and Penacook we run 69 regular trains each way per day, besides a large number of extras, and between Concord and Manchester 30 regular trains each way per day, all on single track and at high speed. This system has so far proved very satisfactory and meets all the requirements of our road.

In regard to the name of this dispatching system, it really has no name. While some roads use more or less of the system it was

FIG. 16. INTERIOR OF SUB-STATION.

not copied from any road, but I made it up to fit the system as it grew and advanced, adopting as much as possible from the steam railroad principle of dispatching and carrying signals. I have in mind a few modern roads that have sent their superintendents here to investigate the system, and it has been copied more or less by them, especially the carrying of signals.

Method of Collecting Fares on the Concord & Manchester Electric Branch of the Boston & Maine R. R.

BY F. L. BROWN, ASSISTANT GENERAL PASSENGER AGENT.

The length of this electric road is 18 miles; there are no branch lines.

The rates of fare are 5, 10, 15 and 20 cents, and the line is divided into four 5-cent fare sections, the divisions being made as nearly as practicable equal as to distances (taking into account the volume of business in certain localities). Each limit in each direction is designated by a sign upon a pole at the side of the track, reading "Collection Point No. .... South"; or "Collection Point No. .... North", as the case may be.

The north and south limits overlap each other, the necessity for which will be readily understood by anyone who has had to do with the arrangement of similar fare limits.

Starting from Concord, going south, the first collection is made as soon as the car starts. The second at the sign "Collection Point No. 2 South," the next at No. 3 South, and the next and last No. 4 South; starting from Manchester, going north, this is reversed.

Double registers are used, one side for transfers and the other for cash. The transfer side is used for all transfers, tickets and checks (the matter of checks is explained later), in a word, the transfer side registers all "paper" collected. On the cash side, each registration indicates a 5-cent fare, and is so charged against the conductor; at the same time, by the system of checks (subsequently explained), the total cash side registration indicates the total number of fares of all denominations (5, 10, 15 and 20 cent fares) collected, and, therefore, shows the actual number of paying passengers.

Collecting Fares and Checks.

On leaving Concord, the conductor ascertains from each passenger the point to which he or she is going, and collects the full fare to the designated point.

Conductor registers each cash collection without regard to its amount by one ring upon the cash side of the register, and issues checks to such passengers as pay 10, 15 or 20-cent fares; no checks being issued to those who pay 5-cent fares. The checks are designated as Form 1, Form 2 and Form 3, each form being of different color from the others. They are bound in books of not exceeding 50 leaves each; each leaf has a stub and each book a printed cover which the conductor detaches when he receives it, signs and sends to the Auditor of Passenger Accounts as a receipt for the checks. The checks are charged by the Auditor of Passenger Accounts to each conductor, according to the receipts sent

m, and conductors are held strictly accountable for each and every check issued to them at 5 cents each.

Each leaf of the book of Form 1, consists of a stub and one check; each leaf of Form 2, of a stub and two checks; each leaf of Form 3, of a stub and three checks. Each book and the checks are consecutively numbered—exactly the same as tickets in a steam railroad ticket office. They are issued by the conductor in regular order from the lowest to the highest number; he detaches the checks from the stubs and retains the stubs for accounting and turns

H. A. ALBIN.

them in with his daily report. Form 1 is for a 10 cent, Form 2 for a 15-cent and Form 3 for a 20-cent fare.

Notices are posted in the cars and waiting stations which explain to the public the method of collecting fares and issuing checks, and which will, therefore, serve to explain same matters in this article. They read as below:

BOSTON & MAINE RAILROAD.

Concord & Manchester Electric Branch.

PASSENGERS WILL PLEASE INFORM CONDUCTORS TO WHAT POINT THEY DESIRE TO PAY FARE: Pembroke Street, Suncook, Hooksett, Manchester, or Concord.

Conductors must give each passenger at the time of payment of a ten-cent fare, one five-cent trip check; of a fifteen-cent fare, two checks; of a twenty-cent fare, three checks—GOOD FOR THAT TRIP ONLY, one check to be collected subsequently by the conductor at each collection point.

CONDUCTOR MUST REGISTER EACH CASH COLLECTION BY ONE RING ON THE CASH SIDE OF THE REGISTER, AND EACH CHECK BY ONE RING ON THE TRANSFER SIDE OF THE REGISTER. EACH CASH FARE AND EACH CHECK MUST BE REGISTERED AT THE TIME OF COLLECTION.

All fares are for continuous passage only.

The checks are printed "GOOD FOR THIS TRIP ONLY", and the question has arisen as to whether this is desirable or absolutely necessary; but we have considered it best to educate our patrons into the habit of paying fares to the points to which they desire to go, and have had but few checks sold on one trip presented for passage on a subsequent one. Our rule is that the conductors shall not accept them except for some very special reason, but refer the passengers to the office, making a report of such cases. We redeem the checks at the office. The effect of this rule is that each conductor accepts only the checks issued by himself.

The checks are, therefore, closely collected, and we avoid having them left in the hands of passengers. The question may arise here as to what becomes of the cash provided a passenger should retain a check, and the answer to this is what has already been said; that we charge conductors with all checks issued, requiring conductors to [illegible] 5 cents each, whether collected or not.

At Collection Point No. 2, the conductor goes through the car again and collects a cash fare or check from each passenger, as the case may be, issuing checks for 10-cent and 15-cent fares. Of course, there are no 20-cent fares to collect at this point. He registers the cash, the same as before, by one ring on the cash side, and each check collected by one ring on the transfer side. He repeats this at Collection Point No. 3, where, of course, the 15-cent fare disappears, so to speak. At Collection Point No. 4, he collects only 5-cent fares from such persons as may have boarded the cars subsequently, and all checks; and registers as before.

It will be observed that as he passes each collection point, the work of issuing checks grows less and less, although the load of passengers may have been largely increased; and at the final collection point the conductor is on a 5-cent basis, so to speak, and has an absolute check upon all passengers.

If a passenger prefers to pay a 5-cent fare within each limit instead of paying all at once, we do not object; but so far as we are aware, only one or two passengers have preferred to do so.

The same method of collecting fares is pursued north-bound.

Anyone conversant with the collection of street car fares will see how easily this method can be inspected. Conductors are required to make a record of the readings of the register and turn it back at each collection point.

Reports.

Conductors are required to make daily reports of registration of cash, transfers and tickets collected. The report blanks are issued to conductors in blocks and are consecutively numbered. They are charged to the conductors when issued and credited as returned. They are used by the conductors in consecutive order. The purpose of this is to insure a return to the office of the report as written upon the car and leads the men to be careful in making up reports to avoid erasures and corrections. If they make mistakes they are, in consequence, particular to call our attention to them and make explanation.

In computing the reports we charge for the total cash reading at 5 cents each and the total number of checks issued at 5 cents each. If the total of the transfer registration exceeds the number of checks issued and transfers and tickets accepted, we charge for such excess at 5 cents each. In case the total transfer registration is less we charge the conductor for the number of checks issued. The report is a complete analysis of the business, showing total

F. E. BROWN.

number of passengers, number paying each denomination of fare, number riding upon transfers, tickets or passes and number of passengers in each fare limit; thus giving data in regard to the volume of business over each section of the road.

The reports are easily examined and checked, owing to the system of stubs and consecutive numbering. In addition to the report we have what are known as register cards, one daily for each car, which furnish a complete record of the readings of the registers from the time they go into use until they go into the junk heap.

Each conductor is provided with a ticket punch, the die of which corresponds with his number. He is required to cancel all tickets, checks and transfers with this punch at the time of collection.

Remarks

This system has been in operation since Aug. 11, [illegible]. In establishing it we tried to look at the passenger's side as well as our own, and to institute a method for collection of fares which would be satisfactory to both. Up to this time we have had no unfavorable comments, but, on the contrary, the plan has been very often commended by our patrons.

As is well known, where the runs are long, or comparatively so, and different denominations of fares are collected, the conductor ought to have some means to check those who have paid, and on some lines this has been done with the ordinary "hat-checks", pieces of paper of different colors. Our patrons use the checks which we issue very largely in that way. They are no more troublesome than the ordinary hat-check, or, for the matter of that, than the ordinary steam railroad ticket. They are made of material of fair weight and are carefully perforated for detaching and are cleanly and businesslike in appearance.

If a conductor uses due care, it is impossible for him to fail to collect fares from all passengers. The checks are not cumbersome and require but little time in issuing; less time than would be required for the collection of cash in each limit.

It will be seen that by this plan a cash fare, a check, a ticket or a transfer must be surrendered in each limit. We require the same plan followed in regard to tickets, that is, a coupon is surrendered in each limit.

The question may be asked whether three forms of checks are necessary. Our reason for using three forms is that we thus obtain a record of the number of fares collected of each denomination. As was stated at the beginning, our fare limits are four in number, requiring three forms of checks. If the number of limits were extended to beyond six, it is likely that the number of books of checks conductors would be thus obliged to carry would prove cumbersome. We have a plan for overcoming this, but up to the present time our plan seems to be working well as it is, and have made no change.

Our system has attracted considerable attention from railroad people, and we have received a number of letters asking for details. The managements of some roads have gone so far as to send a representative here to investigate it.

Standard Car for Boston & Maine Electric Branch.

BY E. T. MILLAR, CHIEF DRAFTSMAN.

The cars adopted as standard for the electric branch operated by the Boston & Maine were designed by Mr. J. T. Chamberlain, master car builder of the company, and were built in the company's shops, at Concord, N. H. The cars are to be used in both city and interurban service between Concord, Manchester & Penacook, a distance of 30 miles, and at all seasons of the year. The general requirements, as laid down by Mr. H. A. Albin, the superintendent, are practically as follows:

To construct a car that would give equal facilities and the same degree of comfort to passengers that they would have in the ordinary steam passenger car in winter; and also permit of the car being converted into as nearly as possible an open car in summer. To have the windows so arranged that when they are lowered there would be no possible chance of accident to passengers, thus insuring safety at high speed while giving the same pleasure or com-

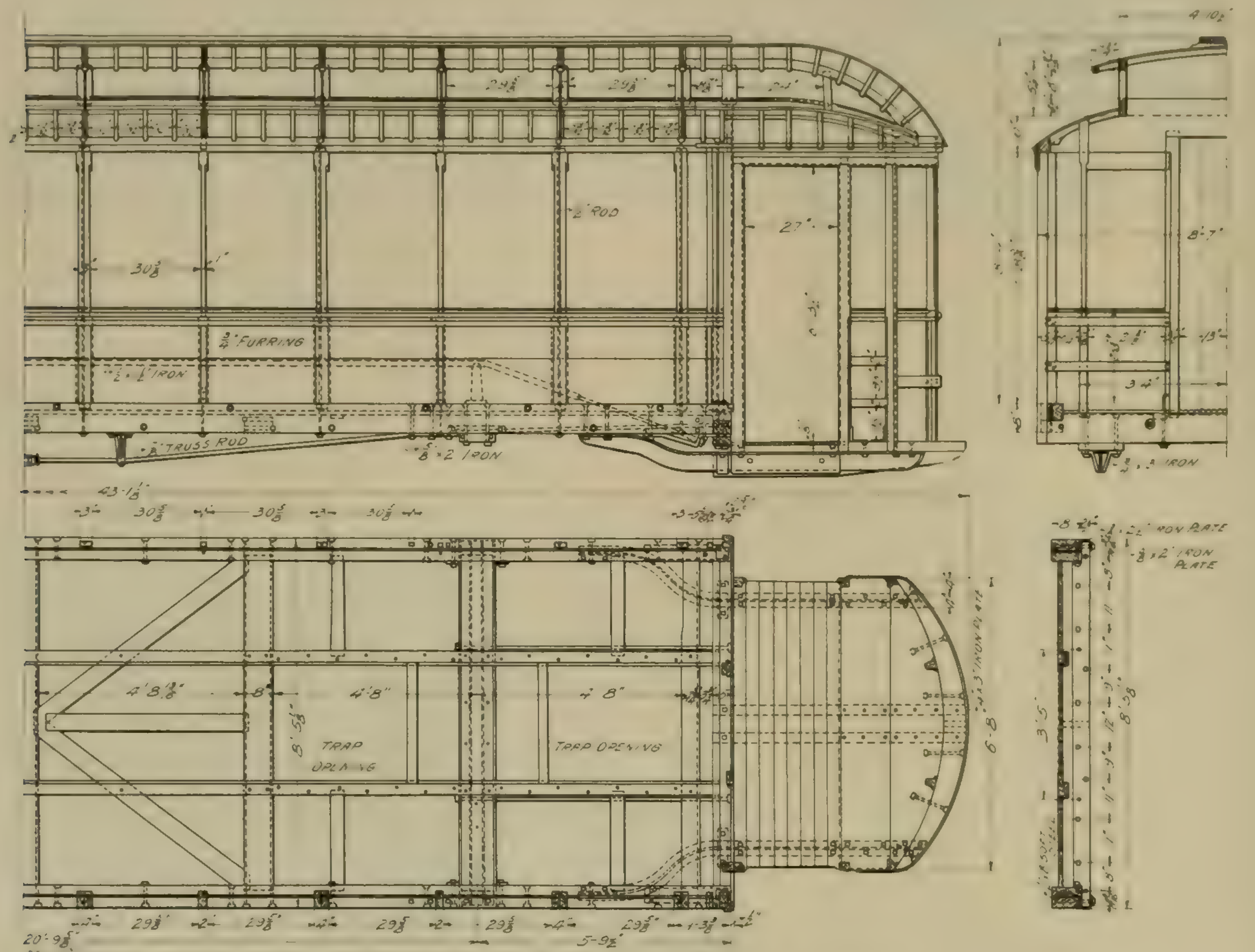


FIG. 19—FRAMING OF STANDARD 32-FT. 5-IN. BOX CAR

fort derived from riding on an open car; and when so converted the windows to be so taken care of as not to be in view or to annoy the passengers in any way by manipulation. As in all mountainous sections, like that through which these cars travel, showers in the warmer season are liable to come up suddenly; it is necessary that the windows could be placed in position by conductors in a short space of time, thus shielding passengers from storm and without the annoyance of the unsightly and flapping curtains.

In addition to these requirements, it was necessary that the car be constructed in a strong and in every way substantial manner, in order to permit of its being run at high speed. In order to maintain the standard wheel of 33 in. in diameter, it was necessary to arrange the framing, trucks, etc., so that the flange of the wheel would come as close as practicable to the under side of the body of the car, in order to permit the latter to be sufficiently low to allow passengers, and especially ladies and elderly people, to enter and leave the car with as little effort as possible.

General Dimensions of Car.

Length of car over end sills	32 ft. 5⅝ in.
Length of car over buffer	43 ft. 1⅛ in.
Width of car over side sills	8 ft. 5⅛ in.
Width of car over eaves	8 ft. 10¾ in.
Length of car between truck centers	20 ft. 9⅜ in.
Length of truck wheel base	5 ft. 0 in.
Height of car post	5 ft. 8⅝ in.
Height of car from bottom of sills over all	9 ft. 0 in.
Height of car from rail over all	11 ft. 7½ in.
Distance from center to center of seats	2 ft. 8⅝ in.
Length of seats over all	3 ft. 0 in.
Width of aisle between seats	1 ft. 7⅛ in.
Distance between seat backs in aisle	2 ft. 0⅝ in.
Weight of car, including trucks and electrical appliances	41,500 lb.

The frames of these cars are of the best quality of southern pine, white oak and white ash, reinforced with soft steel to give the cars the required strength and stiffness. Fig. 19 shows the floor framing, side elevation, end elevation and cross section at bolsters. The side sills are of southern pine in two sections, with a plate of soft steel ½ x 8 in., extending the entire length. In the center the three parts are securely bolted together, and held in position crosswise by rods passing from side to side with nuts and counter-sunk washers at the ends, also by the outer plates of the body bolster being bent so as to form an angle to receive the bolts which pass through them and the side sills.

The side sills are further supported in the center by truss rods and the ends are held up by a continuous iron truss of ½ x 1½ in. iron, which rests on struts located over the body bolster. The ends of these trusses are made of round iron which pass downward through the side sill and engage with a plate of iron designed to receive them; also passing through the end sill and turned up so as to support the end sill. The vestibules are supported by T-irons, which are formed so that the rear end rests under the side sills and where these irons cross under the end sills, they are supported by hangers held in position by bolts which pass vertically through the end sills.

The side plates are of southern pine and are secured to the side sills by rods with nuts and washers at each end; these rods are placed at the ends of the car and each alternate post the entire length of the car. The other posts are secured to the sills and plates by strap bolts. The roof frame of the car is of white ash and oak and framed, as shown in Fig. 19, and further stiffened with 12 iron carlines securely bolted in position.

The posts, which are ash, below the window stools, are rabbeted so as to receive ¾-in. thick filling pieces; these are tightly fitted in all the apertures between the window stool side sills and posts. These filling pieces are securely nailed, glued and glue blocked on the in-

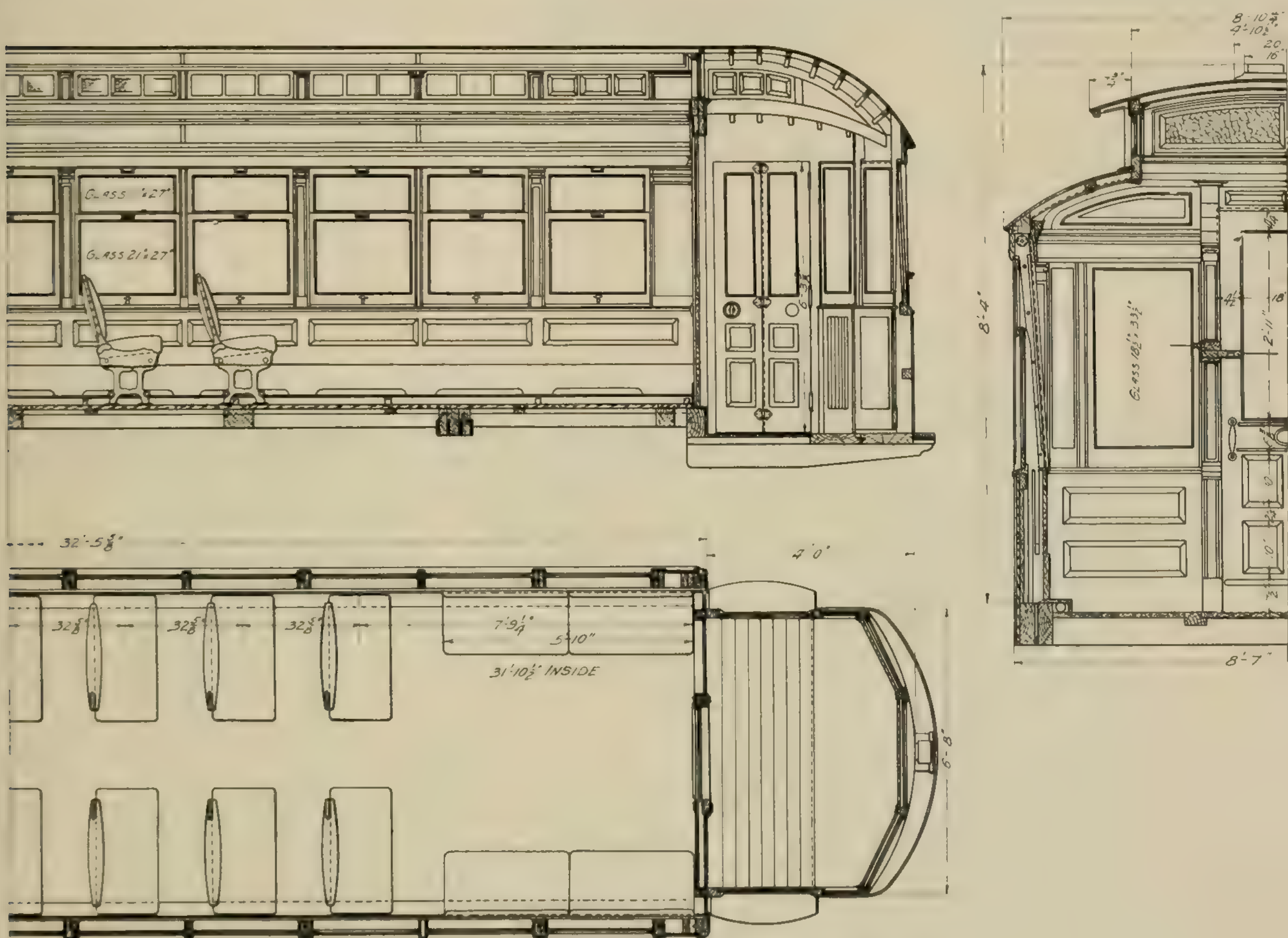


FIG. 20—INSIDE FINISH OF STANDARD 32-FT. 5-IN. BOX CAR.

[illegible] of the car so as to prevent [illegible] and [illegible]. The [illegible] of the car, after the glue [illegible] dressed off perfectly smooth, straight and even before the outside sheathing is applied. The outside sheathing is glued and thoroughly nailed to the side sills, nailing belt and window stool, thus tying the entire side of the car below the windows and sills together and making a structure proportionately as strong as any of the modern built passenger cars.

The exterior of the car is painted standard Pullman color, except the windows, which are finished in mahogany, and the signs, which are painted black with white letters. The Henderson illuminated signs are used. The minor equipment also includes Wilson trolley catcher, the arc and incandescent headlights, track scrapers, fenders and sanders.

Fig. 20 shows the inside finish of the side and end, also the seating plan. The insides of these cars, including the sash, are of mahogany, finished in the natural wood. The ceilings are of good figured quartered oak, neatly decorated, which gives the car a pleasing effect to the eye. The seats are of the Wheeler No. 44 pattern, 36 in. long over all, and are set 32⅝ in. on centers, giving ample room for two passengers of ordinary size on each seat. There are 14

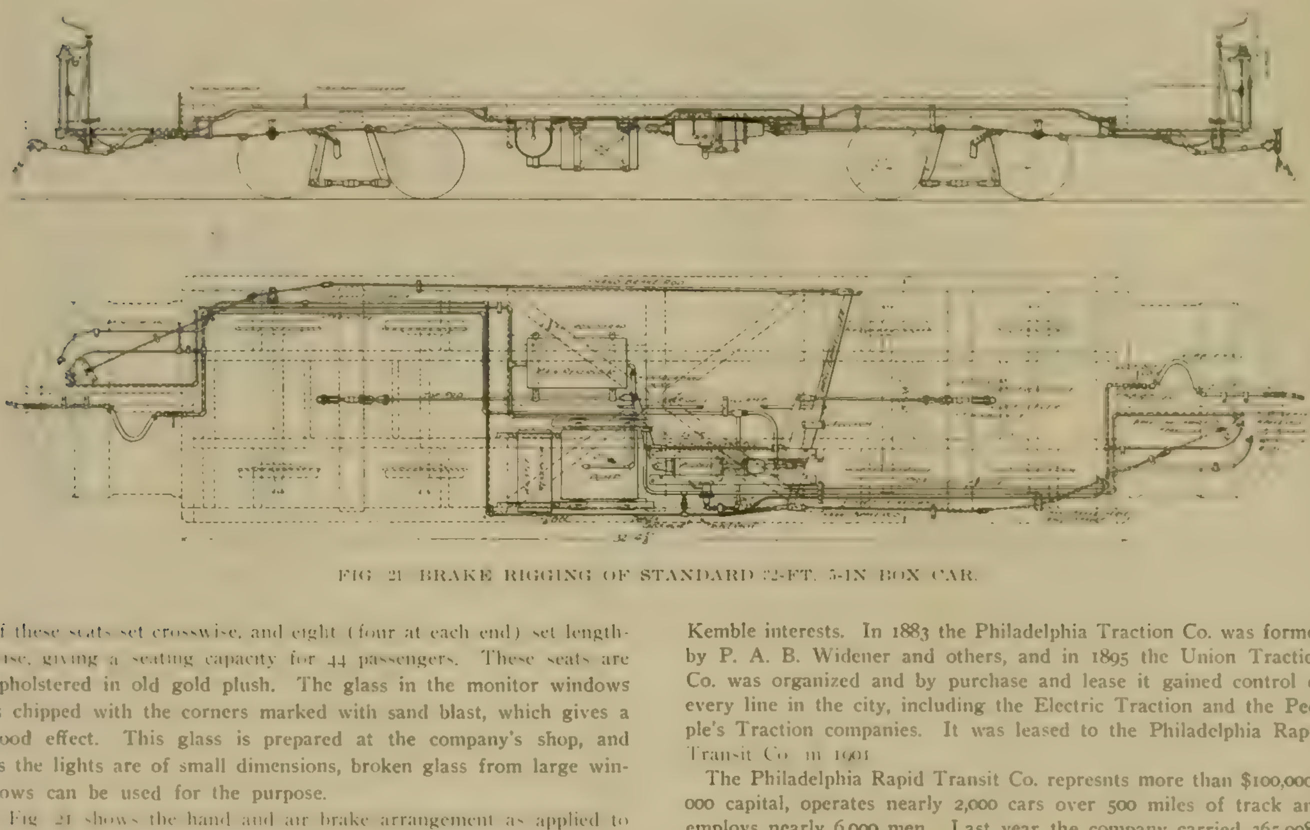


FIG. 21. BRAKE RIGGING OF STANDARD 52-FT. 5-IN. BOX CAR.

of these seats set crosswise, and eight (four at each end) set lengthwise, giving a seating capacity for 44 passengers. These seats are upholstered in old gold plush. The glass in the monitor windows is chipped with the corners marked with sand blast, which gives a good effect. This glass is prepared at the company's shop, and as the lights are of small dimensions, broken glass from large windows can be used for the purpose.

Fig. 21 shows the hand and air brake arrangement as applied to the car. These cars are equipped with Westinghouse quick-action automatic air brakes, with combined auxiliary reservoir and brake cylinder of the type used on the New York Subway cars; the triple valve is located on the side of the reservoir instead of at the end. The cars are also provided with air whistles and have separate whistle reservoirs to avoid the possibility of the motorman's applying the automatic brakes by excessive whistling.

The trucks used under these cars are the Laconia Car Co's. No. 8-B-3, 5 ft. wheel base, designed with hammered steel axles, 4½ in. in diameter at center, and 3½ in. x 6 in. journals.

The equipment consists of four G. E. 67 motors with type M. control.

The cars are heated by the Gold electric system.

The Rapid Transit Commission, New York City, has decided to extend the Brooklyn subway, now under construction, from the junction of Atlantic Ave. up Flatbush Ave. to the Plaza and the Willink gates of Prospect Park.

Fiftieth Anniversary of Philadelphia Railways.

The 50th anniversary of the advent of street railways in Philadelphia, Pa., occurred April 4th. It was on that date, in 1854, that the Philadelphia & Delaware River Railroad Co. was chartered. It was equipped with 10 dummy engines and a few horses and mules. About three miles of track was operated and the road employed 150 men. In 1858 the name of the road was changed by special act of the legislature to the Frankford & Southwark Philadelphia City Passenger Railroad Co. Then followed, in the same year, the organization and construction of a number of roads, among them the West Philadelphia, the Citizens', the Philadelphia & Gray's Ferry, the Second & Third Sts., the Ridge Ave., the Green & Coates Sts., and the Fairmount & Arch St. companies. Only one company was chartered before these, the Philadelphia & Darby Railway Co., which was incorporated in 1857. In 1859 five other companies were incorporated.

Next came what is known as the consolidation period which had its advent in the organization of the Continental Passenger Railway Co., formed to fight the old Union Passenger Railway Co., which afterward leased it. The Union was acquired by the Widener-Kemble interests. In 1883 the Philadelphia Traction Co. was formed by P. A. B. Widener and others, and in 1895 the Union Traction Co. was organized and by purchase and lease it gained control of every line in the city, including the Electric Traction and the People's Traction companies. It was leased to the Philadelphia Rapid Transit Co. in 1901.

The Philadelphia Rapid Transit Co. represnts more than $100,000,000 capital, operates nearly 2,000 cars over 500 miles of track and employs nearly 6,000 men. Last year the company carried 365,908,051 passengers, representing $15,436,572 in gross earnings.

On the Lackawanna & Wyoming Valley R. R.

The traffic department of the Lackawanna & Wyoming Valley Railroad Co., or "Laurel Line" as it is known locally, has issued a very attractive illustrated pamphlet descriptive of the region through which the line passes. This is a third-rail system which is operated between Scranton, Pittston and Wilkesbarre, Pa., and it is conceded to represent the highest type of modern construction, equipment and speed. The pamphlet contains 21 excellent half-tone views, and a full-page map showing the company's system. The text is romantic in style and intensely interesting, especially in view of the wealth of historical reminiscence associated with the Wyoming Valley. The front cover of the pamphlet, which is pocket size, is adorned with a picturesque view, in colors.

The "tea pot" fare collection system has been adopted by the street car company at Marquette, Mich.

Time-Recording Clocks for Keokuk Railway.

We are informed by Mr. A. S. Grenier, superintendent of the company, that the Keokuk (Ia.) Electrical Railway & Power Co. has installed a Bundy time-recording clock at the intersection of 5th and Main Sts., Keokuk, at which point all of the cars of the Keokuk Electrical Railway & Power Co., including those of the Keokuk & Western Illinois Electric Co., which is owned by the former, pass or transfer on every trip. The city is not large enough to warrant an elaborate system of street railway operation, therefore the company has to handle the system as economically as possible, especially as the superintendent besides being car inspector and time keeper, has numerous other duties. Consequently, it was decided that a system of registering at the point named would give accurate information as to how the cars were making connection and whether they were on time. The cars are run on a 15 and 20-minute schedule.

The clock which has been installed is a regular Bundy clock made by the International Time Recording Clock Co., of Rochester, N. Y. Each motorman is supplied with a key which has his number stamped upon it. When he arrives at the corner where the clock is stationed, the motorman is required to leave his car and "punch" the clock, thereby recording the time of day and number of the key upon the tape. The clock automatically winds the paper tape which is used for record on a roll and each morning this roll is taken to the office, and a detailed account of the work of the previous day is thus obtained.

April 2nd the Public Service Corporation of New Jersey caused the arrest at Hoboken of seven conductors and motormen on charges of conspiracy and robbery. It was asserted that the company had lost $75,000 through a system of transfer fraud practiced by a combination of employes.

Cars and Shops of the Portland Ry.

The accompanying illustrations show the type of car that has been adopted by the Portland (Ore.) Railway Co. as best suited to the climatic conditions of that city, and also some views taken in the shops built in 1902, where the company has built or rebuilt the greater portion of the cars now operated.

FIG. 1—ONE OF THE REBUILT CARS, PORTLAND.

These cars may be described as a modified California type with the ends enclosed by semi-convertible vestibules. The central portion is the ordinary closed construction. At each end is a long platform with longitudinal seats facing inward (instead of outward as in the original California type) and a low partition in front of each to provide space for the motorman.

FIG. 2—PARTIAL VIEW OF CARPENTER SHOP.

The new cars of this type are about 39 ft. long having for main sills 8 in. I-beams 34 ft. long, the width over all is 7 ft. 2¾ in. The central closed body is 20 ft. 5 in. long, and the two platforms

are each 8 ft. 8 in. long inside. The entrances are 2 ft. 10 in. wide. It will be remarked that these cars are very narrow, a condition necessitated by the narrow streets of Portland, many of which are but 30 ft. between curbs, and the sharp curves at street intersections.

The rebuilt cars have floor frames of practically the same construction as the new ones, but the closed portion of the car is an old 16-ft. body set on top of the side sills.

All the new cars are mounted on maximum traction trucks built after designs of Mr. Frank I. Fuller, general manager of the company, in which cast steel frames are used. The motors are G. E.-58. Maximum traction trucks are used because the sharp curves and steep grades on all lines prevent high speed, and the extra tractive force is needed on every line, even if only at bridge approaches.

FIG. 3. NEW TYPE OF CAR, PORTLAND.

The views of the wood shop show eight of the new cars on the floor. This room is 67 by 178 ft. and is on the second floor of the building. The woodworking machinery comprises a planer, a sticker, a joiner, a shaper, a sander, a mortiser, a tetoning machine, a turning lathe, a band saw and a borer, the last two tools having been made in the company's shops after the designs of Mr. H. von der Werth, foreman of the wood shop. All of these machines are connected to shaving uptake. For shop power two Sprague railway motors are used.

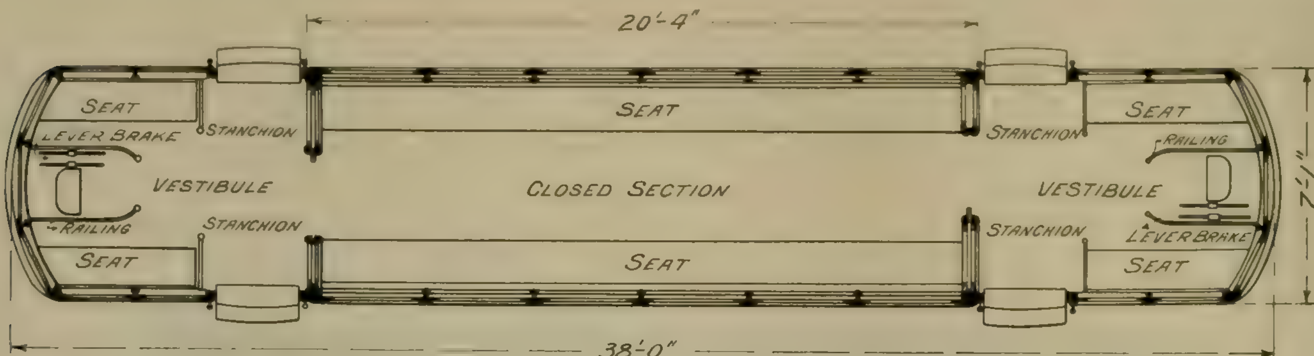


FIG. 4—PLAN OF PORTLAND CAR.

At the right hand side of Fig. 8 is seen the elevator for communicating with the lower floor. The platform of this is 40 x 10 ft. and is suspended by four cables, the winding mechanism being driven by a Sprague motor.

Two ingenious devices of Mr. von der Werth for holding the incandescent lamps for lighting are shown in Figs. 6 and 7. For lighting the erecting floor 16-c. p. lamps are mounted on a narrow strip of ½-in. pine, stiffened by a second piece placed at right angles to it. These bars which are 40 ft. long are suspended by cords running over pulleys fixed to the roof trusses; when counterweighted, adjustment for height can be made easily and quickly. Each bar has at one end a key switch controlling the lamps on that bar.

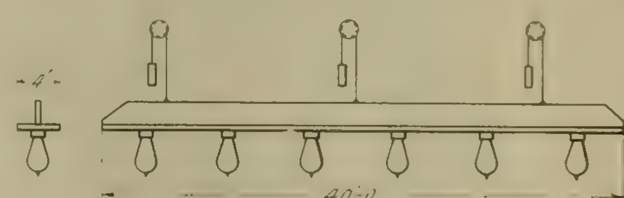


FIG. 6.

FIG. 5—EIGHT 38½-FT. CARS READY FOR PAINT SHOP.

For adjustable bench lights a swinging arm supported by screw eyes is used; on this arm slides a light block with a notch at its lower end shaped so as to hold the flexible cord of the lamp when pressed into it.

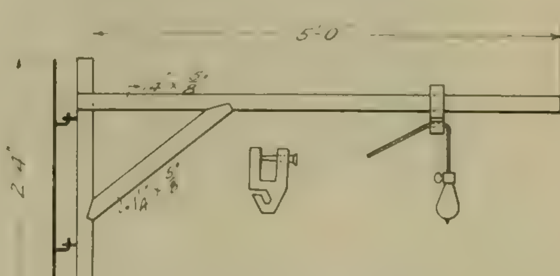


FIG. 7.

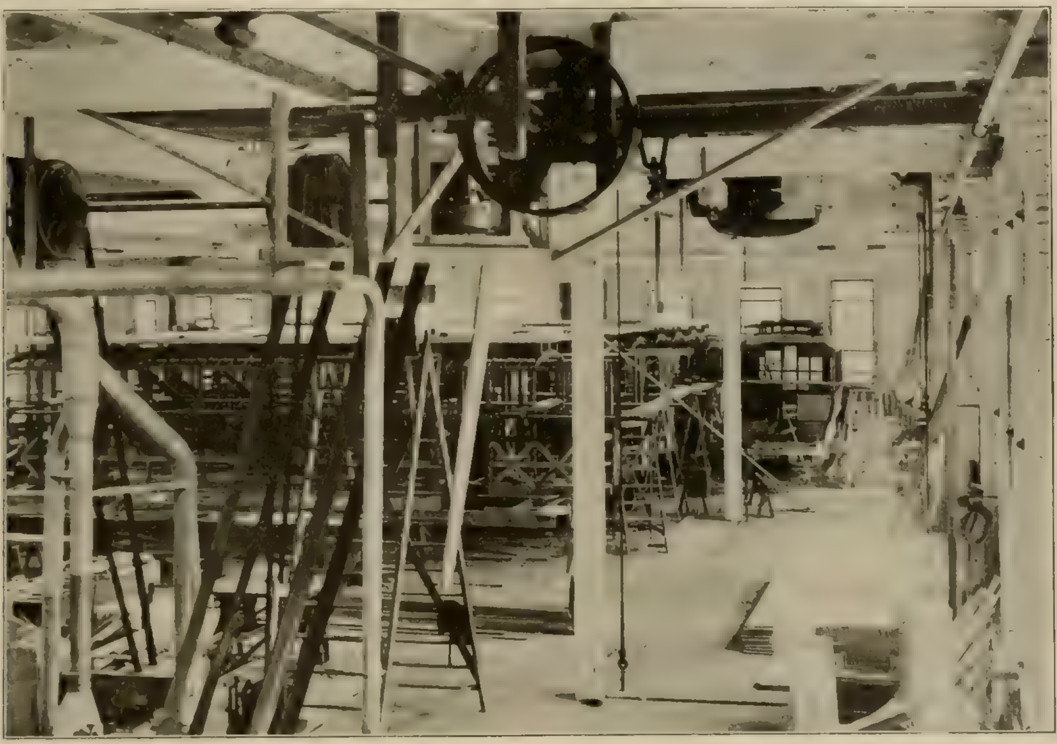


FIG. 8. CARS UNDER CONSTRUCTION AND ONE REBUILDING.

The other departments of the shops are equipped for forging, machine and truck work, painting and building and assembling special work. The foremen in charge are: William Frogmier, machine shop; F. J. Bates, paint shop, Charles Gehrig, armature shop; H. Robertson and J. Bond, truck department.

Inspection of Car Building.

The following pertinent suggestions anent the inspection of cars in the process of building, by a representative of the company for whom the cars are being built, were sent to the "Review" by a street railway official who has had a large experience and is thoroughly familiar with every detail of the business.

Many street railway managers have doubtless asked the question, when placing an order for cars, "Does it pay to send an inspector with the order, to see that the car builder adheres to the requirements of the specifications and drawings?" This depends largely upon the character of the inspector; likewise of the car builder or contractor. An inspector, to be successful, should be a man of good character, with a keen sense of justice and fairness towards the company he represents, at the same time remembering that the car builder has rights that should be considered.

An inspector who at times requires, when walking, a doorway large enough for one of his cars to pass through does not receive the respect and deference, either from the contractor or his employer, that he would if he at all times walked the "paths of soberness." If the inspector is just, he will not treat the contractor as though he expected him to be dishonest, anyway, or act as if he thought the contractor's employes were trying to cheat him. And this brings us to the consideration of the qualification of tact. The inspector who starts in with the idea that he can catch more flies with vinegar than with sugar will soon find that it is the one against the many, instead of the one with the many.

By all honorable means the inspector should keep on the right side of the foremen of the various departments, treating them and their suggestions with deference. There is much to be learned by a friendly exchange of experiences, and if the builders have a better way than yours adopt it with thanks. Laugh at their stories, even if you heard some of them when you were a boy. Call their attention to poor work you see them doing as if you thought it were an oversight on their part, and in nearly every case you will get the wrong righted. Have a pleasant "good morning" for the workmen, for upon them depends largely whether you get good or bad cars. If they have made a mistake unintentionally, do not swear or ridicule, but try to find a way out of it as gracefully as possible.

If you are satisfied a workman is intentionally slighting his work, appeal first to his sense of right and pride in good work; if he still persists in doing wrong, notify his foreman, and if the foreman cannot remedy the evil, ask those in higher authority to take the man off of your work.

Do not ridicule the cars or the city where you may be inspecting. Most persons are sensitive on such matters and all proudly believe "there's no place like home."

Praise the man who does good work for you and thus let him know you appreciate it. Do this especially in the case of boys just starting to learn the trade, for a word of commendation and good advice to such a one is the "sowing of good seed."

An inspector should have large practical experience to draw from and he should be of sufficient age to command respect. He should be able to explain the drawings, and it is especially desirable that he should have had practical experience in the mill and at the bench, and that he should be a good judge of lumber.

Car builders and contractors as a whole endeavor to give good cars for the money, but none are in the business for fun, health or glory, and it is but human when they find that they took the work too low for some of them to look out for number one, to the detriment of the buyer.

Most managers make the mistake of sending the inspector at the wrong time. The inspector should be on hand to fully explain the drawings and specifications when they are delivered to the builder, so there will be no doubt as to their meaning. Then when the builder is ready to begin the work the inspector should be there in order to inspect the lumber as to quality and dryness. He should insist on having for the posts and other important parts of the car good, solid, heavy, coarse-grained lumber of the kind specified, and make sure that it was cut from live trees of vigorous, rapid growth. Ash (with dark spot when color is no object) can be used when heavy and coarse grained. In fact, it is much better than brash white oak of fine, or small, yearly growth.

There are places where brown or calico ash may be used, when the parts are large and are not to be subjected to severe strains. In a word, lumber should be selected for the strain to which it

to be corrected, and it should be well seasoned, [illegible] open sheds or [illegible] where the air circulates freely.

The inspector who has had a good practical experience in select-ing lumber will temper justice with mercy. In the mill he will see that the tenons and the interlocks are a driving fit, for without this the cars will soon get to "working." In the erecting shop see that a generous amount of white lead is used wherever specified; also see that the right quantity of glue is used; take care that the bottom and side and end frames are square, and so on through every department. As a result of his watchfulness the inspector will get better work and material, and also have better cars.

The presence of an inspector has a restraining influence on the man who is inclined to use a Jersey screw driver (a hammer), instead of inserting the screws in the usual manner. A car bottom that is an inch out of square would be "pretty good," were it not for the inspector who insists upon a much smaller discrepancy. The "Dutchman" that would be put in to make up for a bad joint is left out and the work done right, because the inspector will see it. The door that would be occasionally poorly adjusted is made to run smoothly, and so on.

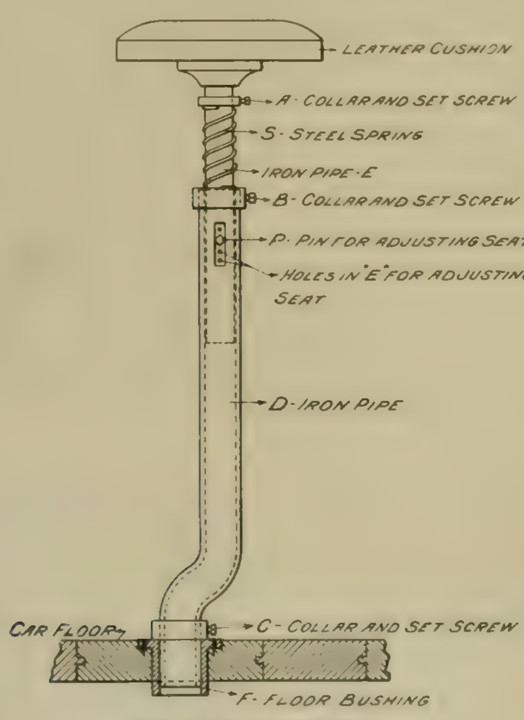
Of course, there are always some men who slight their work if not closely watched, and there are others who will shirk even if they are watched.

In conclusion, if the inspector has done his duty he has been no detriment or cause of financial loss to the conscientious builder, but on the contrary has been a positive help, and he has added to the value of the cars an amount greater than the expense of his inspection trip.

A Seat for Motormen.

The accompanying illustration shows a seat for motormen which is in use by several of the street railway lines in Los Angeles, Cal. There are several types of these seats, but the figure here shown gives a good idea of nearly all. On some lines an ordinary four-legged stool is used.

In constructing the seat a piece of common wrought-iron pipe D,



SEAT FOR MOTORMEN

usually about 1½ in. in diameter, is bent as shown and a shorter piece E small enough to slide inside of D, is secured to the seat. A collar A is secured to the small pipe E and another collar B is secured to the outer pipe D. Between these collars a steel spring S is placed to act as a cushion. A floor bushing F is set into the floor of the car at each end, near the controller. Another collar C secured to D prevents it from going too far into the bushing and at the same time allows the whole seat to turn in the bushing, so that its distance from the controller is adjustable to twice the off-set O in the pipe. Sometimes D is made straight, in which case it cannot be so adjusted.

The height of the seat may be adjusted by changing the position of either of the collars A or C. To limit the travel of the seat, a slot is cut in D and a number of holes H drilled in E and a pin P is inserted in the proper hole.

The seat itself is made of wood and is sometimes cushioned with leather, but is more often left bare, and the connection with the pipe E is made by screwing E into a common floor flange screwed to the wooden seat.

The motormen are allowed to sit only between certain points on their runs. In the crowded parts of the city they must stand, and when not in use the seat is stowed behind the controller or hand brake. The floor bushing F is countersunk flush with the car floor and passengers cannot trip over it when the seat is not in use.

Street Cars at Liege, Belgium.

The street car system at Liege, Belgium, is very good, according to a report by Mr. James C. McNally, United States consul. Five companies control and operate the surface transportation there, and there are several lines which connect Liege with the suburbs, making a total of 46 miles of electric lines built or building in and around Liege. One line operated by small steam locomotives was recently changed to electricity. In the city the cars stop only at certain defined stations, correspondingly close. When the passenger pays his fare the conductor gives a ticket which must be retained, as an inspector often boards the car and requests that the ticket be shown. When the seats are occupied no passengers are allowed to stand inside the car, and none are allowed to stand on the front platform at any time. While those boarding the car enter through the rear door those alighting do so by the front door. Motormen and conductors are uniformed and are extremely polite.

One of the tramway companies, the Tramway Liegeois, which has been voted a 30-years' concession, agrees to pay the city 35 per cent of the total receipts of the existing lines, 5 per cent of the total receipts on any new lines built, and one-third of the profits. The road and rolling stock are the property of the city. It further pays to the city yearly 4 per cent of $115,800, which amount must be paid in the aggregate during the life of the concession. The company will carry first and second class passengers, the fare for the first being 15 centimes (3 cents) and the second class 10 centimes (2 cents).

Summer School for Artisans.

The fourth annual session of the summer school for artisans, which is held under the auspices of the College of Engineering of the University of Wisconsin, at Madison, Wis., will begin June 27, 1904, and continue for a period of six weeks. Courses of study are offered in the following subjects: Steam, gas and other heat engines; applied electricity; mechanical drawing and machine design; materials of construction, fuels and lubricants. In connection with these studies there will be a course of shop work, consisting of practice with hand tools, wood and metal working machinery, blacksmithing and pattern making.

This school has been established for the benefit of machinists, carpenters and of sheet metal workers; stationary, marine or locomotive engineers; shop foremen and superintendents; superintendents of water works, electric light plants, power stations, factories, large store and office buildings, and for such young men who wish to qualify themselves for such positions. The instructional force is taken from the regular faculty of the College of Engineering and the entire laboratory and shop equipment belonging to the University is used by the summer students. The cost is barely nominal.

The requirements for admission do not extend beyond a working knowledge of English and arithmetic. A bulletin describing the work of the school in detail will be sent upon application to the dean, Mr. Frederick E. Turneaure.

It is stated that the Delaware & Hudson Co. will equip its line between Carbondale and Wilkesbarre, Pa., with a third-rail electric system, to compete with the "Laurel Line."

Car Painting.

BY F. S. RANDLETT, MASTER MECHANIC, OLD COLONY STREET RAILWAY CO.

The subject of painting is one in which I am much interested owing to the vast amount of work which is being done in the painting department since the Old Colony Street Railway Co. commenced standardizing the colors for its open and box cars.

All cars that are to go through the paint shop either to be painted or touched up and varnished are first examined by the carpenters who make all necessary repairs. The painters then strip the car of all sash, doors, etc., which are all properly numbered with the car number, and the car is then dusted and all loose dirt removed before the cleaning is commenced. If the car is to be only touched up and varnished it is very essential that all dirt be thoroughly removed as well as all pumice and other foreign substances, for once this dirt is varnished over it is there to stay. This dirt will always show until the car is burnt off and repainted, and is more noticeable on the inside of the car where the wood is finished in natural color. The inside being of a light shade the dirt will show more readily than on the darker colors of the outside of the car.

A good arrangement for the cleaning of cars is to have a tank well filled with water to which washing powder is added until it is of the right strength. Care should be taken not to have this liquid too strong as this will injure the old varnish that is to be covered, often streaking the under coat so that it will show through the new varnish. The cleaning liquid should also be thoroughly rinsed off as this is sometimes the cause of varnish cracking and not wearing well. If this part of the work is well done a first class job will result.

The use of soap for cleaning cars in the paint shop is neither economical nor satisfactory. Cleaners are liable to leave the soap in wash buckets over night which is wasteful, and if it is laid on a seat or window stool, as it is apt to be by a careless cleaner, it will result in the removing of the paint and varnish which has to be touched up. This means a patch and a patch is not pleasing to look at. Cars can be cleaned to good advantage by the use of compressed air but such cleaning should be done some distance from the shop where the varnishing is done. By means of compressed air dirt can be removed from corners that are almost impossible to get at with a broom or brush, and it is very useful in cleaning cushions. The air compressor in use in our shops is similar to the one that is used on air brake equipments but is somewhat larger. This compressor fills a reservoir at 80 lb. pressure and the air is distributed by means of pipes to places where it can be used to the best advantage. These pipes have shut-offs at their ends and a wire bound hose with nozzle attached is provided, which can be coupled to the end of any of the pipes.

If a car that has been touched up for several years should need, in the judgment of the master painter, to be repainted, it is stripped in the same way as if it was to be touched up and varnished, after which the painters commence the work of burning off the old paint with blow torches. There are several solutions on the market for the removal of old paint but these compounds are not so reliable as the blow torch. After the burning off comes the sandpapering and making the surface smooth to receive the first coat of priming color, and when this coat is dry all holes and places that require it are puttied with lead putty.

I might add that right here is one of the causes of paint and varnish cracking after the car has been in service for a short time only, and that is in not giving the first coat time to dry properly. I might also add that the same holds good for the succeeding coats. The first coat consists of white lead thinned with about one-half raw linseed oil and one-half turpentine, with a little japan to aid the drying. If the wood is new and has never been painted a greater proportion of oil should be used. After the putty is hard and dry the paint is again sandpapered and the body panels are treated with a coat of heavy paint which consists of dry white and japan and a small piece of keg lead. This is allowed to stand for a few minutes and is then removed by the use of a wide blade knife similar to a putty knife. After this is dry it is sandpapered and it is then ready to receive the first coat for the ground color in which the car is to be painted. In our case this consists of a coat of venetian red ground in oil and thinned with turpentine and a little japan added. This coat is sandpapered slightly with a fine sandpaper after which two coats of red lake are put on, this being the standard color of the box cars. Then open cars are treated in the same manner except that the finishing coat is cadmium yellow. This done, the car is ready for striping and numbering. Both colors are striped with nickel leaf and edged with black. While this work is in progress other painters are preparing the illuminated signs with which all of our cars are equipped. These have white lettering on a background of black without any gloss. The end and side signs are lettered with nickel leaf and shaded with black.

The striping of the car consists of a stripe one-half inch wide running the entire length of the side panels at the top and bottom thus making one long panel in which is placed the number of the car. The numbers on the box cars are painted in block figures of the Roman type and are shaded with black. The numbers are placed one beneath each end window of the side and the same style of numbering is placed in the upper corners on the dashers. The open cars have the same style of number and on double-truck cars these are placed at each end of the side sills on both sides of the car. Single truck cars are numbered on the center of the side sills on both sides of the car and the dashers are numbered the same as those of the box cars. The dashers are striped the same way as on the side making one panel. The bases of both open and box cars are white and are striped with rich olive, the stripe being of about the same size as on the sides. For a fine line chrome green about ⅛ in. wide is used on the open cars while the box cars have for a fine line orange chrome yellow of the same size. This constitutes most of the striping with the exception of a line here and there on the upper part of the vestibules to relieve the heavy appearance if this were left bare.

After the striping comes the first coat of rubbing varnish and when this has become thoroughly dried the gloss is removed by the use of curled hair and the car is then ready for the finishing coat of varnish. The roof is painted with a shade of buff which is in keeping with the other body colors, and the monitor is painted a light slate color. The trucks are treated with a coat of paint known to the trade as "roof red." This is a mineral paint and comes in dry form, and it is mixed with oil, a little dryer, also some japan. While the work of painting the car body is in progress work on the doors sash and all parts that were removed is carried on simultaneously.

The cost of this work varies somewhat with the size and build of the cars. Some require more striping than others, but on the average the short box single truck cars cost from $30 to $40 while the large double truck cars vary from $45 to $55. These figures include all work done from the time the cars were received at the paint shop. To carry out this work successfully it must be well systematized and all the painters are required to do their work in the shortest possible time and to do it well. Our plan is to put every man on that work to which he is best adapted. One man looks after all painters' tools and has charge of the mixing of colors. He is expected to have all paints and varnishes ready when wanted and to keep everything clean and in its place where the supplies are stored. Paint and varnish brushes will wear and keep their shape much better if they are constantly looked after by one man than if allowed to harden and become gummed as will often be the case where every man has his own kit. The brushes should be of the best quality as in my judgment much more and better work results from the use of good tools than from brushes of an inferior quality. In the latter case the bristles are constantly coming out and it requires considerable time to remove them from the work under way. For heavy colors like lead colors the best brush is a good bristle, the shape and size depending upon the character of the work. In the lighter or flat colors the best brush is a camel's hair, the size and shape like that of the others depending on the work.

Good staging in the paint shop is another essential point. The horses should be of two sizes, one about four feet high and the other about six feet, the higher ones having cross pieces so that almost any height can be obtained. The planks which stretch between these horses should have bolts run through them at each end to prevent them from cracking, which will often occur if they are not bolted.

The grinding of colors and the machinery to grind them might be mentioned here, although, owing to the many reliable firms that make a specialty of this and can produce any shade or color for probably less than we could grind it, we have no grinder installed in our shop. There are more or less old paint and skins that accumulate on paint that are often thrown away. I find that by keeping these in one large vessel and mixing them with the waste oils, var

nish, dregs and turpentine, the result is a paint that will answer for many occasions in first coating.

There are many different types of torches that are used in the paint shop in which naphtha is burned so as to produce a hot blue flame. In some cases it is convenient to use gas which is distributed about the shop in the same manner as the compressed air, to which a hose and burner can be attached, the latter producing a blue flame the same as a torch. Whichever is used it is well to have sand pails conveniently distributed through the shop not only when the work of burning-off is in progress, but in case a fire should start from any other cause, the sand being much better than water.

In all well arranged paint shops the varnish room should be separated by partitions from the other work rooms so that none of the dust arising from the other work will settle on the fresh laid varnish. In many cases where all the work is done in one room certain dusty work must be stopped while varnishing is going on. Even in the varnish room great care should be taken that the dust is settled by sprinkling the floor with water and no unnecessary moving around should be permitted in this room.

Next comes the heating of the paint and varnish rooms and this is an important factor for getting good results for the money expended in the preservation of the cars. One of the best methods of heating is by steam with sufficient pipe to keep the paint room comfortably warm. By this I mean from 55° to 65° F. in the coldest weather. It is not well to have the room warmer than this for paint has a tendency to dry gummy in a room where it is very warm. This is often the case in very hot weather, but it is helped to a very large extent by a good circulation of air. The varnish room should be somewhat warmer, 70° to 75° F. being necessary to have the varnish work and dry well.

Handling Axles and Wheels at Minneapolis.

The Twin City Rapid Transit Co. is now using a heavier axle than formerly, the present standard being what is practically the M. C. B. standard 4¼ x 8-in. journal axle of forged steel of the Pennsylvania R. R. Co's. standard specifications for steel axles. The diameter at the center is 4½ in. to accommodate the motors and the size of the wheel and gear fits are enlarged to 5½ in. The axles are turned over all, the roughing cut leaving them .003 in. larger than the finished size, and they are finished by rolling, a process that has not been, we believe, extensively used in street railway shops. The tool for rolling is a wheel of Sanderson No. 6 special steel, 3 in. in diameter and ¾ in. thick, with a straight face 5-16 in. wide and rounded at the sides to fit the fillets in the journal bearings. This wheel has bosses at each side with grooves

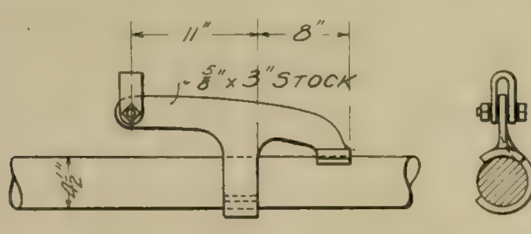


FIG. 1.

to receive bearing balls and is mounted in a fork having on the inner faces of the prongs corresponding grooves to take the bearing balls, and a shank that can be clamped in the lathe tool post.

The lathe for axle turning has two tool posts and in it two axles can be turned complete and surface rolled per day, the lathe being run at high speed in back gear.

The axles are finished to gage and the wheels are bored to gage so that all are interchangeable. The principal reason for finishing by rolling is to provide a hard and smooth surface for the different journals, and also for the wheel and gear fits, that will permit of wheels being replaced without variation from standard size. It is stated that on some of these axles, wheels of standard bore put on for the second or third time require practically the same pressure, 80,000 lb., as when first pressed on.

For drilling wheels tools of self-hardening steel are used with excellent results, the speed being 42 ft. per minute in the 5½-in. hole. Taking roughing and finishing cuts and countersinking, a wheel is bored in about 18 minutes, and by providing special drill holders which will carry two tools, thus avoiding the loss of time incident to setting the tool for the second cut, this time is expected to be reduced one-third. The two tools will be spaced far enough apart vertically so that the finishing cut will not be commenced until the roughing cut is completed, thus avoiding danger of irregularity due to springing of the shaft.

Axles are handled by air hoists running on trolleys, and for lifting the ingenious device shown in Fig. 1 is used. This lifter is forged from ⅝ x 3-in. stock, and at one end has a bearing bent to 4½ in. radius which fits the top of the axle, and near the center a depending hook that passes under the axle.

The axles are stored in racks as shown in Fig. 3, built of 5 x 7-in. timbers secured by 1¼-in. tie rods put through 1¼-in. pipes which serve as distance pieces. The lift of the air hoists is not great enough to allow an axle to be taken from the floor and at

FIG. 2.

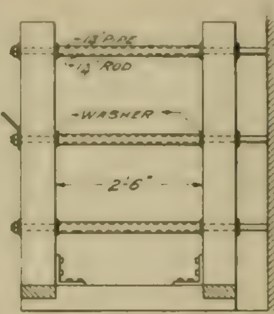


FIG. 3.

once placed on the top bars of the rack, and accordingly a rest is formed by iron straps bent and bolted to the front vertical members of the rack as shown in Fig. 2.

Recent additions to the shop equipment include lathes and boring machines for axle and wheel work, and also a 200-ton hydraulic wheel press which is motor driven. These machines are so located over a track leading outside the shop that as wheels are mounted, they pass directly from the wheel press outside the building to the storage tracks for wheels and axles, thus avoiding the considerable extra labor of handling.

In pressing wheels on axles, the Master Car Builders' recommended practice is used and especial care is taken to see that wheels are gaged correctly and are exactly equi-distant with reference to a prick punch mark at the center of the axle.

To Enlarge Cincinnati Terminal Station.

The Interurban Railway & Terminal Co., of Cincinnati, O., has purchased a lot of land, 50 x 223 ft., just north of its present terminal station on Sycamore St., upon which will be erected a building corresponding in architecture to the present six-story passenger station building. For the present, however, only one story of the new building will be erected, and that will be occupied this season for the handling of express matter. The president of the company, Mr. George R. Scrugham, states that while the company's terminal station looked very large a year ago, the growth of the express business has been so phenomenal that the company was compelled to purchase the additional land. The increased facilities will render possible an arrangement with the Cincinnati, Dayton & Toledo Traction Co., whereby the terminal company will handle the city express business for the other. It is proposed to establish a system of express trolley cars in Cincinnati similar to that in St. Louis, Mo.

The Roanoke (Va.) Railway & Electric Co. issues a serviceable tariff card to advertise its Roanoke, Salem and Vinton fast freight line. It is a white Bristol board card, 6 x 11 in., printed in red and black. There is an eyelet at the top by which it may be hung on the wall. A view of one of the company's freight cars is shown, followed by the rates in cents per 100 lb., and a schedule of cars upon which conductors may receive freight. As stated on the card, it is issued with the compliments of the general manager, Mr. J. W. Hancock, and the card also bears the name of the freight agent, Mr. E. L. Baker.

What the Street Railway Accountants' Association Has Done.

The Street Railway Accountants' Association of America has issued a circular in pamphlet form, setting forth briefly the purposes and accomplishments of the Association, with a view to engaging the interest and support of street railway companies which are not included in its membership. As stated in its preface, the circular is issued in reply to the following inquiries: What is the Accountants' Association? What are its objects? What does it do? What has it done? Will it assist our Accounting Department? Will it pay us to join? These and more are fully answered and explained in the pages of the pamphlet. It is set forth that the Association was organized at Cleveland, O., Mar. 23-24, 1897, and has held regular annual meetings since that time.

In explanation of the objects of the Association and what shall constitute its membership, sections of the constitution are quoted. Then follow concise explanations of the classification of accounts, form of report, blank forms, unit of comparison and method of accounting for material and supplies endorsed by the Association.

The fact that the Association is an honorary member of the National Association of Railroad Commissioners, and is represented at the conventions of that body, is commented upon as being of great benefit to the members of the Association, especially those companies which are operated upon steam road principles.

The efficiency of the Association's methods is shown by excerpts from testimonials by well-known street railway managers and prominent accountants.

The circular shows that the Association has grown from 25 members in 1897 to about 150 at present. It includes members from 36 states, besides many from Canada, England, Scotland and Mexico. If tabulated, the membership would show about 70 per cent of the existing mileage and all the most important companies, indicating that the movement has the support of the largest financial and operating interests.

Large and small companies have alike found it to their advantage to belong to the Association, and all who have attended the annual meetings have derived immeasurable benefit.

The Association desires to have in its membership every street railway property in the country. A blank application is attached to the circular, which concludes with a list of subjects discussed at the annual meetings, covering every variety of accounting practice. Further information will be furnished by the secretary of the Association, Mr. W. B. Brockway, 40 Morris St., Yonkers, N. Y. The circular was compiled by Mr. Brockway and it is tastefully printed and bound in handy pocket form.

Metropolitan Elevated to Adopt Multiple Unit Control.

The Metropolitan West Side Elevated Railroad Co., of Chicago, Ill., will adopt the multiple unit control system for the operation of its trains as soon as the equipment can be obtained. The company has now 87 motor cars which will be changed as to control, and it has ordered 68 new motor cars which will be equipped with the multiple unit control apparatus likewise. Forty-five of the new cars are being built by the American Car Co. and the other 23 by the Jewett Car Co. The Metropolitan recently borrowed $1,000,000 to pay for these and other changes, the principal part of the money to be used in completing the new downtown terminal and in building two storage batteries of about 1,800 ampere hours capacity each. The Electric Storage Battery Co's. "Chloride Accumulator" batteries will be installed.

Accidents.

A Santa Barbara (Cal.) Consolidated Railway Co. car jumped the track on a down grade April 10th, struck a telegraph pole and overturned, killing five persons and injuring 40 others.

As a result of a collision between two Metropolitan West Side Elevated Railroad Co. cars at the Logan square terminus, Chicago, April 7th, one of the injured passengers has died at the hospital.

International Electrical Congress.

We are informed that the following papers are promised for Section A—the Section on "Theory" of the Congress, of which Prof. E. L. Nichols is chairman and Prof. H. T. Barnes secretary:

Foreign.

Prof. Paul Drude, "Metallic Conduction."
Prof. W. Jaeger, "Electrical Standards."
Sir Oliver Lodge, F. R. S., "Ions."
Prof. N. Nagaoka, "Magneto-Striction."
Prof. J. J. Thomson, F. R. S. (subject to be announced).
Prof. J. S. Townsend, F. R. S., "The Theory of Ionization by Collision."
Mons. J. Violle, "Secondary Standards of Light."
C. T. R. Wilson, F. R. S., "Condensation Nuclei."
Prof. P. Zeemann, "Magneto-Optics."

American.

Prof. H. T. Barnes, "The Mechanical Equivalent of Heat as measured by Electrical Means."
Dr. Carl Barus, "Atmospheric Nuclei."
Dr. Louis A. Bauer, "The State of our Knowledge Regarding the Earth's Magnetism."
Prof. D. B. Brace, "Magneto-Optics."
Prof. H. S. Carhart and G. W. Patterson, jr., Ph. D., "The Absolute Value of the Electromotive Force of the Clark and Weston Cells."
Prof. G. D. Child, "The Electric Arc."
Dr. K. E. Guthe, "Coherer Action."
Prof. E. P. Lewis, "Electrical Discharges in Gases."
Prof. L. T. More, "Electro-Striction."
Prof. E. F. Nichols, "The Unobtained Wave-Lengths between the Longest Thermal and the Shortest Electric Waves yet Measured."
Prof. E. L. Nichols, "Standards of Light."
Harold Pender, Ph. D. "Magnetic Effect of Moving Charges."
Dr. H. I. Pupin, "Electrical Theory."
Dr. Edward B. Rosa, "Alternating Current Measurements."
Prof. E. Rutherford, "Radioactive Change."
Prof. J. C. McLennon, "Radioactivity of the Atmosphere."
Prof. J. Trowbridge, "Electrical Discharge in Gases."
Prof. A. G. Webster, "Electrical Theory."

It is evident from the above list that a very fine program has been secured by the officers of Section A.

A meeting of the Congress Committee of Organization is scheduled for April 23d, at 1:30 p. m., in New York. All Congress officers have been invited to attend. The meeting will be at 95 Liberty St., New York, and by kind permission of the American Institute of Electrical Engineers, at its offices.

Acceptances of membership in the Congress number over 1,300 up to the present time, and 150 papers have been promised, in all.

The following societies have all promised to hold conventions at St. Louis, during the Congress week, and to hold conventions with one or more Sections of the Congress:

The American Institute of Electrical Engineers,
The American Physical Society,
The American Electro-Chemical Society,
The American Electro-Therapeutic Association,
The International Association of Municipal Electricians.

The British Institution of Electrical Engineers has also arranged to co-operate under some plan, the details of which have not yet been determined.

The following bodies have promised to co-operate by sending delegates.

The Societe Internationale des Electriciens.
The National Electric Light Association.
The Association of Edison Illuminating Companies.

Co-operation is expected from various other societies.

New York Rapid Transit Bills Passed.

Two rapid transit bills which were passed by the New York General Assembly April 7th were recommended by the New York City Rapid Transit Commission. They abolish the limitation placed upon the city authorities in the expenditure of moneys for rapid transit roads and permit the commission to consider bridges in laying out rapid transit routes. Governor Odell sent an emergency message to both branches of the Assembly, removing constitutional barriers to the immediate passage of the bills. Under the new bills the $55,000,000 limit on subway building is removed, and the new limit can be whatever the city may stipulate.

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The publisher of the STREET RAILWAY REVIEW issues each year on the occasion of the meeting of the American Street Railway Association four or more numbers of the *Daily Street Railway Review*, which is published in the convention city and contains the convention reports. The *Daily Street Railway Review* is separate from the STREET RAILWAY REVIEW, but is in its nature supplementary thereto.

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CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

DOES THE MANAGER WANT ANYTHING?

If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

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SUMMARY OF CONTENTS.

INTERCHANGEABLE TICKETS FOR INTERURBANS.

In the "Review" for March we discussed the opportunity existing for electric interurban railways to adopt a ticket book or form of mileage that could be used on a considerable number of interurban lines, thus stimulating passenger traffic and giving patrons the advantage of the reduced rates afforded by mileage books without asking them to make an unreasonably large investment. Since then the Ohio Interurban Railway Association has been organized and an interchangeable ticket adopted. This ticket, which will be placed on sale in May will bear the names of at least 16 companies on the cover and be valid on about 1,000 miles of track. The form adopted is the coupon book as distinguished from the mileage book, which was chosen as leaving each company greater liberty in fixing rates of fare. The essential features are: A book cover containing a strip of 240 coupons of the face value of 5 cents each, sold for $10.00, thus giving a discount of one-sixth, which corresponds to the discounts on the principal lines using mileage books. The time limit within which the ticket must be used is one year, and the books are not transferable.

The coupon ticket is equally convenient for all rates of fare and can also be used on "limited" cars where an excess fare is charged, and the companies adopting it are so well satisfied as to the simplicity of accounting that no joint audit bureau is contemplated at present. The coupons will bear a distinguishing mark, name or initials of the road selling, and the road collecting coupons will bill the proper companies for the tickets of each.

OHIO INTERURBAN RAILWAY ASSOCIATION.

On February 20th the representatives of several of the electric interurban lines of Ohio attended a meeting at Dayton that had been called to discuss the practicability of adopting an interchangeable ticket, a subject that is of great importance at this time. The attendance at this meeting was so much larger than expected and the desire manifested for uniform action on subjects of mutual interest was so keen, that the gentlemen present went further than was first intended and determined to effect a permanent organization. The name chosen, "Ohio Interurban Railway Association," has already ceased to be descriptive of the membership, as companies in Indiana, Michigan, West Virginia and Pennsylvania joined during March and were represented at the first regular meeting held at Dayton March 31st. The association wishes it distinctly understood that it is not a strictly Ohio organization, and we believe that as the membership from other states increases and the possibilities of the association are better appreciated, the name will probably be changed to "Western" or "Central," as being in closer conformity to the object and scope. The Ohio roads are deserving of recognition as the founders, but the superior advantages of a geographical title that is truly descriptive are apparent.

It is the intention of the new association to follow the precedents of the New England Railway Club rather than of the older national and state associations, and hold its meetings every month instead of only once a year. Short programs and frequent meetings for the discussion of live subjects by those having interests in common will ensure success. The first subject taken up by the association was satisfactorily disposed of in the manner noted in another paragraph, and there are numerous others that suggest themselves, so that the association can find plenty of important business to occupy it.

Interurban railways as now developed in the central states radiate from a number of centers as Detroit, Toledo, Anderson, Indianapolis, Dayton, Columbus, Cleveland, Cincinnati, Pittsburg, Wheeling, the different systems touching each other so that many of these centers are connected now, and all of them will be within a few years. With railways offering continuous routes, through cars are only a question of a short time; with regular through cars will come a demand for special long distance scervice, as offered by limited cars, sleeping cars, freight and express cars, etc. When the cars of one company have to be operated over the lines of others, the broad field of standards and car interchange rules is opened for discussion. Traffic rates and agreements demand consideration wherever passengers or freight have to be transferred. All of these subjects are peculiarly within the province of an interurban association; they should interest the electric interurban companies of Illinois and New York quite as much as do they those of Ohio;

they demand prompt attention now and in the near future will be of greater importance.

While there are some excellent reasons the interurban association just formed should become national in scope, and perhaps represent long distance electric railways as distinguished from street railways, geographical considerations and the difficulty of finding common interests of equal importance to all, are not easily overcome. Now the association promises to cover the central states and care for questions arising from existing conditions there; its utility is evident, and its development we confidently predict will be along the lines where it can accomplish the best results.

SPECIAL WORLD'S FAIR "REVIEW."

The "Street Railway Review" for June, which will appear on its regular publication date, the 20th, will be a special number devoted largely to the Louisiana Purchase Exposition. This issue will be a souvenir edition printed upon special paper, profusely illustrated, and in all respects conforming to the standard set by former special numbers of the "Review."

The Louisiana Purchase Exposition, which will be opened at St. Louis April 30th, is by far the largest undertaking of its kind. Comparison with other expositions will give some idea of the physical magnitude of the St. Louis Fair: At St. Louis the exposition grounds comprise 1,240 acres, almost exactly twice the area available for the Columbian Exposition at Chicago in 1893, and the same proportion obtains in the areas of exhibit spaces in the buildings of these two fairs. Compared with the smaller expositions in this country, that at St. Louis is ten times as large as the Pan-American and twenty to twenty-five times as large as any of the others. This bigness, however, was not in itself an object, but is the result of the design to portray adequately the resources of the country and the unparalleled developments of recent years.

The "Exposition Review," aside from the more general articles on the city of St. Louis and the Fair, which are of peculiar interest at this time, will thoroughly cover those exhibits which are within the electric railway field, and give a comprehensive summary of and guide to those portions of the contents of the fifteen "Exhibit Palaces" which have to do with electric transportation. As each of these fifteen palaces is the equivalent of six to ten city blocks, the task confronting an individual visiting the fair and wishing to take full advantage of its educational features is apparent. The "Review" will do the preliminary part for electric transportation interests.

"DAILY STREET RAILWAY REVIEW" AT ST. LOUIS.

The "Daily Street Railway," which for the last five years has been published in the convention city during the week of the annual meetings of the American Street Railway Association, and its allied bodies, is recognized as one of the important features of the convention. For five years the "Daily Review" has been the only medium through which those interested in the street railway conventions received prompt, accurate and complete reports of proceedings, and the appreciation of the street railway public is reflected in the growth of the "Daily" which has increased from an average of 42 pages per issue in 1899 to an average of 92 pages per issue in 1903.

The field for the "Daily" in 1904 is broader than it has ever been before and in all probability we shall publish more numbers. We can not make definite announcements until after the Accountants' and Mechanical and Electrical Associations have decided upon the dates for their meetings, but the "Daily Review" will appear in St. Louis the week of October 10th.

The choice of St. Louis for the conventions, and the further selection of Festival Hall, one of the buildings on the exposition grounds, for the business meeting, is admirable in that it will bring the convention delegates into close touch with what will undoubtedly be the most elaborate exhibits of electric transportation apparatus that the world has ever seen. But there are many regular exhibitors at street railway conventions, however, who will not have space at the exposition, and those who are there will be distributed through the Electricity, Transportation, Machinery, Varied Industries, Manufacturers, and probably other of the Exposition buildings. This condition will of course preclude such a centralized exhibit of exclusively electric railway apparatus and supplies as has for ten years distinguished the annual conventions of the A. S. R. A.

One reason for naming but two days for the A. S. R. A. meetings and suggesting that the allied associations meet one before and one after the American, was that railway officials could attend the conventions in relays, so that the entire executive force of a company would not have to be absent from home at one time. This division of attendance, the dispersion of the exhibits, and the fact that if the number of delegates and supply men approximates that at recent conventions, but a small part can hope to secure accommodations at one hotel, all combine to make the "Daily Review" more important than ever before to those who desire to reach the delegates and keep in close touch with the convention.

VOX POPULI IN CHICAGO.

For seven years the question of the terms on which the street railways of Chicago would operate after July, 1903, has been kept open in order that it might continue serviceable as a political issue. Attempts to draft new ordinances that would obviate the necessity of adjudicating the rights of the companies under the so-called 99-year act have failed because the city demanded the waiver of the companies' 99-year claims as a preliminary to negotiation. A year ago all the efforts of the city were devoted to securing the passage by the Illinois Legislature of an act enabling the city to try municipal ownership, and the so-called Mueller act was passed. Negotiations proceeded during the summer and fall, but both the companies and the council committee were only half-hearted because the mayor's attitude made it clear that no legislation could be passed until after the spring election. In the meantime, July, 1903, came and went and the city to save its face granted temporary extensions. The street railways continued to operate, but under conditions which precluded a prudent concern from making substantial betterments that would improve the service given to patrons.

The spring election was held April 5th and the voice of the people was heard. Ever since the vote was known the press of Chicago has been trying to reconcile the result with the hypothesis that the electors of the city are sufficiently intelligent to pass upon the questions submitted. Four questions were submitted:

1. Shall the Mueller law be adopted in the city of Chicago? Yes, 152,432; no, 30,104. 2. Shall the city council proceed without delay to acquire ownership of the street railways? Yes, 120,744; no, 50,893. Shall the city instead of granting franchises, temporarily license the street railway companies until municipal ownership can be secured? Yes, 120,181; no, 48,056. 4. Shall the board of education be elected? Yes, 115,553; no, 58,432. The total registration for this election was 359,937, and the total vote for aldermen, 230,711.

The fourth question has nothing to do with street railways and is mentioned here to show that the voters were almost as heartily in favor of a proposition that was unanimously condemned by the respectable press and leading men of the city, as they were in favor of adopting the Mueller law, which was advocated as strongly as the other question was opposed. The second proposition, for immediate municipal ownership, is admitted to be impossible, because the city could raise no money to improve the railways were the present owners willing to sell; "Mueller law" certificates of indebtedness might be used to buy the roads if the companies would accept them, but cannot be used to pay for the much-needed improvements.

THE DOUBLE-DECK CAR.

The Twin City Rapid Transit Co. is now building a double-deck car and will operate it as an experiment, so that American roads will soon have the opportunity of availing themselves of recent American experience.

The double-deck car for street railways has never been extensively used in this country, though it is very popular abroad, where it is quite satisfactory from the company's standpoint as well as from that of patrons. There were once ten double-deck cars operated on the roads of Washington, D. C., but their use was discontinued ten years ago; cars of this type were also tried in Philadelphia and Boston, and probably in other cities, but only as an experiment and were never adopted. In 1896 there were a few double-deck cars run on the cable lines of Pittsburg, which we know from personal observation were very popular with the patrons of the road; so much more desirable were the double-deck cars

conceded that intending passengers would frequently allow a dozen or more of the ordinary cars to pass and wait for the double decker. The upper deck was more pleasant in every respect, and the only objection now recalled was the feeling of uneasiness when the car was running on tracks equipped with an overhead trolley wire, as it did for a portion of the route. Why these cars were not continued in use is not a matter of record.

The principal objections urged against this type of car are that it affords greater opportunity for accidents that would increase damage claims, that extra work would be thrown upon the conductor, that too much time would be consumed in reaching the upper seats, and that the upper deck is suitable for the warm season only. On the score of danger to passengers, the fact that double-deck cars are permitted in Europe should assure American managers of their safety; the other side of the case, danger to the company, is not so easily judged by foreign experience since the "snitch" lawyer and his fake damage claim are not so well established abroad. The practicability of the open upper deck for winter use in northern cities in America is a question like that of operating open cars in winter; but where the severe climate precludes use of the open section in winter our car builders would quickly provide removable sides or apply the convertible construction.

The second deck would increase the seating capacity of the car, practically doubling it, and the changes necessary in construction would not increase the cost in the same proportion. Whether this together with the advantage of catering to the purely pleasure riders, which we are satisfied this type of car does, are sufficient to overcome the other objections mentioned, is a matter that cannot be determined without trying the cars in service. Cars of this type would be impracticable in cities having elevated railways in the streets, or where the steam railroads have elevated their tracks and built viaducts designed to clear ordinary vehicles only, but such cities are few in number.

Mayor Harrison on Chicago Railways.

In his message to the Chicago City Council Mayor Harrison reviews the street railway situation, and says:

"Two possibilities would therefore seem to present themselves. The first is to draft an ordinance along the lines of the so-called tentative ordinance of the local transportation committee, inserting a provision for a fair and reasonable rate of compensation as well as a provision enabling the city at the end of ten years from date of the grant, upon the payment of a fair price, to acquire the lines, with a further proviso calling for the creation of a sinking fund account of all or a part of the compensation moneys to be used ultimately as purchase money, offer the ordinance to each company, and, if either or both accept, arrange that the ordinance shall be submitted for popular approval or disapproval at the fall election.

"The second plan calls for laying aside the tentative ordinance and for the drafting of a new ordinance, offering to pay the companies in Mueller law certificates the full value of their present tangible property, the value of all their unexpired franchises excepting their alleged rights under the act of 1865, the value of the improvements and betterments to be made necessary by a complete rehabilitation of the systems, finally making a lease of the lines to the companies upon a fair basis, the entire ordinance to be conditioned upon an absolute waiver of all the rights the companies accepting it may claim under the ninety-nine-year act.

"In either proposition the saving clause would be the necessity for the ratification of the action of your honorable body by the public when the referendum vote was had. Each proposition provides for the public ownership, which the people in the 'little ballot' have demanded. Each proposition offers fair terms of settlement to the traction companies. Each proposition would prepare the way for a betterment of the atrocious service to which the riding public of Chicago is today subjected."

April 18th the United States Circuit Court of Appeals reversed the ruling of the Circuit Court, enjoining the minority stockholders of the North and West Chicago Companies from suing in the Illinois state courts to attack the modified leases made between these companies and the Chicago Union Traction Co. Judge Grosscup will instruct the receivers for the railway companies to apply for a writ of certiorari so that the United States Supreme Court may pass upon this injunction.

Chicago Elevated Traffic.

The daily averages of traffic on the Chicago elevated lines for March, 1904, as compared with March, 1903, are as follows: South Side Elevated Railroad Co., 92,547, an increase of 4,556, or 1.11 per cent; Northwestern Elevated Railroad Co., 74,344, an increase of 4,274, or 6.10 per cent; Metropolitan West Side Elevated Railroad Co., 122,507, an increase of 5,790, or 4.96 per cent; Lake Street Elevated Railroad Co., main line, 43,909, a decrease of 147, or .33 per cent; same, with transfers, 45,524, a decrease of 192, or .42 per cent.

New Lines and Extensions Opened.

March 19th the first car was run between San Jose, Cal., and Los Gatos on the new San Jose-Los Gatos Interurban Ry.

The Biloxi (Miss.) Electric Railway & Power Co. began operating cars on regular schedule March 22nd. The line runs through the city east and west from the Camp Grounds to Point Cadet and north and south from the beach to Back Bay.

March 25th the initial trip over the Jersey Shore Electric Street Railway Co's. line from Lock Haven, Pa., to Oak Grove was made by the officers of the company and invited guests.

The York County Traction Co., of York, Pa., has completed its Wrightsville extension as far as Hellam and cars have been running to that point on hourly schedule since April 1st. The fare is 15 cents, or 25 cents for the round trip. The line is well patronized. It will be completed to Wrightsville by July 1st.

The City Electric Railway Co., of Rome, Ga., opened its line to Lindale April 2nd. A 30-minute schedule was instituted and will be maintained.

The Philadelphia Rapid Transit Co. recently opened its new West Spruce St. division, which serves a territory which has not been reached by cars, and where it is expected 1,500 new houses will be built this year.

The first car on the Rockford (Ill.) & Freeport Electric Railway Co's. system was run April 6th. Regular service was inaugurated April 7th. The dispatching system is used.

The new Coeur d'Alene & Spokane (Wash.) Ry., which was built chiefly for the benefit of lumbermen in the vicinity of Coeur d'Alene Lake, was opened recently. It is operated by steam and electricity—steam for the lumber traffic and electricity for passenger and package freight service.

The Jersey Central Traction Co., of Keyport, N. J., opened its line between Keyport and Red Bank April 7th. The road passes through Keensburg, Belford, New Monmouth, Middletown and Fairview.

Brief Notes from Southern States.

The Vicksburg (Miss.) Railroad, Light & Power Co. voluntarily increased the wages of its conductors and motormen 2½ cents an hour recently.

The Pascagoula Light, Street Railway & Power Co., formerly the Moss Point & Pascagoula Railway Co., which recently converted its system from steam to electricity, has petitioned for exemption from supervision of the state railway commission on the ground that it is now an interurban electric road.

The Mobile Light & Railroad Co. contemplates extending its lines to Magazine Point and Plateau, several miles from the city. The principal sawmills in the vicinity of Mobile are in the section named The company may also do a light freight business.

Chief Engineer Grout of the proposed Summit & Magnolia (Miss.) Electric Ry., has completed his survey and reports that the topography of the country is such that the road can be built at a less cost than anticipated.

The New Orleans Railway Co. is making extensive improvements and repairs. Rapid progress is being made upon 4½ miles of track on Magnolia and Ferret Sts.; a new race track is to be built this summer which will require two miles of double track to be built, while a winter resort is to be established near the city which will require the construction of new stations, tracks, etc.

Mr. L. C. Bradley has been appointed general superintendent of the Scioto Valley Traction Co., Columbus, O.

Birmingham Railway, Light & Power Co.

Describing the System which Is a Consolidation of Fifteen Companies — Track and Overhead Construction — Car Barns and Shops — Power House — Rolling Stock — Freight and Express — Steam Heating — Gas Works — Organization.

BY THOMAS DE GRANVILLE, BRABSTON.

The system of the Birmingham Railway, Light & Power Company of Birmingham, Ala., is one of the most interesting and attractive electric railway properties of the country, to say nothing of its other interests. Birmingham is a city of comparatively recent founding and is located in the center of an extensive mining and manufacturing district, which offers unusually favorable environments for the successful operation of a street railway. This company today controls all street railway lines, electric plants and gas works in Jefferson County, besides maintaining a system of steam heating, the exhaust steam from the power plant being utilized for this purpose. The system at present is the result of successive consolidations, there having been at one period as many as 15 different street railroads operating at the same time. From time to time these roads became absorbed by the Birmingham Railway & Electric Co., which was reorganized in 1901 and merged into the Birmingham Railway, Light & Power Co. along with the lighting and gas properties. From that date up to the present upwards of two and one-half millions of dollars have been spent in rebuilding and improving the system under the direction of Mr. Robert Jemison, president, and Ford, Bacon & Davis, engineers, represented by J. A. Emery, engineer in charge. The complete system embraces 110 miles of track, of which about one-third is double track. An examination of the accompanying map suggests the idea of a rimless wheel, Birmingham being the hub; and the lines extending from it in all directions carry out the idea of the spokes, which serve about 140,000 people, and touch 25 or more small towns, varying in population from 2,000 to 15,000 inhabitants, and forming what will in the course of a short time become Greater Birmingham. To facilitate operation, there are 15 subdivisions or lines, viz.:

East Lake.	Avondale and Fountain Heights.
Gate City.	Highland Loop.
North Birmingham.	Highland Avenue.
North Bessemer.	Owenton.
South Bessemer.	Wylam.
North Ensley.	Rugby.
South Ensley.	Idlewild.
North and South Highlands.	

VIEW ON 21ST ST. BIRMINGHAM. DOUBLE TRACK WITH VITRIFIED BRICK PAVING

The longest line is the North Bessemer, which connects Birmingham with Bessemer, and was until 1903 operated with steam dummies. It is 14 miles in length and the currrent for this, as well as all other lines, is supplied from a central station, details of which are given in another place.

The South Bessemer line has its terminal in Bessemer, reaching it through a different territory in a parallel direction to that of the North Bessemer.

The East Lake and South Ensley lines are 7 miles each in length and double track the whole way. The East Lake line leads to the East Lake residence district and Pleasure Grounds, and the South Ensley to Ensley, the home of the large steel plant and rail mill of the Tennessee Coal, Iron & R. R. Company.

The North Ensley line reaches Ensley by a different route from that of the South line, passing through Pratt City and Thomas.

The North Birmingham and Gate City lines serve industrial districts to the north and east of the city.

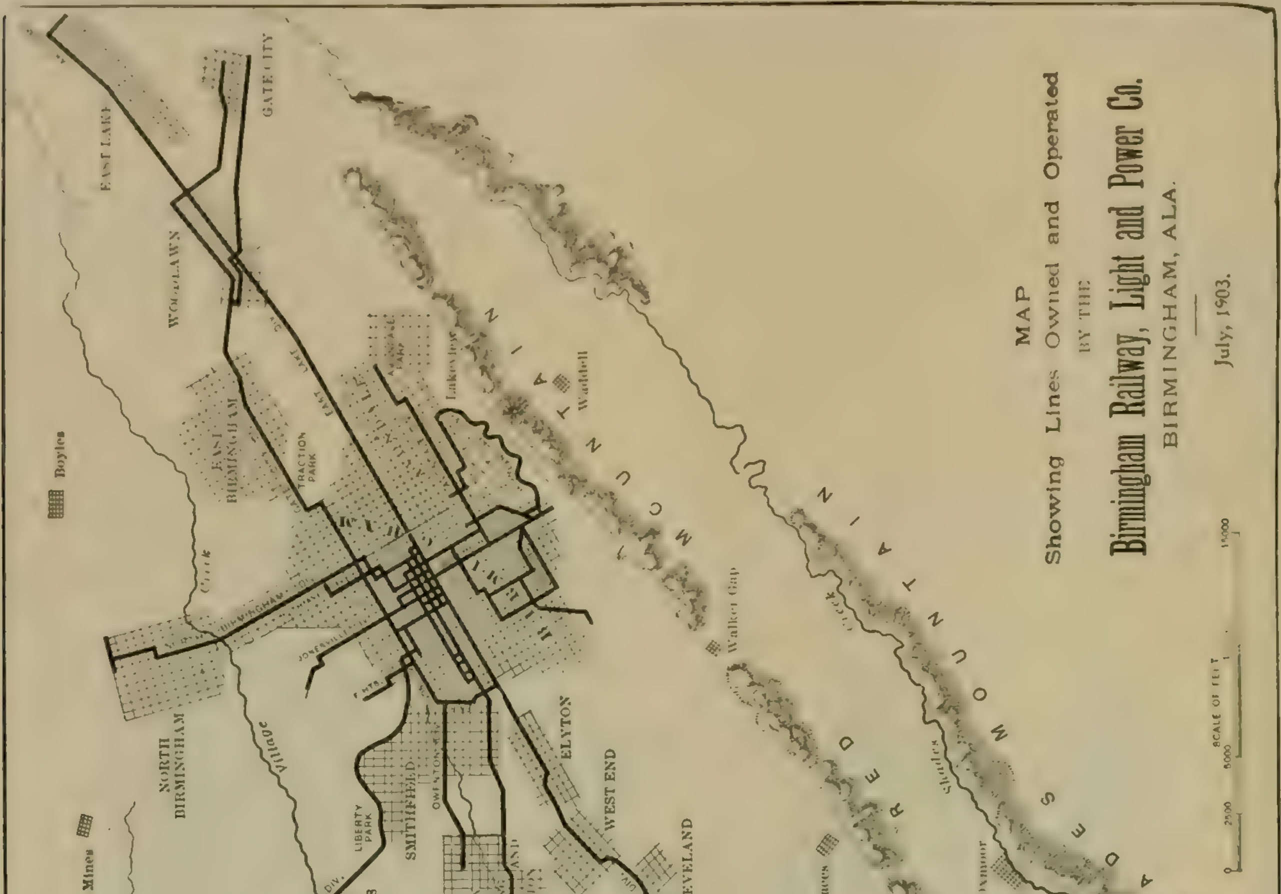
The North & South Highlands and Highland Loop lines, which are both double track throughout, are cross town lines, connecting the fashionable residence district on the Highlands on each side of the city.

The Highland Avenue line is a loop covering another popular residence locality.

The Rugby line is a short line running from the terminus of the East Lake line to Rugby Highlands, a suburban residence locality.

The rate of fare is 5 cents, excepting on the Ensley lines, where it is 10 cents and on the Bessemer lines 15 cents.

Transfers are issued between all intersecting lines except in those



The Avondale and Fountain Heights, the Owenton and the Idlewild lines run diagonally across town and extend to suburban towns and residence districts.

The Wylam line is a short line, recently built from Ensley to Wylam, a thriving little mining town.

cases where the issuance of a transfer would enable a person to return to the vicinity from which he started. These transfers are printed in different colors for each line, the year, month and day of the week being printed on them. They bear the Stedman patented time limit, thus making it only necessary for the conductor

to punch the time and destination. The system necessarily requires more transfers to be printed for each day than are actually used, but it is thought that the time saved to the conductor and the less liability of mistakes in issuing them, compensates for the extra expense. A city ordinance imposing a fine of not less than one hundred dollars for giving, selling or disposing of a transfer, is printed on the back of all transfers.

The cars on the 10 and 15 cent fare lines are equipped with Ohmer registers. The fare denominations on these are arranged after an idea original with this company, being 5 cents, 10 cents, 15 cents, 5 cents and transfer, 10 cents and transfer, tickets and trunks. This obviates the necessity of ringing twice for one fare and enables an inspector to accurately check a car.

The maximum number of cars operated daily is 95 and the minimum 64. This is the average for ordinary days.

Track and Overhead Construction.

Up to the recent consolidation the majority of the rail in use was 40-lb. T section. This has nearly all been taken up and heavier rail substituted. In the business and residence district, which is for the most part paved, an 88-lb. semi-grooved girder rail is laid on pine ties 6 in. x 8 in. x 8 ft., 2 ft. c. to c., under which are 8 in. of slag, making a roadbed that is unusually solid and durable. On the suburban lines the standard is 70-lb. A. S. C. E. T rail, laid on 6 in. x 8 in. x 8 ft. heart pine ties spaced 2 ft. c. to c. on 10 in. of slag ballast, with the slag between the ties, which makes a track that will grow more firm as it ages.

Weber joints are used on all 60-lb. rails and "Continuous" joints on that 40-lb. rail which remains. All tracks are standard gage.

In the heart of the city a great deal of expensive special work has been put in, and connecting curves have been installed at almost every corner, so that cars may be changed from one line of track to another at will, with the greatest possible dispatch. On the East Lake, South Ensley, Loop and North & South Highlands lines, all of which are double track lines, cross-overs have been placed at frequent intervals so that in case of a blockade it will be possible to run around the blockade and continue the schedule without interruption to the service.

The overhead construction has been changed from center and side pole bracket to span. The poles are all of uniform size and height, being 12 in. square at the base and tapering to 8 in. at the top. They are creosoted pine, and are imbedded in 4 in. of concrete, which renders them practically impervious to water and decay.

CAR HOUSE AT THIRD AVE. AND 10TH ST.

The standard trolley wire is No. 0000 grooved section, which has been found to be the most serviceable of any used.

Car Barn and Shop.

Until 1902 the cars were housed and repairs made at no less than five different barns and shops. This arose from the fact that each road operating in Birmingham had its own shop, which was continued as a division shop after the consolidation. A condition of this kind naturally was not only extremely expensive, but work could not be as successfully accomplished as at one central shop under the supervision of one master mechanic. Therefore a mammoth car barn and shop were built at Third Ave. and 10th St., about two-thirds of a mile from the center of the city. The barn is 140 ft. wide by 392 ft. 10 in. long, and is double ended, the cars going in at one end at night and out the other in the

VIEW ON EAST LAKE LINE.

morning. The height from top of rail to under side of roof trusses is 18 ft. Nine tracks extend the entire length of the building and one track runs half through, this trackage being sufficient to hold one hundred of the largest cars. The walls of the building are of red pressed brick laid with red mortar, surmounted by a pitch and tar composition roof supported on steel roof trusses. The floor between the tracks is of rolled cinders, rendering it practically the same as concrete and considerably less expensive. The pit floor is of concrete, and the pit space is eight tracks wide and 160 ft. long, the tracks being carried on pipe track supports. An unique feature of the pipe track construction is that there are no braces or girders used, and access throughout the pit from track to track is thus made possible without coming out of it, the whole pit space being unobstructed except by the track supports. This is very convenient and somewhat unusual. Two tracks nearest the wall are designed for washing cars and have sloped floors. Hose connections are arranged at frequent intervals and all the appliances for

[illegible] to be found at the [illegible] remarkably clean appearance of the [illegible], and [illegible] are allowed to appear in active service that are dingy and dirty.

The interior of the car house is well lighted by numerous windows in the side walls and cross sky-lights in the roof.

In the Third Ave. and 11th St. corner of the barn are located

ONE SECTION OF CAR HOUSE

the office of the barn foreman, the office of the superintendent of the railway department, who is at the barn from 10:00 to 11:00 a. m. daily to call the attention of the men individually to rules they have violated, and that of the receiving cashier, whose duty it is to receive the reports of conductors when they bring their cars in the barn at the completion of their runs. Immediately joining this office is a large waiting room for the motormen and conductors. This room is provided with comfortable chairs, tables and copies of the leading street railway publications. It is well lighted and heated, and boards showing bulletin orders, runs, etc., are also found here. In connection with this room and leading from it is a well kept, attractive looking toilet room, provided with all of the necessary toilet accessories.

To the rear of this room is located the sand drier, where, within an incredibly short space of time, a car load of wet sand may be thoroughly dried and rendered fit for use in the sand boxes.

An important feature of the building is a fire wall in the center extending the entire length. In the event of a fire breaking out among the cars in one part of the building, the fire doors may be lowered, and even if the fire were not successfully checked, the wall would save the equipment in the other side. The building is further protected against fire by a complete independent piping system with hose.

All the cars of the system, except those on the East Lake line, use this barn. The travel on this line is very heavy at morning and night, making the use of trailers advantageous, and on this account the individual or division barn near the end of the line has been retained.

The company is contemplating the installation of a lunch counter at the central barn, for the use of the motormen and conductors, a great many of whom leave very early in the morning and get in very late at night. If this plan is carried out, the prices will be arranged to make the income cover the actual expenses of maintaining it. The idea is heartily favored by the men.

The first car from the barn leaves at 3:40 a. m. and the last one comes in at 2:10 a. m.

On the other side of the block with an alley between is the repair shop, occupying a space 114 x 400 ft. This building is of red pressed brick and red mortar, covered by a pitch and tar composition roof on steel roof trusses. A second story 20 ft. wide and running the entire length of the building is used for a store room, and in time a portion of it may be utilized for a car men's club room. Access to this second story is obtained by means of two outside staircases.

The master mechanic's office is situated in about the center of the Fourth Ave. side and entrance to and from the shop is obtained through a passageway by his office. In this passageway is located a time recording clock on which the men are required to register upon entering and leaving the shop. The door from this passage into the main shop is locked with an automatic lock operated by a push button from the office. Adjoining the master mechanic's office on one side is the store room for shop supplies, with a very complete and carefully designed system of shelving and racks. On the other side of the passageway is the armature room, where all rewinding of armatures is accomplished and where the baking is done, electricity being used for this purpose. Splendid success has attended this feature of the repairs and the company has a record in this connection of which it is justly proud. Adjacent to the armature room is the locker and lavatory room, the same excellent arrangements pertaining here as in the barn. The cleaning room, with a sloping floor, joins the lavatory, and leading from the cleaning room is a door into the drying room, which is rendered as nearly dust proof as possible. In this room all sash frames and finished parts are placed to dry, when they have received their final coat of varnish. Next to the drying room is the paint room, practically a vault, built of brick with iron doors. This construction was adopted so that in case of fire originating in this room the iron doors could be closed and the fire confined.

Three tracks run entirely through the shop and four half through.

The blacksmith shop is near the 10th St. end and is equipped with down draft forges and all approved appliances necessary in this department. Between the carpenter and blacksmith shop is the machine shop, which is supplied with the most approved machines obtainable. There are three drill presses, one of which is a new improved sensitive drill rarely found in street railway shops; a latest model Niles wheel boring machine; a wet drill grinder; a sheet iron roller and numerous other smaller machines such as are found in the best appointed shops. Next to the machine shop is found the carpenter shop, supplied with all modern tools for properly carrying on the work.

INTERIOR OF CARPENTER SHOP

The shop floor is of plank and the cellar floor is of rolled cinders. In the cellar will be kept car wheels on axles and the requisite

shafting for running the different machines. All handling in blacksmith, machine shops and pits is done by jib cranes with air hoists. The machinery is all operated by electric motors.

The same excellent fire protection obtains here as in the barn, galvanized iron fire doors separating each department, and making it possible to confine a fire to one special department. A 10,000-gallon tank and a system of fire hose distributed all over the place are found at the repair shop, the same as at the car barn, and once a week the employes go through a fire drill. At both places the fire protection system has been splendidly carried out. The heat is supplied from a boiler located on the side of the building near the center in a room 18 ft. 4 in. x 37, built of brick, with a concrete floor.

GENERAL SHOPS AT THIRD AVE AND 10TH ST

Heavy wooden doors have been placed at each end of the building.

With the present shop facilities it is possible to build and turn out completed the finest passenger cars. However, it has not been found desirable to build passenger cars, although several construction motor cars and the freight motor and box cars were all built in the company's own shops and go to show what may be done if the demand was made.

STANDARD TWO-CAR TRAIN, EAST LAKE LINE

No expense has been spared to equip the shop with the newest and best equipment obtainable and the excellent condition of the equipment at present evidence the result of the expenditure.

Emergency Station.

The department of any great street railway system must of necessity be maintained and operated along the same lines as that of a city fire department, and the emergency department of this company is in many respects better. It is located just five blocks from the heart of the city and contains stalls for six horses and space for two wagons and a line car on the first floor. On the second floor are sleeping apartments, store rooms, work shop, bath rooms and a reading room. From the second floor are two of the conventional brass sliding poles down which the men slide in answer to an alarm. When a breakdown occurs this station is notified by telephone and by the pressure of a single button a gong sounds over the stalls of the horses, opens the gates of the stalls, throws open the front doors and at night rings a gong over the beds of the sleeping men. The harness is the regulation fire department type and the horses are thoroughly trained to run to their places the moment the gong sounds. A watchman stays on duty at night and in less time than it takes to tell it the wagon is speeding on its way to the break.

The wagon is one of the newest improved extension ladder wagons, carrying the regulation supply of tools requisite for overhead repair work, and in addition to this two hose jumpers weighing 600 lb. each are used to take care of fire hose at fires and thereby prevent interruption of service. A fire alarm indicator is installed at the station and when an alarm is sent into the fire station it registers at the emergency station also, and it frequently happens that the hose jumpers are on the ground before the fire company arrives, much rivalry existing between the two departments and some close

STANDARD SUBURBAN CAR GEARED FOR FOR 35 MILES PER HOUR, 4 G. E 57 MOTORS, CHRISTENSEN AIR BRAKES.

[illegible] stations.

A small wagon with stationary ladder is used only for small repairs and for calls which come in when the other wagon is out. In addition to the wagons is a line car for use at remote distances from the station. It is 16 ft. in length, equipped with air brakes, two G. E. 1000 motors, arc headlight and an extension platform on the top. The inside of the car is arranged to carry a supply of rope, blocks, wire, hangers and all other material necessary for repair work. This car relieves the horses of a great many long hard runs.

STANDARD OPEN CAR

Mr. Ben B. Hood is in charge of this department and much credit is due him for its present thoroughness.

Rolling Stock.

The company's passenger equipment consists of fifty-three 40-ft. closed cars mounted on St. Louis Car Co's. No. 23-B M. C. B. type trucks, 20 of which are equipped with four G. E. 57 motors and the rest with two G. E. 57 motors, seven 42-ft. closed cars mounted on St. Louis Car Co's. No. 23-B M. C. B. trucks and equipped with four G. E. 57 motors, twenty-seven 31-ft. closed cars mounted on Lord Baltimore single trucks and equipped with two G. E. 1000 motors, thirty 10-bench open cars mounted on Lord Baltimore trucks and equipped with two G. E. 67 motors, eighteen 34-ft. closed trailers with longitudinal seats, sixteen 34-ft. 14-bench open trailers and eight 37-ft. closed trailers. The prevailing tendency is to discard trailers altogether on regular schedule cars and use them only for gala days.

FREIGHT AND EXPRESS STATION

The freight equipment comprises two 30-ft. freight motor cars mounted on du Pont trucks and equipped with two G. E. 57 motors, 15 box cars varying in length from 26 to 30 ft., 12 flat cars and 22 slag dumps.

The standard color is being changed as rapidly as possible from chrome yellow-lemon to olive green, with cream trimmings and gold striping. All cars are equipped with Hale & Kilburn walkover rattan seats and Hunter illuminated signs. (This was the first company in the South to adopt these signs as a standard.) Twenty-eight cars are provided with Ohmer registers and the rest with double International registers. All suburban cars use Mosher arc headlights and have two trolleys. The double truck cars are all equipped with Christensen air brakes and where trailers are pulled they also have the air attachment. With a few exceptions, the cars were built by the St. Louis Car Co. Fenders of the company's own make and design are in service on all cars. They are of the guard or vertical type, projecting only about six inches beyond the bumper. They are hung on springs and are provided with rollers so that they may be adjusted close to the ground. No lettering whatever appears on any part of the cars, merely the figures designating the number.

TYPE OF CROSS-TOWN CAR

Freight Business.

The freight business has assumed such proportions during the last few years that it has almost become a formidable rival to the passenger business. From an extra car attached to a regular passenger car once or twice a day on one or two lines, this service has increased to that point where every division of the system has an express service at freight rates, from one to four times daily. Twenty-two independent freight trains leave the central station in a day and each train consists of a motor car and one or more box cars. The Birmingham station is situated just five blocks from the business center of the city and is a frame building, a photograph of which is shown elsewhere, containing besides the offices and warehouse a covered freight shed with three tracks and a driveway for wagons, making it possible to load and unload wagons and cars in all kinds of weather. The whole place is enclosed by an 8-ft. plank fence. The warehouse is separated from the shed and the offices by fire doors. The method of handling freight is along the same lines as that prevailing on steam roads, with the exception of the billing system, which is of particular interest. This consists of a triplicate form, the original copy being the way bill, the duplicate the freight bill and the triplicate the freight receipt. By means of this a great deal of time is saved and errors are less likely to occur. When the bills are made up the conductor of the freight train is given all three. He delivers the way bills at each station after checking out the shipments, along with the freight bills and freight receipts, and the

agent is thus ready to make deliveries at once. This system is a remarkable advantage over the usual plan followed, and to Mr. H. D. Carr, chief clerk in the local freight office, is due the credit of originating and perfecting it. A reproduction of the form is shown herewith.

There is under trial at present a "Freight Stamp" parcel delivery system. The idea is to sell these stamps in books of say 50 to 100, the face value of the stamps being 10 cents. A stamp is attached to a package and when it is delivered at the suburban town for which it is intended it is turned over to a local transfer company, which delivers it to the residence or place of business of consignee, and accepts for this service 10 per cent commission on all packages handled. The proposition has met with most favorable consideration by both the merchants and their customers, and indications point to its installation in the very near future, which will add additional revenue to this department without any additional cost of operation.

The company has issued a notice effective April 1, 1904, providing for a parcel delivery system to cover the retail delivery from Birmingham to various points. The following is an extract from the order and the accompanying engraving shows the form in which the parcel delivery checks are printed. The original and duplicate, before being separated along the perforated dotted line as shown, measure 4¼ in. wide by 5½ in. long. It is simpler than the usual carbon duplicate check.

"Parcel delivery checks have been printed in books of fifty and will be on sale at the Treasurer's office, 2104 First Ave.

"These checks are in duplicate. The original to be attached to the package and the duplicate will be accepted at our agent's office for the transportation and delivery charge.

"The price of these books is $5.00, equal to 10 cents per package. Below is shown the suburban towns where this delivery will be made and for your convenience the time of departure of trains from our Birmingham freight station, First Ave. and 16th St., is shown:

Town	Trains Leave Birmingham.		
East Lake	9:00 a m	11:00 a m	3:00 p m
Woodlawn	9:00 a m	11:00 a m	3:00 p m
Avondale	9:00 a m	11:00 a m	3:00 p m
Gate City	11:00 a m	3:00 p m	
Kingston	9:00 a m	11:00 a m	
East Birmingham	9:00 a m	11:00 a m	
North Birmingham	1:00 p m		

"Additional service will be provided as necessity arises.

"Final residence delivery will be made immediately on arrival of trains. Our object is to provide Birmingham with unequaled facilities for the handling of its suburban trade and your co-operation is solicited."

The switching of standard cars from trunk railroads to manufacturing industries along the various lines affords a nice revenue in itself.

There are 14 agents at local stations, five of whom are on salaries and the others on commission.

The department is in charge of Mr. E. W. Ford, freight traffic manager, whose long experience with steam roads makes him admirably suited for this branch of the work. Mr. Ford was for a long time local agent of the Missouri Pacific in St. Louis, Mo. To Mr. Albert B. McClary is largely due the success of the freight traffic, he having been identified with this department for 15 years, which makes him thoroughly familiar with every phase of the work. He is at present local agent for the Birmingham station.

The electric freight service in connection with street railway operation in Birmingham is one of the best examples of its kind in the country, and the company feels unusual pride in its wonderful success, the future of which augurs boundless possibilities.

The company also has a contract with the United States government for hauling sealed mail pouches to Ensley, East Lake, Woodlawn, Avondale and North Birmingham. These pouches are car-

FORM 73.

FREIGHT BILL.

From BIRMINGHAM, ALA. Shipper _____ No. _____

To _____ Consignee _____

_____ Time _____ M. Car _____ Date _____ 190 __

MARKS

To Birmingham Railway, Light & Power Co. *Dr.*

For transportation charges on the following described property:

Pkgs.	ARTICLES	Weight	Rate	Advances	Freight Collect	Freight Prepaid	
							Received payment for the Company
	TOTAL,						AGENT

FORM OF TRIPLICATE FREIGHT BILL.

Birmingham Railway, Light & Power Co.

ORIGINAL 10c A

PARCEL DELIVERY CHECK

THIS CHECK, attached to a Package weighing under 25 pounds, will insure its delivery at the address shown on the package, if within the Limits at Stations where delivery is made.

E. W. FORD,
Freight Traffic Manager

SHIPPER _____

Birmingham Railway, Light & Power Co.

DUPLICATE 10c A

Parcel Delivery Check.

THIS CHECK will be accepted for the Transportation and Delivery Charges on the package to which the original is attached, if presented at the Freight Station with the package.

C. Simpson
Treasurer.

SHIPPER _____

PARCEL DELIVERY CHECK.

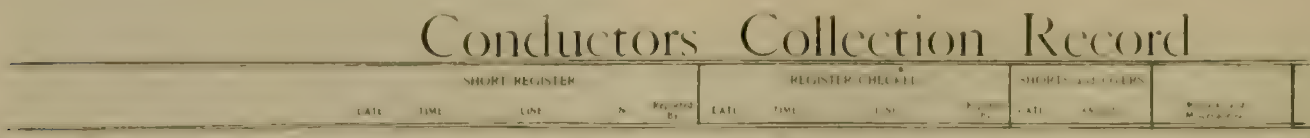
tacked on a regular conductor's passenger car, and, while not profitably remunerative, no extra expense is attached to the handling of them.

Employment and Discipline.

Particular attention is given to the selection and training of men for the service. When a man presents himself for a position he is given a general questioning as to his previous occupation and habits. If these inquiries prove satisfactory he is given an application blank to fill out, and this must have the endorsement of a local business man or firm, or that of an employe of the company. If the application is accepted he is subjected to a regular United States Army physical examination, no man less than 5 ft. 8 in. being eligible to the service. After passing this he is given practicing orders and is required to practice under a specially appointed instructor for 15 days or more without compensation. Then follows a written examination of 180 questions, and if the applicant is training for motorman under the supervision of a motor instructor, he is given a series of practical lessons on a practice car for that purpose, after which an official examiner goes over the questions with the "cub" and explains each point in detail. The prospective employe having passed these ordeals successfully is given an order to the official watch inspector to have his watch examined. Much weight is given to men having accurate timepieces, the standard being very high. He is then issued a badge, and after securing a uniform is ready for work. This would seem at a casual glance to be an unnecessary lot of "red tape", but the effect is noticeable in the way the cars are operated, and the fidelity in the execution of rules and orders.

The Brown system of discipline is in vogue and a fixed charge for each infraction of rules obtains. Special attention has been given to the deportment of employes. The benefits of this and the attention that it attracts are so obvious to a stranger that experts consider the system a model one from this standpoint and about as perfect as it is possible for it to be. The number of car men varies from 275 to 300. When an infraction of a rule occurs, the man is called personally before the superintendent and is reprimanded. As a result a man seldom has to be spoken to twice about the same thing.

The question of keeping a complete record book at once concise and yet containing a man's full record is a live one at all times, and the record book of this company comes nearer meeting this requirement than any heretofore observed. The form was designed by Mr. J. A. Emery, general manager, and consists of a loose leaf ledger in which the numbers of the pages are the badge numbers, and when a man leaves the service his page is transferred to a dead ledger and a new account opened in its place. A reproduction of the page headings is shown herewith. The first page shows a man's age, whether married or single, his previous occupation, list number and his successive promotion numbers, at the top of the page. Beneath, the page is divided into a debit and credit side and entries are made according to reports turned in from the various sources. At the end of each month a general estimate is made of each man's work and appearance during the month by the dispatchers and officers. These are averaged up and entered accordingly. A man who has had no accidents, no miss-outs, and a clean record on debit side of his account during the month is given a certain number of days credit. The conductors all have a second page for their accounts, known as a Collection Record, on which are entered all checks of registers made by secret service inspectors and others, the adverse showing in one column and the clean checks in another. These checks are averaged up by means of a formula once a month, and if any adverse checks appear on the record a certain number of debit days are the result. This page also shows the amount of shorts and overs in returns. Both accounts are balanced up at the close of each month and the balance is carried forward. If a man's account shows a continued heavy balance on debit side of the ledger, he is called before the superintendent and his attention called to the matter. If improvement is not shown, his name is dropped from the list.

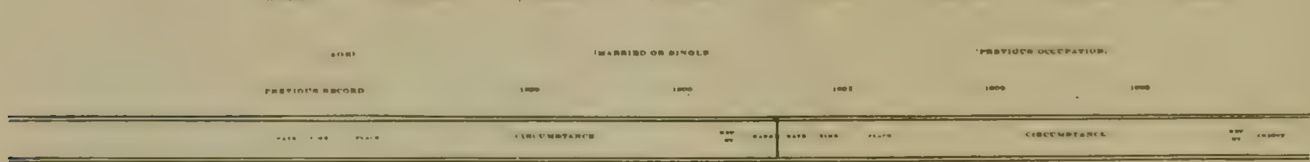


HEADING OF PAGE FOR CONDUCTORS' COLLECTION RECORDS

Parks and Advertising.

Parks as a means of inducing extra travel during the summer months seem to be attracting the attention of street railways to a greater extent every year, and there is no doubt that when conducted along the proper lines their operation is proving of material benefit. This company controls several parks which have proved most desirable adjuncts. North Birmingham Park, located three and one-half miles out, is used principally for picnics and a dancing pavilion in connection with it is the scene of an informal dance by private individuals or clubs, every night during the summer, the booking for same often times covering a month in advance. The park is brilliantly lighted at night and a refreshing spring adds much to its attractiveness. Avondale Park, situated in another part of the city, offers to small parties very desirable facilities for small picnics and outings.

The place, however, which is most popular and at which unusual inducements are to be found is East Lake, at a terminus of the East Lake Line, seven miles from the city, and served by superb cars over a fine double track road. Here is to be found an artificial lake, covering over 30 acres, on which boats, naphtha launches and sculls ply backward and forward and where those aquatically inclined may satisfy their inclinations at a nominal price. Bathing is also indulged in profusely, a neat little bath house being one of the features. However, the strongest drawing card of the place is a beautiful theater 108 x 159 ft. built out in the lake and to which a walk-way 20 ft. wide leads. The stage has a total width of 68 ft. and is 21 ft. deep. The seating capacity is about 1,500, and during the summer months various theatrical attractions give performances every night. The price of admission charged is twenty-five cents and crowds of good-sized proportions have been in nightly attendance in the past. In addition to this there are numerous midway attractions and a fair restaurant. The lighting facilities are particularly worthy of mention, incandescent current being



HEADING OF PAGE FOR TRAINMEN'S RECORDS

supplied from Birmingham and by means of a transformer converted into the proper voltage. Myriads of incandescent globes gleam among the trees and about the buildings and the spectacle at night is strikingly beautiful.

The ensuing summer promises to be one of the most successful since its opening. Mr. Joke Wells, the well-known theatrical manager, and several other local capitalists have organized a stock company with a capital stock of $40,000, $20,000 of which will work is well under way, and May 15th, the date set for the opening, will see these ideas consummated. The proposed car service will be a special feature; through trains of three cars to the train, air equipped throughout, will make the run in from 15 to 20 minutes and the largest crowds can be handled expeditiously. Musical comedy will probably be the bill at the theater and with all the other inducements held out to the pleasure seekers great business is anticipated.

AQUATIC THEATER, EAST LAKE

be expended for improvements and for the purpose of providing amusements. Work has already commenced and the shoot-the-chutes, which was never a popular attraction, has been torn down. A toboggan slide will be erected in its place. A roller coaster will be installed, the present restaurant will be remodeled and operated on a more genteel plan, a roof is to be placed over the theater, new bath houses and a large boat house will be built, additional boats added to the present quota, a bowling alley put in, and every other kind of park attraction available will be secured to lend to the grounds a Coney Island appearance. The present terminal facilities will be changed altogether, some confusion having been experienced in loading and unloading heretofore. The plan which has been adopted is to enclose the loop where the

FLOWER BEDS, NORTH BIRMINGHAM PARK

cars make the turn in a high fence with automatic gates admitting the cars out bound, where they will run along side of a 200 ft. covered platform with eaves protecting over the car roofs, the platform being flush with the steps of the cars. From the platform turnstiles arranged to permit egress only will lead to a covered walk-way from the station to the theater, so in case of rain the crowds will not be exposed to the weather. Admittance to the cars will be by means of another gateway in charge of gatemen who will admit only as many people as will fill the trains in the yard. Liability to accident and discomfort occasioned from loading and unloading simultaneously will thus be avoided. All this

Each Sunday morning throughout the year what is known as the "Birmingham Railway, Light & Power Co. Weekly" is issued. This is a little folder 2½ inches by 6 inches, containing news of interest concerning the several departments, the current attractions at the theaters, crisp little jokes, and advertising matter pertaining to commodities for sale by the company. This little publication is placed in small nickeled bronze racks by each seat in the cars. It is eagerly sought by the patrons and read with avidity.

Power House—Building.

Birmingham offers perhaps one of the best examples of central power supply and electric service in the entire South. The plant is located at Powell Ave. and 19th St., in the geographical center of

ENTRANCE TO EAST LAKE

the city and only a few blocks distant from the principal business center. The location with relation to the railroads is most advantageous, being adjacent to the railroad yards. The coal supply is thus easily obtainable. Every town within a radius of 15 miles is served with current from this station, with the exception of Bessemer, where an independent plant is operated. All current used by the car lines comes from this station. The current is transmitted at a high voltage to the small towns and there transformed to the required voltage.

In 1901 when the company commenced its extensive improvements, the building covered a square 250 x 133 ft., with

the exception of a space 105 x 54 ft. This latter space was first covered and now a second addition 160 x 130 ft. is being completed which will make the building 160 x [illegible] ft. The building is brick with a [illegible] and gravel roof supported by steel trusses. The floor is of wood, which is being changed to cement, being an additional protection against fire. Two 8-ton cranes of [illegible] 53 ft. span are in use in the generator room.

Boiler Equipment.

The entire boiler equipment now consists of twenty-two 125-h. p. return tubular boilers built by the Birmingham Boiler Works, six

SPRING HOUSE, AVONDALE PARK.

400-h. p. latest improved Babcock & Wilcox boilers, six 600-h. p. Babcock & Wilcox extension furnace boilers tunneled to accommodate two 100-in. Buffalo Forge & Engine Co's. engine-driven fans for forced draft. To this, at an early date, are to be added seven 600-h. p. B. & W. boilers. The 22 return tubular and the five 400-h. p. B. & W. boilers are connected to two self-supporting steel stacks, one 8 ft. and the other 100 ft. in diameter, each 150 ft. high. The six 600-h. p. B. & W. boilers are connected to a special tile chimney 12 ft. in diameter, 150 ft. high, on a base 40 ft. square and set 15 ft. below the floor. The chimney was built by the Alphons-Custodis Chimney Construction Co. The boilers are all hand fired; labor for this purpose being more economical than machine stoking. Coal is delivered in standard railroad coal cars on elevated track running into the station and dumped; however, it is contemplated installing coal bunkers and conveyors for both coal and ashes at an early date.

Feed water for the boilers is obtained from the city water mains by two large and five small steam pumps and heated by seven closed type Wainwright exhaust steam feed water heaters.

The batteries of boilers are set in two rows facing each other, with the coal track between. Over each row of boilers is a steam header and a third steam header is on the boiler room floor next to the engine room wall. The three lines of headers are to be extended the full length of the station and broken up into sections to take care of expansion and contraction. Other steam lines feed from one header to the other so as to allow feeding steam through the series of headers either directly across the boiler room or diagonally across the station from any battery of boilers to any engine or group of engines. The headers over the boilers are 14-in. and 16-in. and the header on the floor from which the engines draw steam is 20-in. The cross headers are 14-in. and 16-in. The valves are so arranged for the final design that it will not be possible to shut down more than two batteries of boilers or two engines when the piping system is crippled at the most critical points —generally only one battery or one engine will be affected by the breaking of a steam main.

Engine and Generator Equipment.

Some of the lighting machines in use at present belong to the installation made when the plant was first built, are belted to jack shafting and are soon to be discarded. These consist of a number of small Edison bipolar 110-volt dynamos, belted in pairs to high speed engines, and are among the earliest Edison direct currrent equipments in the South.

To supply the railway current, there is in use one 1,600-kw. 550-volt generator, directly connected to a [illegible] 2,400-h. p. corliss engine running at 75 r. p. m., built by the Birmingham Machine & Foundry Co.; two 850-kw. 550-volt generators each direct connected to a 1,200-h. p. 28 x 48-in. twin engine of the same make; two smaller units of 300-kw., each belt-driven from counter shafting, are being used temporarily for boosting purposes on the Bessemer railway lines, and will be disposed of when the new railway sub-station at Brighton is put in operation.

This new railway sub-station at Brighton is on one of the railway lines between Birmingham and Bessemer, two and one-half miles from Bessemer. This sub-station receives 13,200 volt three phase current over three bare No. 0 copper wires at a distance of 10.5 miles from the power house. This sub-station is equipped with two 300-kw. six-phase rotary converters and six 110-kw. air blast static transformers. The sub-station will be in operation within the next thirty days.

Lighting Equipment.

The business section of town near the power house is lighted by the three wire Edison system and the resident districts are furnished single phase current at 2,300 volts, while the distant suburbs are lighted by 2,300 volt single phase current from sub-stations which are fed with high tension current from the power house. These transmission lines are at present operated at 6,000 volts, but are soon to be changed to 13,200 volts.

There is in use for Edison three wire lighting, one pair 200 kw. G. E. 125-volt generators direct coupled to two 20 x 30-in. corliss engines running at 150 r. p. m.; one pair 100-kw. G. E. generators propelled by an "Ideal" 20 x 30-in. engine running at 200 r. p. m.

To augment this service there are temporarily employed four of the old Edison bi-polar, 60-kw. 125-volt generators. There is for this purpose also utilized in case of emergency one of the 850-kw. 500-volt railway machines by separately exciting it for and operating it at 250 volts; this of course being at a much reduced capacity.

One of the late additions to the power generation is a 400-kw.

EXTERIOR VIEW OF POWER STATION.

rotary making direct current at 250 volts. The furthest point of direct current supply for the Edison system is about 3,000 ft. from the station. For points beyond this, single phase alternating current is used, and fed from the three phase generators at 2,300 volts.

The alternating current is generated at 2,300 volts, 60 cycles, three phase, by the following machines: One 300-kw. belted generator, which was changed from single phase to three phase by

renewing the armature of one of the old machines; one 1,500-kw. alternator direct coupled to two 36 x 60-in. corliss engines manufactured by the Birmingham Machine & Foundry Co. Another alternating unit of this size is being installed at present.

Woodlawn, Avondale, Ensley, Pratt City and East Lake are lighted by 2,300-volt single phase current, from sub-stations fed by transmission lines at high potential. For points within three miles of the power house 2,300-volt single phase lines are run. The present maximum output of the power house is about 7,000 kw., although the capacity is 8,500 kw.

At present the power house and sub-stations fed by it furnish current for a connected load of:

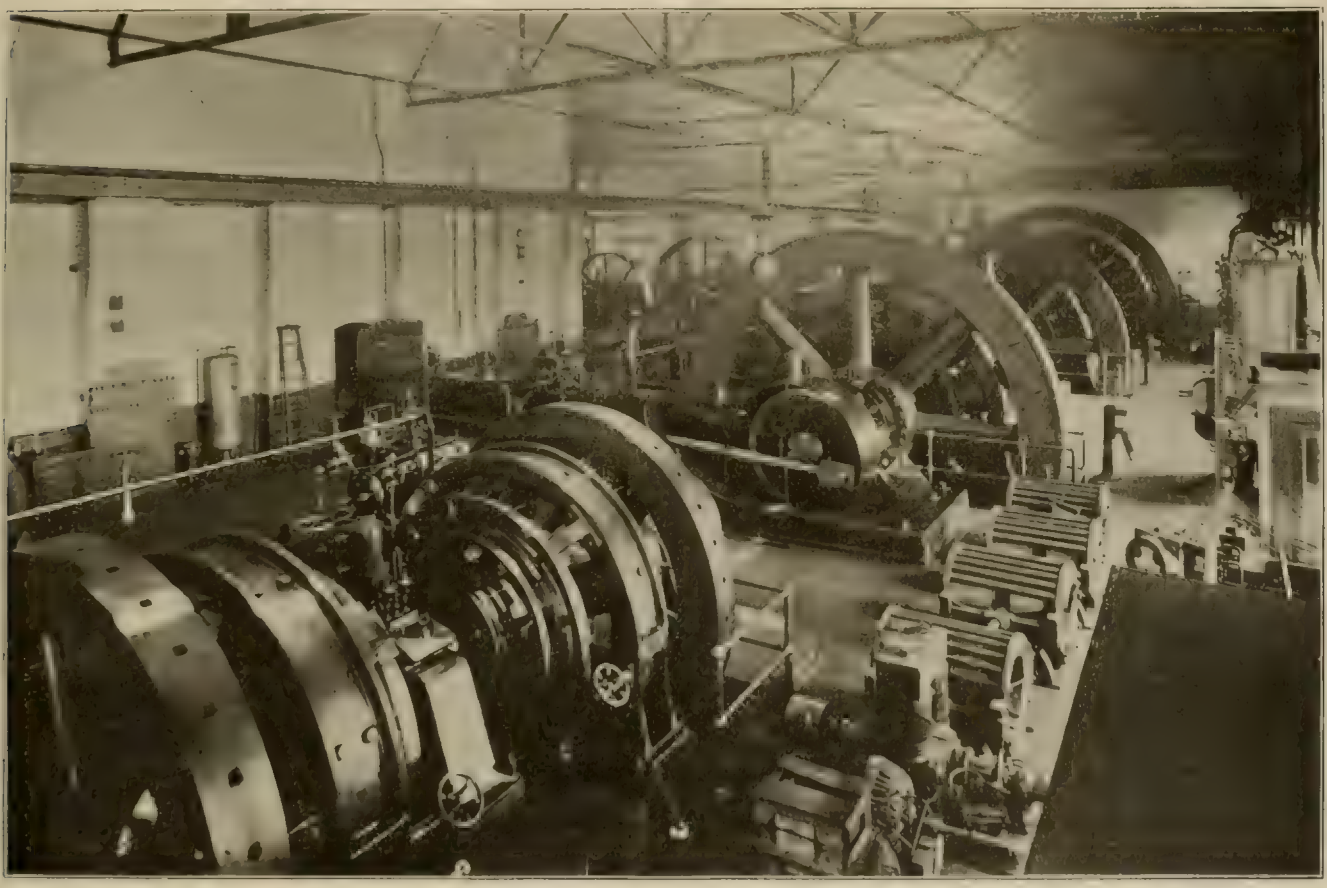
301—2,000-c. p. municipal arcs
77—2,000-c. p. commercial arcs
232—1,200-c. p. commercial arcs
40—1,200-c. p. commercial arcs (a. c. multiple)
542—1,200-c. p. commercial arcs (d. c. multiple)

Total 1,192 arc lamps.

To Mr. R. A. White, of Ford, Bacon & Davis, we are indebted for the drawings and very complete description of the power plant. Mr. White has charge of the improvements in this department.

Steam Heating.

In the fall of 1903 a steam heating system was installed which is supplied by the exhaust from the power station. The pipes form a net work under the streets throughout the business section and embrace all four sides of each block in the most important locality. The farthest point reached is seven blocks from the station. There are in all 11,068 ft. of mains. The main which leads from the power station is of wrought iron, as are all the mains of the system. It is 16 in. in diameter at the station and 6 in. at the remotest point. The iron pipe is wrapped in asbestos and enclosed in a 2-in. tin lined wooden jacket with a 2-in. dead air space between the jacket and the pipe. The whole thing is then enclosed in tar paper and placed not less than 5 ft. in the ground. From this main service pipes are tapped and connection made with the radiators of the consumers. After the steam passes through the radiators it goes into a cooling coil, is condensed and passes into the sewer.



INTERIOR VIEW OF POWER STATION

57,764 lamps (incandescent).
1,000 h. p. in motors.

Bessemer Plant.

For supplying lighting current for the city of Bessemer, 13 miles removed from Birmingham, an independent plant is operated. This generating station will soon be supplanted by the sub-station at Brighton, fed from the Birmingham power house, a description of which is given above.

The equipment of the present plant consists of two 120-kw., 2,300-volt, 60-cycle single phase G. E. generators belt driven from counter shafting by one 300-h. p. 80 r. p. m. corliss engine and one 130-h. p. high speed Ball engine. Steam for these engines is supplied by two 150-h. p. horizontal return tubular boilers.

The output capacity is 240 kw., 20 municipal arcs, and 71 commercial arcs, of 7½ ampere G. E. series lamps, and 3,000 incandescent lights are served by this plant. As stated above, all this will be taken care of by the Birmingham plant at an early date.

The rates charged for this service are as follows:

150 to 300 sq. ft. at 26 cents net per sq. ft. per season.
300 to 450 sq. ft. at 25 cents net per sq. ft. per season.
450 to 600 sq. ft. at 24 cents net per sq. ft. per season.
600 to 1,000 sq. ft. at 23 cents net per sq. ft. per season.
1,000 to 1,500 sq. ft. at 22 cents net per sq. ft. per season.
1,500 to 2,700 sq. ft. at 21 cents net per sq. ft. per season.
Above 2,700 sq. ft. at 20 cents.

The heating season is six months.

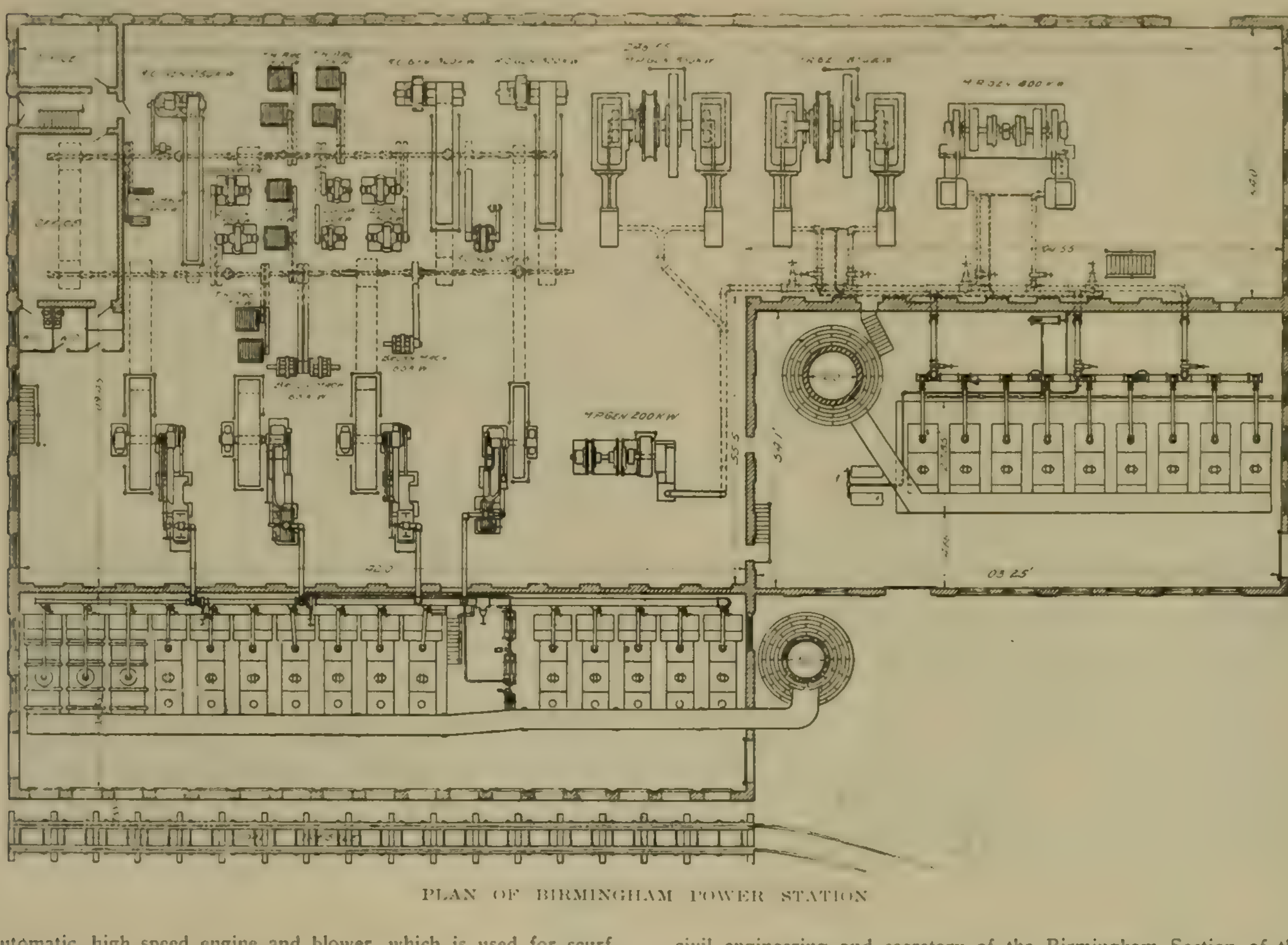
All of the principal office buildings are being supplied by this system and a number of the stores. The heat is uniform and sufficient, keeps the building warm day and night without extra charge, does not affect the successful operation of the engines at the power station and ever since its installation has given entire satisfaction in every respect.

Gas Works.

With the acquisition of the gas property, the same liberal policy pursued with reference to the other departments was adopted in the extending and improving of the gas plant. Today the department evidences a complete metamorphosis and the demand for gas, coke, tar and ammonia in many instances exceeds the supply. At the time of the absorption by the consolidated company the equipment was in bad shape and the products not used very extensively

The lot occupied by the works covers a space the dimensions of which are 400 by 140 ft., and in addition to the necessary buildings for the machinery and apparatus a neat office and complete bath rooms are to be found.

During the years 1902 and 1903 eight new improved benches of retorts, one-half depth sizes and of the regenerative type, together with an exhauster, tar extractor, condenser, scrubber and ammonia concentrator were added, besides which were installed two boilers, one 100 h. p. and one 50 h. p., a brick oxide yard, a coal elevator, and conveyor, and for blowing purposes one Sturtevant vertical, automatic, high speed engine and blower, which is used for scurfing retorts.



PLAN OF BIRMINGHAM POWER STATION

Two holders at present contain the output of gas; one of them is of the steel tank type, with a capacity of 204,000 cu. ft., and the other with a brick tank of 60,000 cu. ft. capacity.

During the present year one 500,000 cu. ft. capacity steel storage tank, ten benches of retorts of the same kind as those now in use and with a daily capacity of 500,000 cu. ft. will be among the many other improvements. A coke crusher and bin are also to be added.

During the year 1903, 106,134,200 cu. ft. of gas was made and consumed. The mains extend all over the city and aggregate 45 miles, to which is to be added about 4 miles more this year.

Organization.

There are three main departments into which the company is divided, viz.: the railway, which includes passenger, express and freight branches; electric lighting, power and steam heating; and the gas lighting, heating and fuel. For convenience these three main departments are subdivided as follows:

Productive Departments.	Business Departments.
Railway.	Accounting.
Electric.	Stores.
Gas	Claims.
Steam Heating.	Sales.

Mr. Robert Jemison is the president and is responsible to the executive committee for the welfare of all departments. All executive matters and construction work are directly under his supervision. He is a man of rare business ability and a clever financier. Principally through his efforts was the present consolidation brought about. Mr. James A. Emery, M. Am. Soc. C. E., succeeded Mr. D. A. Belden as general manager in August, 1903; prior to this time, he was chief engineer of construction for Ford, Bacon & Davis. By him the general problems of operation are solved and all department heads report to him. Mr. George H. Harris is superintendent of the railway department, and succeeded Mr. J. B. McClary in this position on January 1st of the present year. He is a graduate in civil engineering and secretary of the Birmingham Section of the Engineering Association of the South. He is responsible for the discipline of the car men, and to him the freight traffic manager, master mechanic and dispatchers report. Mr. J. M. Bradley is superintendent of the electric department and is one of the pioneer electric lighting men of the South. He has been associated with this department since its primitive days. Mr. Timothy Byron is superintendent of the gas department, and has been since the early days of Birmingham. Mr. C. O. Simpson is auditor and treasurer, coming to this company from a like position with the Augusta Railway & Electric Co., of Augusta, Ga. Through him his department has become one of the best systematized to be found anywhere. Mr. J. P. Ross is secretary and sales agent, and has seen long years of service with the company previous to its consolidation. Mr. C. A. Avant is the claim attorney and has immediate control of all damage claims and suits, which, owing to peculiar local conditions, require unusually clever handling. Mr. Avant's 15 years'

experience with the East Tennessee, Virginia & Georgia R. R. and Southern Railway have eminently fitted him for this work, and his efforts have been very successful. Mr. W. A. McWhorter is the master mechanic, and has only been with the company since February 1st, when he became successor to Mr. E. W. Hiller. Mr. McWhorter was formerly connected with the Georgia Railway & Electric Co., of Atlanta, Ga. Mr. Marion Snead, a comparatively young man, is superintendent of stores. This office is of recent creation, and so far Mr. Snead has displayed commendable ability in executing the duties of his office.

Summary.

In summing up the system as it stands today, a visitor to Birmingham cannot fail to notice the remarkably stable physical condition of the various branches of public service controlled by this company, when compared with other cities. In the hurry and haste of development thoroughness is often sacrificed to gain the ends aimed at, but in this instance such a procedure is conspicuous by its absence, and one is impressed by the one dominant idea; that is, that only the best and most approved methods are used, and Greater Birmingham is dependent to a marked degree on the progressive methods of this company, which seems to think that nothing is too good for its patrons and customers, so with continued prosperity and the fulfillment of proposed vast improvements and extensions, the future seems to hold out nothing but golden privileges and possibilities that will place this great corporation on a footing second to none.

Philadelphia to New York by Trolley.

The New Jersey Short Line Railroad Co. has just been incorporated to build a 15-mile electric line between New Brunswick and Elizabeth, N. J., and when this line is completed it will shorten the route between Camden and Jersey City 14 miles. The distance by trolley at present is 88 miles. The new road will be an extension of what is known as the Trenton and New Brunswick "fast line," and a part of the system which crosses New Jersey from New York to Philadelphia. Until the system is built the trip will be made to Jersey City from Trenton by the way of New Brunswick, Bound Brook, Plainfield and Elizabeth. The single trip fare will be 80 cents; round trip, $1.50. There will be few changes of cars.

March 28th the connecting link between the Trenton and New Brunswick and the Camden trolley lines was completed, and it was expected that cars would run through this month. The Public Service Corporation of New Jersey virtually controls all the lines between Jersey City and Trenton. The time to be allowed for the run to Camden from Jersey City is 4½ hours. From Camden into Philadelphia the ferry must be used, and from Jersey City to New York is by ferry also. When the North River tunnel is completed the cars will continue through to Manhattan.

Another route from New Brunswick to New York is to be presented by the way of Perth Amboy, connecting with the Staten Island trolley system by ferry. The Public Service Corporation owns the Perth Amboy division.

Improvements at Clinton, Ia.

Recently the State Electric Co., of Clinton, Ia., which operates a 12-mile trolley line, was granted permission to extend its lines over additional streets of the city, with the understanding that it would reconstruct its system. The work of reconstruction is to begin at once, the company having ordered the rails and ties, and by the time they are delivered the roadbed will be in readiness. The work will start at the corner of Eighth Ave. and 2nd St. and proceed northward until the system has been rebuilt to the end of the present line at 2nd and Main Sts., Lyons. The 2nd St. line will be double tracked from the corner of Main and 6th Sts. to Eighth Ave. and single tracked from 6th to 2nd Sts. on Main St. The Sixth Ave. line is to be of 80 lb. steel rails, as on this line the cars of the Illinois & Iowa Electric Railway Co. will enter the city.

The State Electric Co. intends to institute a six-minute service on the main line, instead of a 10-minute headway as at present. The power house facilities will be increased and new rolling stock added also.

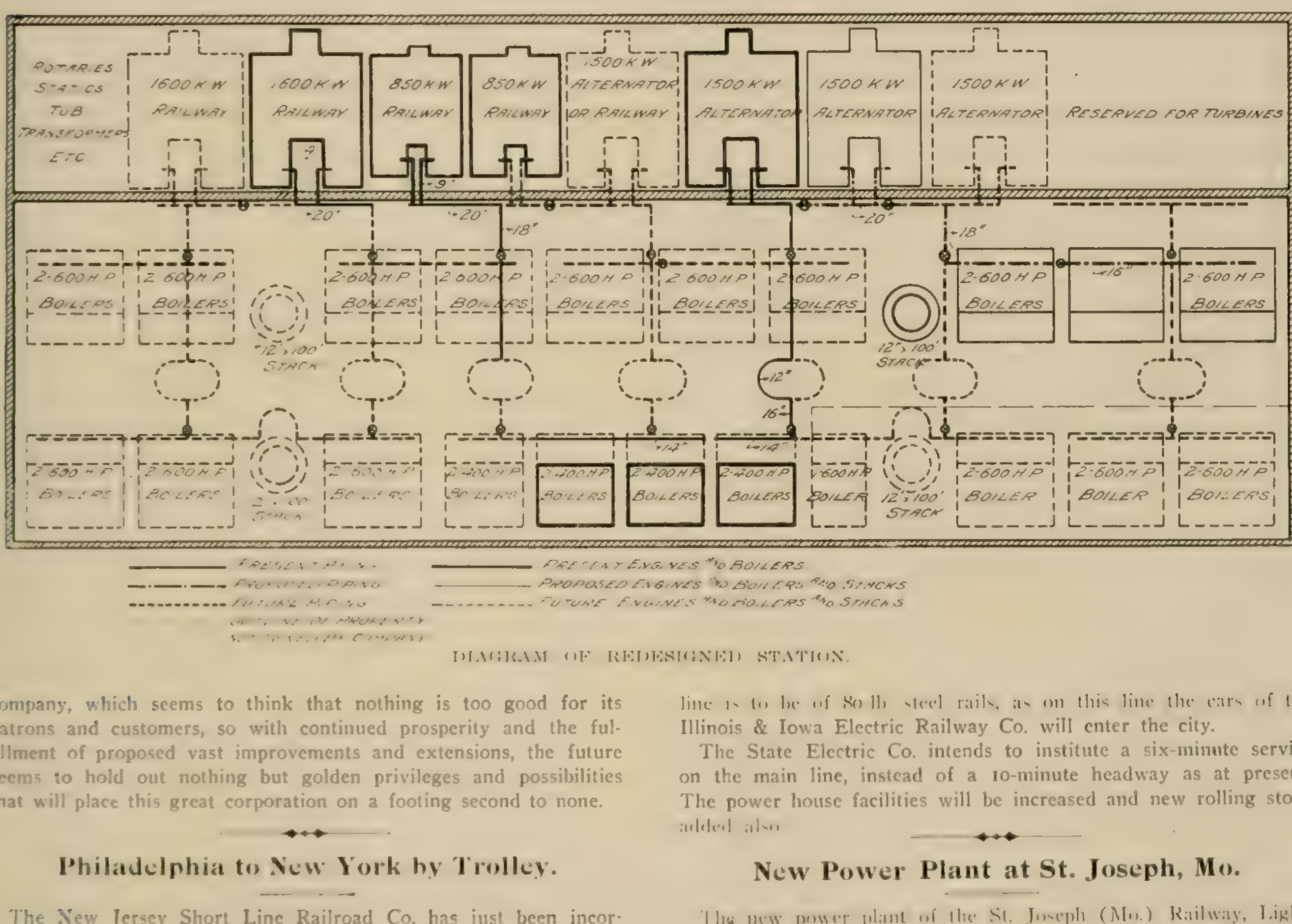


DIAGRAM OF REDESIGNED STATION.

New Power Plant at St. Joseph, Mo.

The new power plant of the St. Joseph (Mo.) Railway, Light, Heat & Power Co. is practically completed. There have been installed in the boiler room four Aultman & Taylor boilers, of 2,000 h. p. capacity. Everything in connection with the boilers is of the latest pattern, including the economizers and the forced draft apparatus. In the engine room is one 1,000-kw. generator for railway work, direct connected to a 1,000-h. p. condensing corliss engine made by the Fulton Iron Works, of St. Louis. In the light department there has been installed a 1,500-kw. steam turbine, together with one 450-kw. and one 325-kw. motor generator sets. The railway end of the new station has been in operation about two months and it was expected that the lighting apparatus would be in operation before the end of March.

The Rochester & Eastern Rapid Railway Co. has equipped its interurban cars with fire extinguishers.

Some New York, Ohio and Indiana Interurbans.

BY MORTON MACARTNEY, ROADMASTER OF THE INTERURBAN RAILWAY CO., DES MOINES, IA.

Twelve years ago an Ohio man approached several capitalists with a proposition to build a 20-mile electric railway to connect two large towns with a city of 60,000 population, passing through an exceedingly prosperous and thickly settled rural district. He barely escaped arrest on the ground of insanity; today, however, he is the general manager of a large interurban railway system. If in those days a man had suggested a trip from Buffalo, N. Y., to Chicago, Ill., by electric railways he would probably have been sent to jail without delay.

It was my pleasure to travel from Buffalo to Chicago last February, chiefly over electric lines, and the following cursory observations en route may interest the readers of the "Street Railway Review."

The first electric line on which I journeyed is the Buffalo and Lockport division of the International Railway Co. Boarding the car at the Terrace in Buffalo, the route passes out Main St. to the Erie R. R., where it turns and enters the Erie's right of way, over which it runs on its own track to Tonawanda. The roadbed and track are similar to the best steam road construction, being ballasted with stone and slag and having heavy standard switches. High speed is capable of being maintained on this line. The day I patronized it a heavy snowstorm was raging and the snow was badly drifted on the track, but our car arrived at Lockport on time, although it left Buffalo five minutes late. The trip from Main St., Buffalo, to Lockport, a distance of 19 miles, was made in 35 minutes, including several stops. Steam trains in that section were all late throughout the day.

This line, like many other interurban lines, is compelled to run very slowly within the city limits, making the same stops as the city cars and, in fact, doing regular city street car work. It requires about 25 minutes to go four or five miles in the city, or within 10 minutes of the time required to make the 19 miles outside.

From Tonawanda to Lockport the line uses the Erie roadbed, having a long lease of it, and the track construction is nearly as good as from Buffalo to Tonawanda. The line operates an express and package delivery, using regularly equipped express cars and running on schedule time. In addition, there is an electrical locomotive for handling standard box, flat and coal cars which are interchanged between the steam lines. I saw this locomotive hauling 10 large 50-ton cars loaded with coal, and I was informed that it has even a greater capacity.

The line is fortunate in having slight grades and no sharp curves, which makes the handling of standard cars easy. The cars are dispatched by telegraph operators over part of the line and by telephone orders over the rest. I was told that the International Railway Co. expects soon to use the Egry autographic register in connection with its telephone orders.

Returning to Buffalo, I next went to Niagara Falls over the International company's line. This trip renders ample return for the trouble one may be put to, and it is to my mind the best way to see the Falls, as well as other places of historic and scenic interest.

From Buffalo I took the Lake Shore & Michigan Southern Ry. to Dunkirk, N. Y., intending to take the electric line from there to Westfield. I was disappointed when I reached Dunkirk to find that the line was not completed. I then proceeded to Westfield and was again disappointed to learn that while the line from Westfield to Northeast, Pa., is completed, it was not in operation on account of the snow. Because of the severity of the weather and the uncertainty of electric train service I went to Cleveland via the Lake Shore & Michigan Southern Ry.

Cleveland, like Buffalo, is connected with many outlying districts and small towns by electric lines, all of which center at Public square, where there is an interurban ticket office and where timetables and information may be obtained. Lack of time prevented my inspection of some of these lines.

I left Cleveland over the Lake Shore Electric Railway Co., passing through the outskirts of the city on the city lines to Rocky River, the terminus of the interurban road. This line operates limited cars between Cleveland and Toledo, making few stops and excellent time. It was my misfortune to make the trip just after the floods at Fremont had occurred and the company was only running every other local car through to Toledo. The trip was naturally a slow one, the power going down a number of times. The line has its own right of way, most of the distance it being only wide enough for a single track and an occasional turnout. It is laid with 70-lb., 60-ft. T-rails and the roadbed is well ballasted. The grades are above the average of those I saw on my trip; that is, there are few heavy grades, and the territory the line passes through requires very little grading. The line uses the highway within town and city limits. The dispatching is done by telephone. The cars are about 40 ft. long, having baggage and smoking compartments.

This line is the longest I traveled upon, it being 118 miles from Cleveland to Toledo. The route lies through a country varying in condition, sometimes in sight of Lake Erie and again passing through woods, vineyards, orchards and meadow land. It took us six hours to complete the trip, a much longer time than is usually required. At Fremont we saw the effects of the floods. Ice five and six inches thick extended upward on tree trunks and buildings to a height of three feet above the street level. I was informed that the company was obliged to remove ice of this depth from its line for more than half a mile before it could operate its cars.

Between Toledo and Fremont lies a very populous oil district and it is an excellent territory for an interurban to draw from. I noticed many young men and women and children traveling from the rural districts into the towns, bound for schools and colleges. The company has a special ticket for these and they form an important part of its patrons.

The Lake Shore Electric Railway Co. operates over its lines the regularly-equipped cars of the Electric Package Co., the cars running at scheduled intervals. It does not do a heavy freight business, however, and it does not use standard freight cars or interchange with steam roads.

At Toledo all the interurban lines enter a union station. This is the only city I visited where there is a union interurban station. Here a general ticket office is maintained and one always finds courteous employes in attendance to give information concerning the interurban lines entering the city.

I went out to Morenci, Mich., and return on the Toledo & Western Railway Co's. line, which traverses a district not heretofore reached by a railway, either steam or electric. Besides maintaining a passenger, express and baggage service the company has an electric locomotive for hauling standard freight cars.

From Toledo I went south on one of the Toledo, Bowling Green & Southern Traction Co's. cars to Findlay, O. This road at present has no track of its own into Toledo, but operates over the Maumee Valley tracks from Perrysburg. I was told that the company is building a line of its own into Toledo, however. From Perrysburg the line passes through the oil region of northern and central Ohio, then through Bowling Green to Findlay. This line is to be extended in the near future to Lima, to close the gap between Toledo and Cincinnati.

From Findlay I went by steam road to Lima, and from Lima to Piqua I traveled over the Western Ohio Railway Co's. system, which is one of the best constructed lines I have seen. From Piqua to Dayton I used the Dayton & Troy electric line. The car from Lima to Piqua makes direct connection with the car for Dayton and one has only to step from one car to the other at Piqua.

Dayton, like Toledo, Cleveland and Buffalo, has many interurban lines centering there. There is no union station, but each line has its own depot, all being in adjoining locations. I was informed that the companies are planning to build a union station this summer. All the lines running into Dayton carry express and baggage, many of the roads having special cars for that traffic.

From Dayton I rode to Richmond, Ind., on a Dayton & Western Traction Co. car. This railway uses the highway, following its curves and grades. This highway is the old government road and forms the principal street in a number of towns and cities including Dayton, Columbus and Indianapolis. The railway company owns its bridges and in some places it has its own fills and cuts at the side of the highway. It seems to be a common custom in Ohio and Indiana for the interurban roads to use the highways, but I understand that there is a growing tendency to purchase their own rights of way where possible. During the ride from Dayton to Richmond a heavy sleet storm made travel very difficult and slow.

From Richmond to Indianapolis the trip is made over the Indianapolis & Eastern Railway Co's. system, but the cars do not enter Richmond, on account of a low railroad bridge, which is being

raised. To get to the Indianapolis car I rode out of Richmond on a city car, transferring at West Richmond. Before summer arrives, I understand, the interurban cars will be running direct to Richmond.

The cars on the Indianapolis & Eastern, and also on the Dayton & Western, are large, high cars, very much like modern steam railway coaches, and are by far better than any I had heretofore seen. The Indianapolis & Eastern also follows the highway most of the distance, and the line, like the Dayton & Western, has its own bridges. The car upon which I rode was a "limited," stopping only at three points between Richmond and Indianapolis. Greenfield was one of the stopping places and here are located the company's offices, shops and car barns. Here also were kept the much-talked-of Holland sleeping cars. I stopped over at Greenfield and was shown the remains of one of the sleeping cars which had been damaged by fire.

In Indianapolis the interurban cars are obliged by city ordinance to stop at all the street crossings at which the city cars stop. This delays the through cars and causes much complaining on the part of the traveling public.

Of the many lines entering Indianapolis, I inspected the Indiana Union Traction Co's. line to Anderson and the Indianapolis & Martinsville Rapid Transit Co's. line to Martinsville. Both are very good examples of up-to-date interurban railways. Some of the lines out of Indianapolis, especially those recently constructed, have their own rights of way, while others use the highways. As a rule the cars are very fine, possessing every convenience of Pullman palace cars. The grades are in some places very steep and the curves are frequently quite short. These lines carry the bulk of the express and freight business in their territories, in spite of the fact that the rates are higher than those charged by the competing steam roads.

From Indianapolis I went to La Fayette, Ind., on the Indianapolis & Northwestern Traction Co's. line, which, when completed, will be about the finest line in either Ohio or Indiana. It has the best cars I rode upon anywhere. It has its own right of way part of the distance and uses the highway elsewhere.

All of the Ohio and Indiana electric railway men I talked with were enthusiastic for the future. There is much talk of putting on dining and sleeping cars on all lines of any length. Many have limited cars which stop for through patrons at the larger towns only. Several of the companies are planning to combine for the purpose of running through cars between large centers, and as soon as the bridge at Richmond is raised through cars will be run from Indianapolis to Columbus and from Indianapolis to Cincinnati. The Indiana Union Traction Co., I was told, is pushing northward to Chicago.

Interurban lines in all directions are projected in Ohio and Indiana and if only a small part of them are built there will be a busy season in that region.

Jackson & Fort Wayne Ry.

The Jackson & Fort Wayne Interurban Railway Co., which was recently incorporated, has secured a 33-ft. private right of way adjacent to populous highways from Fort Wayne to Waterloo, Ind., 30 miles, and the company purposes to complete this section of the proposed line first. The survey has been made, the line established and the necessary franchises obtained, together with estimates of cost and revenue. The maximum grade of the line will be 2 per cent. The population to be served, including that of Fort Wayne, is 82,000. Garrett and Auburn, within 4½ miles of each other, are en route. Ultimately the line will extend to Jackson, Mich., 130 miles. The officers of the company are: President, J. H. Roberts, Grand Rapids, Mich.; vice-president, William Sullivan, Mackinac Island; treasurer, Will H. Mann, Muskegon; secretary, Joseph C. McKee, Grand Rapids. The directors include these and Charles W. Watkins, also of Grand Rapids.

The United States consul at Leipzig, Germany, Mr. B. H. Warner, jr., reports that the Great Leipzig Street Railway Co. has decided to grant all employes annual leave of absence with pay. Motormen and conductors who have served between two and five years will be [illegible] three days a year; those who have served five years or more, five days. The leave is to be taken immediately after a regular off day, which every man receives weekly.

Freshets, Storms and Floods in March.

Early in March there was in the vicinity of York Haven, Pa., the greatest ice freshet in the Susquehanna River that has occurred for more than a century, with the result that the new electric power plant of the York Haven Water & Power Co. was partially wrecked. In consequence, the plant cannot be put in operation by the first of May, as was intended. The damage to the plant was confined to the power house, which was demolished, and the wire alley, which was swept away. It is thought that the plant cannot be rebuilt before next fall. Much of the material, such as bricks, roofing, trusses and girders, can be used again, as it was not carried away. The damage to the machinery in the power house was comparatively small, and the sub-structure, water-wheel equipment, transformer house and dam are intact. About all that will be required to repair the damage to the mechanical parts will be the winding of the generators and the renewing of the switchboard. It was thought that most of the cables which were swept away can be recovered.

The power house was built 9 ft. above the previous high water mark; the recent flood rose 15 ft. above that mark. The plant could have withstood the water, but the ice pressure was too strong. In the future this will be guarded against, probably by building jetties.

The construction of the plant was begun a few years ago. It is of imposing dimensions. Extending from the sub-structure up stream to Conawago Falls is a massive granite wall 3,500 ft. in length and from 28 to 34 ft. high. Its width varies from 20 ft. at the bottom to 16 ft. at the top. During the freshet the wall acted as a bulwark and prevented the destruction of the York Haven paper mills. A race 500 ft. wide and 60 ft. deep is enclosed by the wall. At the point where the wall terminates up stream a large crib dam, 3,000 ft. long, 30 ft. wide and from 7 to 18 ft. high, is built at an angle across a portion of the falls. The dam is formed by heavy timbers ballasted with stone and secured to the river bed by massive anchor boats.

The officers of the York Haven Water & Power Co. are: President and manager, Henry L. Carter; vice-president, Judge W. F. Bay Stewart; treasurer, Henry W. L. Stokes. Thomas Green is superintendent of construction and T. W. Shock is chief electrician. The building was designed by J. A. Dempwolf.

A number of the Indiana roads suffered considerable damage as a result of storms and floods. The big bridge on the Indianapolis, Columbus & Southern Traction Co's. line, near Edinburg, was swept away by the Blue River March 26th. The current undermined the south pier and two spans, each 120 ft. long, went out. The company's bridge over Sugar Creek, near Franklin, was pulled out of line by the current. It was thought that it would be two or three weeks before operation could be resumed.

March 25th operation was suspended on the Indianapolis & Martinsville Rapid Transit Co's. line, owing to four bad washouts. The cars could not be run for several days. The Indianapolis Northern Traction Co. had heavy washouts at Broad Ripple and Noblesville, and the Indianapolis & Northwestern Traction Co. will be compelled to practically rebuild its heavy fill between the White River bridge and the large cut in the hill to the north. The track was badly twisted.

March 26th the car barns of the Indianapolis Traction & Terminal Co. were flooded and partially undermined and bags of sand had to be placed around the power house in order to permit the water to be pumped out of the basement. As it was, the machinery could not be used for a short time and traffic was suspended. The Ft. Wayne & Wabash Valley Traction Co's. line between Logansport and Peru was crippled for a time, although there were no serious washouts.

The Clinton interurban line of the Terre Haute Electric Co. was under water for a considerable distance March 26th and 27th and cars were only run as far as the bottom lands. The road had to suspend operation in Clinton altogether for several days.

The Indiana Union Traction Co. lost over $20,000 on account of floods. At Peru a steel bridge was swept away and the overflowing of the Wabash River washed out considerable right of way. Traffic was suspended 24 hours north of Anderson and the car shops and power house at North Anderson were threatened seriously. The Marion line had a great deal of trouble, also. Other lines which suffered more or less are the Indianapolis & Eastern, Indianapolis,

Shelbyville & Southern and the Indianapolis & [illegible] Traction Co.; the last named road's lost a bridge at [illegible], the high water necessitating extensive repairs.

In Ohio the principal sufferers so far as reported were the Cincinnati, Hamilton & Dayton Traction Co., the Cincinnati, Dayton & Toledo Traction Co., the Cincinnati, Lawrenceburg & Aurora Electric Street Railroad Co., the Cincinnati & Eastern Electric Railway Co. and the Springfield Railway Co., of Springfield, O. Most of the damage was due to washouts and sections of the various lines were tied up for from one to four days. The Cincinnati Traction Co. also had difficulty in two or three instances because of mud which was washed onto its tracks. The Springfield company's power house was flooded. The Northern Ohio Traction & Light Co's. Akron-Barberton line was put to inconvenience March 31st, a strip of track about 500 ft. long being under water and traffic was temporarily suspended.

The Portland Railway Co's. old wooden car barn at 19th and Washington Sts., Portland, Ore., collapsed March 18th, it having been undermined by an overflow of water from what is known as the Tanner Creek sewer. Ten open cars were in the barn, but were not damaged to any extent. The sewer had been reopened to drain flooded land in the vicinity. The company's lease of the car barn property had expired and it was seeking a new site. The loss was estimated at $1,500.

March 21st Duluth, Minn., was visted by a blizzard which blockaded the Park Point line of the Duluth Street Railway Co. Banks of snow from 20 to 30 ft. in depth obstructed the tracks, owing to the snow not having been removed after previous storms. The Duluth-Superior Traction Co's. lines were also affected by the blizzard, so that cars were run very irregularly.

During the night of March 21st the Fox River in the vicinity of Elgin, Ill., rose several feet and seriously impeded traffic on both the Aurora, Elgin & Chicago Railway Co. and the Elgin, Aurora & Southern Traction Co. systems. For two days rushing floods carrying tons of ice did considerable damage, carrying away the two bridges of the Elgin, Aurora & Southern and demolishing the dam at Batavia. Part of the long dam at South Elgin was carried away also.

March 21st and 22nd an electrical storm and heavy rains damaged the property of the Illinois Valley Traction Co. to quite an extent. At the power station at La Salle, Ill., and at the substation at Ladd the lightning wrought havoc with the electrical apparatus, while floods near Utica overflowed the tracks so that service between Utica and Ottawa was suspended.

March 24th a heavy wind storm swept over a portion of Chicago, doing considerable damage to the Calumet Electric Street Railway Co's. lines and making it necessary to suspend operation between 95th St., Chicago, and Roseland, West Pullman and Gano.

The same storm caused a great deal of damage in northern Indiana, especially in La Porte County. The roadbed of the Chicago & South Shore Electric Railroad Co. was softened and a section of the interurban roadbed was washed out.

A washout occurred on the Wenona Beach line of the Bay City (Mich.) Traction & Electric Co. March 25th and for two days no cars were run to the beach.

Owing to a flood at Saginaw, Mich., March 25th interurban service between Saginaw and Bay City was entirely cut off. The power house of the Saginaw Valley Traction Co. was flooded, so that one-half of its boilers could not be used. The company was obliged to shut down its 500-h. p. engine in consequence.

One of the bridges of the Rockford, Beloit & Janesville Railroad Co's. line over a dry run between Beloit and Janesville, Wis., was damaged in the storm of March 25th to the extent that the cars were not run between the two cities for three days.

The Michigan Traction Co's. tracks between Kalamazoo and Battle Creek, Mich., were seriously damaged by floods during the week of March 23-30. It was stated that the company would renew its entire roadbed.

A bill was introduced in the New York General Assembly March 23rd, at the request of the New York Central & Hudson River Railroad Co., providing for a four-track electric road between New York City and Croton; two tracks for fast trains and two for trains running virtually without schedule. Already provision has been sought for the granting of state prison land at Sing Sing for the widening of the roadbed at that point.

Proposed New Haven Suburban Service.

The president of the New York, New Haven & Hartford Railroad Co., Mr. C. S. Mellen, recently gave out a statement partly outlining the company's plans for connecting a number of Connecticut cities by trolley lines. The company has purchased the Fairhaven & Westville Railroad Co's. system, and it is announced that negotiations are in progress looking to the building of an additional track upon the New Haven & Northhampton line, between Mt. Carmel and Cheshire, which may be used by the Fairhaven & Westville company, which may also use the Meriden, Middletown & Waterbury line of the New York, New Haven & Hartford, so that within a short time New Haven cars will run to Meriden, Middletown and Waterbury. This covers the development under contemplation for the immediate future, but plans for further extensions are being considered and will be announced later.

Elevated Loop between Brooklyn Bridges.

April 4th a bill which had been prepared by the borough president of Brooklyn, N. Y., Mr. Martin W. Little, was introduced in the New York General Assembly, providing for an elevated loop railroad to connect the two Brooklyn bridges, the road to be constructed, owned and operated by the city, its construction to be supervised by a commission, and a three-cent fare to be charged. The bill provides that the mayor shall appoint three commissioners to serve until the work is completed, one of them to be named by the borough president of Brooklyn, one by the borough president of Manhattan, and the third to be nominated by the mayor.

The proposed line is to run from the Park Row terminus of the Brooklyn Bridge in Manhattan, up Center St. and across Delancey St., to the new Williamsburg Bridge, and on the Brooklyn side the bridges will be connected by a line running from the end of the Williamsburg Bridge through Roebling and S. 5th Sts., Union and Willoughby Aves., by tunnel under Fort Greene Park, and then by elevated through Fulton, Washington and Tillary Sts. to the Brooklyn Bridge. The bill also provides for the issuance of $15,000,000 bonds for the purpose of the act.

National Electric Co's. New Department.

The National Electric Co., of Milwaukee, Wis., successor to the Christensen Engineering Co., has inaugurated a new department at its plant for the purpose of providing dinners at the company's expense to the officers of the company, heads of departments and the employes in the executive offices and the engineering department. Two pleasant dining rooms, a butler's pantry and a kitchen have been fitted up on the second floor of the new office building recently erected at the plant, near Riverside Park. One dining room is for the officers and their guests, who will include business callers, and the other is for the employes mentioned. The chef will have the entire charge of the menu and dinner will be served promptly at noon. It is thought that besides affording an excellent opportunity for the officers to get into closer personal touch, the result will be beneficial in that the employes will take more interest in their work because of this social hour, at the same time returning to their desks 45 minutes earlier than under the old system, when they were allowed an hour and a half for luncheon.

A handsomely-appointed buffet car has been placed in regular service on the Indianapolis Northern Traction Co's. division of the Indiana Union Traction Co. between Tipton and Indianapolis. The schedule time for the run is 1 h. 30 min.

Mr. J. Brown, of Dunmurry, Eng., has devised an "all-stations" express train which does not stop at the intermediate stations between express-service points, but still takes and delivers passengers at all stations. This is accomplished by means of a new electric car which can be dropped or taken on by the train while going at full speed, one of these cars being used for every station. The car to be taken on is loaded with passengers and started before the train comes in, to avoid collision; the train, while passing the station, drops the car for that point and, without stopping, is connected with the moving car which is to go on.

Compressed Air in Electric Railway Work—the Air Brake—II.

It is in its application to braking for the modern electric railway car that compressed air finds its most general use in connection with electric railway work, and perhaps this may be called its most useful application, for without the air brake the passing from speeds of 10 and 15 miles an hour to 25, 30, 40 and even 50 and 60 miles an hour to which we are rapidly becoming accustomed, would hardly have been possible. It is proper therefore in an article upon the uses of compressed air to devote considerable space to the air brake.

At the present time there are two well known and widely used classes of compressed air brakes for electric railway service: those commonly known as the "Christensen" systems, developed and controlled by the National Electric Co., successor to the Christensen Engineering Co.; and those made under "Westinghouse" patents by the Westinghouse Traction Brake Co. There are other systems in use, several of which possess advantageous features, but the two companies mentioned control the bulk of the business, and their various styles of equipments may be said to represent the standard accepted types.

Both of these companies have very recently brought forward new equipments for electric service, improved as to details, and the descriptions appended have been furnished expressly for this article by the engineers of the respective companies. The data on the power required for compressing air for braking purposes especially will be found new and interesting.

The Christensen Air Brake Systems.

The National Electric Co. furnishes either straight or automatic air brake equipments but its recommendations are strongly in favor of straight air for ordinary electric railway service. In this connection we quote the following remarks on the advantages of straight air over automatic:

"On account of the remarkable success attained in the use of automatic air for braking cars in steam road practice, an impression seems to exist in some minds that automatic air is preferable to straight in any service. This is an error which will become apparent upon second thought. A marked difference between steam and electric road practice is in the length of trains employed. One great advantage of the electric service is in the economy with which short units can be utilized at close intervals. In the development of electric roads this feature will continue to be advantageous and long trains will always be the exception. This being the case, straight air will be the rule for the following reasons:

"In the straight air system we have a large reservoir charged with a high air pressure. To operate the brake the engineer moves the handle of his valve to a position that provides an unobstructed opening for compressed air to pass from the reservoir to the brake cylinder. The operation of setting the brake is, therefore, absolutely certain. This is the acme of simplicity which carries with it absolute certainty. The time elapsing before the pressure is equalized between the reservoir and the brake cylinder on the last car of a train of three or four cars through a ½-in. or ¾-in. pipe is so short as to be practically instantaneous, consequently the brake is set as quickly on all the cars in the train as is possible by any system.

"In the automatic air system we have an auxiliary reservoir in close proximity to the brake cylinder on each car, and between the brake cylinder and the auxiliary reservoir is placed the triple valve. All the triple valves on the train are connected to each other and to the engineer's valve on the motor car by the train line. The triple valve is operated by reducing the pressure in the train line, which is accomplished by moving the handle of the engineer's valve to open a port communication from the train line to the atmosphere. When the pressure in the train line is reduced six or eight pounds, the triple valve automatically operates, creating an opening between the auxiliary reservoir and the brake cylinder. This operation of the triple valve occurs simultaneously or nearly so on all the cars in the train and the compressed air has only to pass the short distance from the auxiliary reservoir to its particular brake cylinder. On long trains, the saving of time by this method results in setting the brakes on the last car quicker than would be the case with the straight air system. In the short train, however, the time consumed in reducing the pressure in the train pipe, and the operating of the triple valves, is fully as much as that required in the straight air system in delivering air from the main reservoir on the motor car to the brake cylinder on the last car in the train. Thus it cannot be claimed that the brakes in a short train can be set any quicker with the automatic than with the straight air system and on single or two-car trains the advantage, though too slight to be of much importance, is with the straight air system.

"Should a train of cars equipped with automatic air break in two, the train pipe would also be broken and a reduction of air in the same would take place, which would cause the triple valve to operate and both sections of the train would be stopped, but the chances of a short train breaking in two, as compared with a heavy train of many cars, are reduced to the minimum and can be still more reduced by an increased strength in hog chains and couplings, for it is possible to have a much greater factor of safety in these details with three or four cars than with fifty. If, however, nothing could be said against the automatic system for short trains, the above advantage would be worthy of consideration, but to counter-balance this advantage we submit the following: The engineer's automatic valve is complicated, compared with the straight air valve, and, therefore, in direct proportion to its complication, more liable to fail. Further, the triple valve as compared with an unobstructed opening between the reservoir and brake cylinder is also complicated. If we have a train of, say fifteen cars, equipped with automatic air, and one, two, even three triple valves fail to operate, a stop will be made within the usual distance, for the engineer gages the amount of reduction of his train pipe pressure, which controlls the amount of pressure in the brake cylinder, by the effect which he feels is exerted in stopping the train and, if only twelve brake cylinders are in operation, he will increase the amount of pressure on these to obtain the desired result and no one is the wiser. Any user of triple valves will admit that they sometimes get out of order and do not operate. Should this occur on a single car, the motorman would be helpless to stop the car. On a train of two cars, should the triple valve on the motor car fail to operate, the train must depend on the traction of the light trailer car for stoppage, and as the light trail car probably exerts less than one-third the traction of the train, the stop would be very slow and long drawn out.

"The question thus resolves itself into the selection of the lesser of two evils, and our conclusion must be determined by our opinion as to whether failure of any one triple valve is more likely to occur than the parting of a short, light train equipped with heavy couplings and hog chains and should be further influenced by whether the results in one case are more likely to be disastrous than in the other. For our own part we consider the equipment of single cars with automatic air not only folly but positively dangerous and for two cars almost equally so. We do not expect that all will agree as to the exact length of the train on which it becomes an advantage to place automatic air devices, but in our opinion there is no question that for trains of three cars or less straight air is the safest, cheapest and most easily maintained in perfect order.

"Another advantage possessed by the straight air system is in the fact that the operator can diminish or increase the amount of pressure in the brake cylinder at will and with a very nice degree of accuracy, whereas with the automatic system, in order to diminish the pressure it is necessary to release the brakes entirely and reset to the desired extent. This function of the straight air system is very convenient in drifting down long hills with varying grades as well as in making stops when such stops have to be made accurately at a given point.

"Fig. 1 shows a diagrammatic arrangement of the straight air brake

[illegible]

pose of distinctly showing the relative simplicity of straight air brakes compared with automatic."

The Christensen straight air brake equipment has been described fully in the columns of the "Review" (see the "Review" for April, 1902). To recapitulate briefly it consists of the following essential parts:

1. The air compressor, which furnishes the compressed air. This [illegible] pressor having two pistons, the two machines combined into a single compact piece of apparatus, the motor driving the crank shaft of the compressor through gear and pinion. All moving parts run in oil and are completely enclosed and protected from dirt and moisture.

2. The automatic governor, which stops and starts the air compressor by the variation of pressure in the main reservoir.

3. The air gage, which is provided with two hands, one indicating the pressure in the main reservoir, and the other the pressure in the train pipe, the former hand being painted red and the latter black. A plain single hand gage may be used in place of a duplex to show the pressure in the main reservoir only; the duplex being more particularly adapted for automatic air brake equipments.

"The motors are series wound, and are started and stopped at predetermined pressures by means of an automatic governor. No starting rheostat is used, the voltage being impressed directly upon the motor. The starting current is from one and one-half to two times normal full load current, and varies but slightly with change of reservoir pressure against which the compressor is started.

"The motors are designed for intermittent running, and are given the same kind of factory test as is given street car motors. The temperature rise permitted, however, is less than that allowed in street car motors. The following gives the average temperature rise above the surrounding air of the several parts of the motor-compressor for one hour run: Field coils, 55° C.; armature, 40° C.; yoke, 25° C.; compressor cylinder, 50° C. The operation of the motor from a standpoint of sparking is better than that of street car motors. That this is so is partly due to the fact that the armature is run in but one direction, thereby permitting the setting of the brushes in a position favorable to good commutation. All commutators should polish when working under normal load.

"The construction of these motors must be most rigid, and painstaking, inasmuch as they must operate in a position difficult of access where but little care can be given them. They must also be constructed to operate on a grounded circuit, and for this reason are constructed to stand a test of 2,000 volts, a. c., to ground immediately after a temperature run of one hour.

"For ordinary single car equipments a compressor of 11 cu. ft.

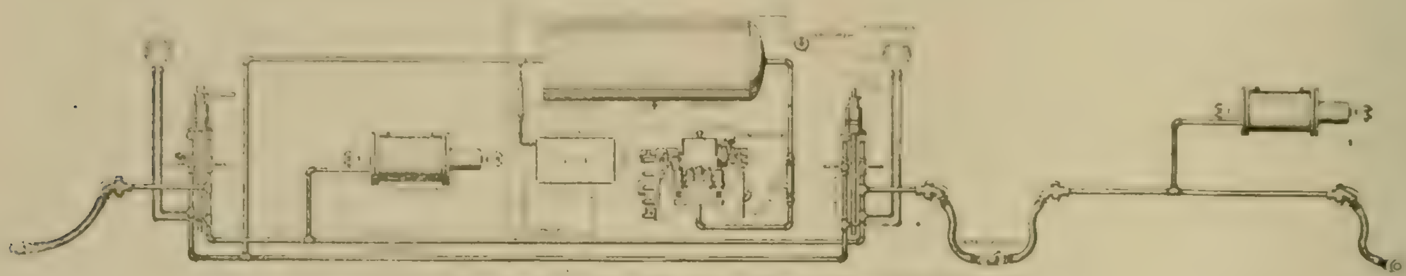


FIG. 1—DIAGRAM OF CHRISTENSEN STRAIGHT AIR EQUIPMENT

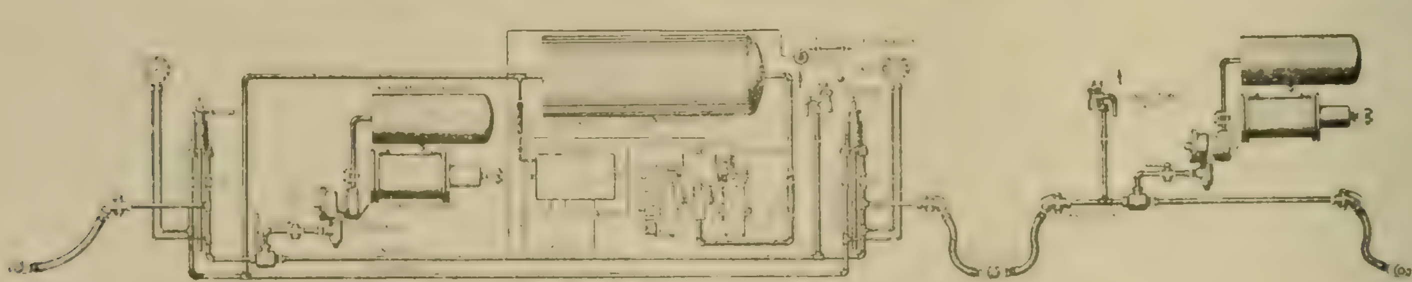


FIG. 2—DIAGRAM OF CHRISTENSEN AUTOMATIC AIR EQUIPMENT.

4. The pipe connecting the main reservoir with the engineer's brake valve, and the pipe leading from this valve and extending throughout the whole length of the train. The latter is known as the train pipe and is provided with hose couplings between the individual cars, with stop cocks at each end of each car and with a branch pipe connected to the brake cylinder, arranged under each car.

5. The main reservoir in which the compressed air is stored.

6. The engineer's brake valve, by which air is admitted from the main reservoir to the brake cylinder and from the brake cylinder to the atmosphere.

7. The brake cylinder, provided with a piston having its rod attached to the brake lever system in such a manner that when compressed air is introduced into the brake cylinder by means of the engineer's brake valve, the brake shoes are forced against the wheels by the compressed air acting on the area of the brake cylinder piston.

8. The hose couplings arranged on each end of each car, by which the train pipes on the cars are connected, thereby forming a continuous train pipe line.

Power Required for Operating Air Brake.

Mr. W. J. Richards, of the National Electric Co., supplies the following data:

of free air per minute when running at full load on the motor is required. This requires a motor to operate the compressor with an input capacity of about 3.7 amperes at 550 volts, when pumping against 90 lb. The actual time to fill a 4-cu. ft. reservoir to 90 lb. pressure is about 2 min. and 15 sec. In this connection it must be remembered that at the lower pressures the actual capacity of the pump is greater than 11 cu. ft. of free air per minute, inasmuch as the motor runs at a much higher speed at part load than at full load. The average time for pumping from 80 lb. to 90 lb. into a 4-cu. ft. reservoir, is about 25 seconds.

"For large cars, such as are used on elevated trains, where a motor compressor is furnished with each car, a motor compressor of 20 cu. ft. of free air per minute is ordinarily used, requiring about a 4-h. p. motor. Where an entire train is supplied from one motor compressor, motor compressors from 35 to 50 cu. ft. of free air per min. are ordinarily used, requiring from 7 to 10-h. p. motors to operate them."

Westinghouse Air Brakes.

The Westinghouse Traction Brake Co. furnishes us the following statement of its work in this connection:

The Westinghouse Traction Brake Co., which handles the product of the air brake company of the same name for electric railway service, offers a number of systems of air brakes, including both axle

driven and motor driven compressors and brakes operated by air stored under pressure in tanks carried under the car. The system in most general use to-day is that which includes a motor driven compressor unit on every car.

The source of the air for operating the brakes in this system is the Westinghouse duplex motor compressor. This machine is dust and water proof, obviating the necessity of enclosing it in a box and removing the possibility of dust and dirt getting in to cause excessive wear of the bearings and impair the efficiency of the machine. Enclosing a compressor of the type required for braking systems tends greatly to impair its efficiency through the lack of proper ventilation. The motor of this machine drives the compressor portion by means of a tempered steel chain, which does away with the noise of gearing. Another advantage of this chain drive is found in the ease with which the lost motion, resulting

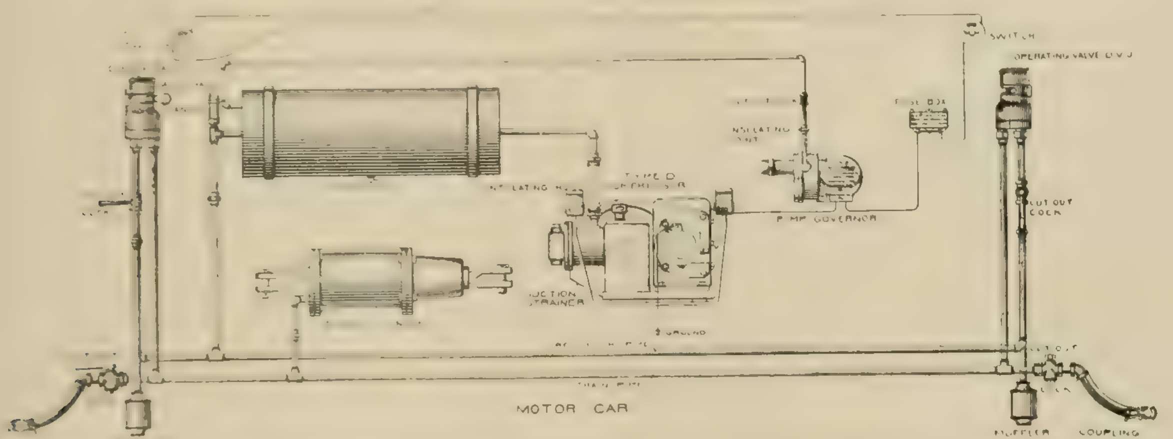


FIG. [illegible] DIAGRAM OF WESTINGHOUSE STRAIGHT AIR EQUIPMENT.

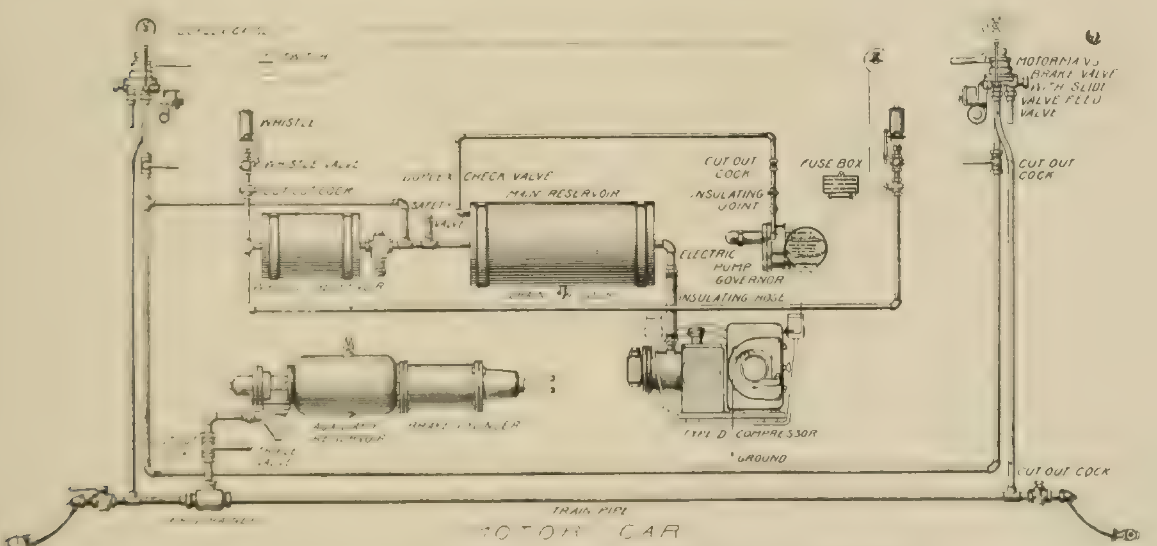


FIG. [illegible] DIAGRAM OF WESTINGHOUSE AUTOMATIC AIR EQUIPMENT.

from wear, can be taken up, the motor frame being so arranged that [illegible] can be provided for by adjusting the distance [illegible] Automatic lubrication is provided by a system of oil circulation. The chain and cranks run in baths of oil, and the bearings are lubricated automatically. The pump [illegible] arranged that no oil can [illegible] thus protecting the winding [illegible]

The pump [illegible] when the predetermined maximum or minimum air pressure has been reached, [illegible] The reduction of pressure below the predetermined minimum point causes a reverse action and again closes the pump circuit.

For cars which operate singly or haul one or more trailers, the brake system used is generally that known as the "Straight Air System." In this type of apparatus the air from the compressor, which is stored in a reservoir, is piped to an operating valve and thence to the brake cylinder. In applying the brakes the operating valve is moved so as to admit air from the reservoir to the brake cylinder and in releasing the same the port from the main reservoir is closed and the air from the brake cylinder allowed to exhaust to the atmosphere.

The Westinghouse operating valve is a plain sliding valve so designed that it wears itself into place, continually finding its own seat without repairs or attention. The Westinghouse company has the gage mounted directly on the valve stand, forming a part of the operating valve. This gage shows pressure in the reservoir and also that in the cylinder. Its face is protected by heavy plate glass. Its position brings it immediately under the eye of the operator. The operating handle that is used with this valve can only be inserted or removed when the valve is in lap position and all ports are closed. When this handle is removed the operating mechanism is fully protected from meddling by passengers.

The exhaust from straight air brakes is conducted to the atmosphere through a muffler to avoid the disagreeable noise caused by the direct rush of air under pressure to the atmosphere. This apparatus is also provided with a safety valve connected in the piping near the main reservoir, as a measure of protection in case for any reason the compressor should continue to operate for any length of time after the predetermined maximum pressure has been reached. This company provides its reservoirs with drain cocks.

[illegible] that water [illegible] is drained from them. Water [illegible] by reducing the volume [illegible] and freezing in cold weather. [illegible] quently it is of the greatest importance that the reservoirs be drained at least once a week.

The automatic system of air brakes finds its place where the cars are operated in trains. Its two great advantages are safety and smoothness of application, and in case of accident to train pipe or couplings or in a break-in-two, with the automatic system, the brakes are set instantly on every car in the train. Furthermore, with the automatic, the disadvantage of successive brake applications on the cars in the train, resulting in disagreeable bumping, is avoided, as the brakes are set on every car almost at the same instant.

With the exception of the electric driven compressor the automatic air brakes which this company furnishes are identical with those that have proved so successful in steam railway service. The Westinghouse triple valve in emergency applications vents from the train pipe to the brake cylinder, insuring 20 per cent higher pressure than can be obtained with plain triple valves or those which vent the train pipe to the atmosphere. This triple valve is capable of following a service application by an emergency application without first making a complete release and recharging the train pipe.

The type of brake cylinder depends on the room under the car. This may be either the regular Westinghouse passenger type with detached auxiliary reservoir or, what is just as well adapted to traction service, a combined auxiliary reservoir and brake cylinder. With this, however, is furnished a standard passenger triple valve.

The automatic equipments, like the straight air brakes, also include drain cocks for all reservoirs, and safety valve for main reservoir.

The operating valve used with this type of brake when trains of not over six or eight cars are handled differs from that used in steam railway practice in that it does not contain the equalizing discharge valve. This feature is only necessary where long trains are handled, as in steam railway service, and it is only occasionally that service conditions on electric roads require the use of the regular engineer's valve. This valve has three pipes leading to it: One of these is from the main reservoir; one goes to the train line, which, indirectly through the triple, leads to the brake cylinder; and one goes to the exhaust. The handle which operates the valve has five positions, viz: release, running position, lap, service and emergency. The running position is that occupied when the cars are in motion and the brakes are not applied or in operation in any way. In this position the train line is connected to the main reservoir through the slide valve feed valve, which forms a portion of the motorman's brake valve. The feed valve thus supplies all leaks in the train line. The air in the main reservoir is maintained at a pressure of 90 lb.; that in the train line is kept at 70 lb. The slide valve feed valve reduces the 90-lb. air to 70-lb. air. In the release position 90 lb. of air in the main reservoir is connected to the train line, which has been reduced below its initial 70 lb. by the application of the brakes, and is now brought up to 70 lb. by this excess of pressure in the main reservoir.

The triple valve has four openings or pipes to it: One to the brake cylinder; one to the auxiliary reservoir; one to the train line and one to the atmosphere. To apply the brakes move the motorman's brake valve handle to service position. This exhausts some of the air from the train line, bringing the pressure there below 70 lb.; then the 70 lb. in the auxiliary reservoir acts on the piston of the triple valve and moves it forward, thus opening communication between auxiliary reservoir and the brake cylinder, and allowing the air from the auxiliary to move the piston of the brake cylinder and apply the brakes. Since this train line is connected from car to car and the triple valve on each car is connected to the train line, the reduction of pressure in the train line causes every triple valve to act at practically the same time. To release the brakes the handle of the brake valve is turned to release position, which recharges the auxiliary reservoirs and lets the air from the brake cylinder exhaust to the atmosphere. The conductor's valve on each car is connected to the train line. When opened it reduces train line pressure and sets the brakes just as the motorman's brake valve does.

The main reservoirs are connected from car to car by an additional train line in order to give the advantage of the large volume for recharging and also that the governors may each cut in its pump when the pressure is reduced to the cutting in pressure.

Although automatic air can be used when cars are operated singly, still straight air is generally considered the most advantageous for this kind of service, due, as stated before, to the directness, certainty and simplicity of the straight air application. The air which actuates the brake cylinder piston is admitted directly through the medium of an operating valve without the interposition of the complicated triple valve, and the braking force is thus under much closer control of the motorman, the advantages of the triple valve lying in its avoidance of the successive application of brakes on the cars in the train, and also in the automatic application of the brakes in case of accident. With straight air the motorman can diminish or increase the amount of pressure in the brake cylinder at will; while with the automatic system, in order to diminish the pressure, the brakes must be entirely released and then reset. The release with the straight air system is also very much quicker than with automatic air. Service conditions on a great many roads require the operation of cars singly for a portion of the day and in trains during the rush hours. Furthermore, electric motor cars on a great many roads are used at times to haul trains of steam railway freight cars or pasenger coaches or of electric railway trailers. For service conditions of this kind the Westinghouse company offers an equipment by the use of which either straight or automatic air is made available on the same car. This secures additional advantages from the fact that the presence of the straight air on the motor car makes it possible to hold a train when standing on grades, at the same time recharging the automatic system, to have the train brakes ready for immediate use on starting. This system requires the use of a straight air operating valve, as well as a motorman's brake valve.

Automatic separation of the two portions of this apparatus is effected by a double check valve, which has four openings; one leading to the straight air side and straight air operating valve; one to the safety valve; one to the automatic side or triple valve, and one to the brake cylinder. The air is carried from the main reservoir by two separate lines to the separate operating valves and from them to the double check valve from the straight air side, and through the triple to the double check valve on the automatic side. When using automatic brakes the air goes into the check valve from the triple, pushing back a piston which closes the port leading to the straight air operating valve, and opening the port to the brake cylinder. When the straight air system is used the air comes in direct from the operating valve, and by pushing the piston in the opposite direction, closes the port leading to the triple valve and enters the brake cylinder. This system has been largely used on switching locomotives in steam railway service, where it has proved eminently satisfactory, and it bids fair to find an extensive use in the electric railway field.

Storage Air Brakes.

The storage system of air brakes may be regarded as still in a more or less experimental stage, as its use is very slight as compared with the motor compressor system. The first large installation of storage air brakes is at St. Louis, where the Westinghouse company is at present installing 1,500 equipments on the cars of the St. Louis Transit Co.

In this system the air for operating the brakes is stored in steel tanks under the car at a pressure of 300 lb. From these tanks it is conducted to a service reservoir corresponding to the main reservoir of the motor compressor equipment. In the pipe line between the storage reservoir and service reservoir is placed a reducing valve, which is set to bring the 300 lb. air down to 65 lb. This system requires the erection of stationary air compressing plants, provided with air compressors and storage tanks. These air compressing plants, including 40 electrically driven air compressors, were furnished by the Ingersoll-Sergeant Drill Co.

In operation the cars must be stopped at these stations and charged from an air hydrant which is connected with the storage reservoir through a hose and coupling. The matter of charging varies greatly with running conditions, and it is hard to set any standard. In the storage systems now installed the total time required in charging the cars, including allowance for stopping and for getting under way, is from 30 seconds up, depending on the skill of employes in charge.

The operation of the car brake equipment is substantially similar to that of the motor compressor system. The equipment includes drain cocks and safety valves, and also an additional gage to indicate the pressure in the storage tanks.

The sphere of the storage system of air brakes is yet to be determined. There are suburban lines and city lines operating under

this system, but it is probable that it will find its widest application in city service, where the headways are small and the arrangement of routes is such as to make this system of brakes available.

One of the greatest faults in street railway practice to-day is the lack of care which is given to brake equipments. The reservoirs should be drained at least once a week. The shoe slack should be well taken up so that the piston never travels more than 8 in. when full pressure is applied. Brake levers and pins should be regularly inspected. The piping should be kept tight and the motorman instructed in the economical use of air. This will save excessive operation of the compressor. Compressors of a type required for braking systems should never be required to work more than half of each hour and under proper conditions should never operate more than one-third of the time in the city service. Thorough care and inspection of the brake apparatus will prove a true economy with electric roads, as it has been with steam roads, and it is probable with the further development of electric railways that they will more nearly approach the steam railway standards in these matters.

Air Whistles.

Air whistles have now come into general use on electric cars equipped with air brakes. The whistle can be heard at a much longer distance than an ordinary gong, and can be mounted to occupy less space. Both of the prominent brake companies supply air whistles with all equipments, and either company will furnish whistles either to take air from the main brake reservoir or from an auxiliary reservoir. The Westinghouse company recommends the use of an additional reservoir with a check valve placed in the pipe line between it and the main reservoir. With the straight air system the advantage of this is found in the additional amount of air it makes available to supply the demands of the whistle. When this arrangement is used, excessive use of the whistle cannot prevent the proper application of the brakes in emergency by reducing the available pressure.

With the automatic system, in addition to giving an increased volume of available air, the use of the whistle reservoir is important to prevent setting the brakes through the excessive use of the whistle, which could be done by so reducing the pressure in the main reservoir that the pressure in the train line would be reduced below 70 lb. However, with automatic air brakes the use of separate reservoir with check valve is variously regarded. A few railway companies who employ only high-class motormen state that they prefer to trust the use of the whistle to their motormen's judgment. They say that in the event of running into any one at a crossing they would be less liable to be held for damages if it could be shown that the whistle had been regularly used, and in the event of their having a small whistle reservoir in which pressure had been so reduced by whistling, previous to an accident, that there was no air available to operate the whistle, pressure in the main reservoir not having been sufficiently high at the time to recharge the whistle reservoir, it would go much harder with the company in the trial than would have been the case if the apparatus had been so arranged that the whistle would have had available the main reservoir supply of air. The use of this reservoir with automatic equipments is therefore largely influenced by local operating conditions.

The whistle is preferably placed above the motorman's cab and connected by ½-in. pipe to the whistle valve. This valve should be placed inside the cab and as close to the whistle as possible. The whistle valve should be connected to the main reservoir pipe and never to the governor line under any conditions. A cord may be run from one end of the whistle lever across the cab, with enough slack to come within easy reach of the motorman. On open cars the whistle may be placed below the platform and operated by means of a wire attached to the lever handle and brought up through the floor. It is not recommended that this valve be arranged to be operated with the foot, as this practice usually leads to the disadvantageous waste of air.

Mail service has been inaugurated by the Indianapolis & Northwestern Traction Co. between Lebanon and Frankfort, Ind.

The Marlboro & Westborough (Mass.) Street Railway Co. and the Boston Suburban Electric Companies have entered into an agreement whereby the cars of the latter will use the former's tracks between South Framingham and Worcester. In Worcester the cars will be operated by the Worcester Consolidated Street Railway Co.

A. S. R. A. Convention.

March 26th the executive committee of the American Street Railway Association met at St. Louis to decide upon the dates for the 23rd annual convention. There were present: President W. Caryl Ely, Buffalo; E. C. Foster, New Orleans; John Grant, St. Louis; T. C. Penington, Chicago; J. C. Hutchins, Detroit, and W. A. Smith, Omaha. After visiting the Exposition Grounds and inspecting the buildings, and conferring with representatives of the leading hotels, the committee decided to hold the A. S. R. A. convention in St. Louis, Wednesday and Thursday, October 12th and 13th, the entire week of October 10th being designated Convention Week, however. The committee has suggested that the American Railway Mechanical and Electrical Association hold its meetings on Monday and Tuesday, the 10th and 11th, and the Accountants' Association on Friday and Saturday, the 14th and 15th.

The business sessions will be held in Recital Hall in the large building on the Fair Grounds known as Festival Hall.

Wednesday, October 12th, has been designated "Street Railway Day" by the Fair authorities. The banquet of the A. S. R. A. will be held on the evening of the 13th.

Headquarters will be at the Southern Hotel.

Details of the convention program are not yet announced, excepting that Prof. W. E. Goldsborough, Chief of the Department of Electricity, will deliver an address at the opening meeting, October 12th.

Interurban Transit Co., Camden, Ark.

The Inter-Urban Transit Co. is the title of a company which was organized Mar. 7, 1904, with a capital of $350,000, to build an electric interurban line from Camden, Ark., through Van Duzer, Onalaska, Eagle Mills, Millville, Bearden, Best, Harlow, Little Bay and Thornton to Fordyce, Ark., and to build such branch lines as may seem desirable. It is also proposed to supply current for lighting, power, heating and other purposes, and to improve and develop real estate. The road will carry passengers, express, mail and freight. It will be equipped with large, comfortable cars, with vestibules, heated and lighted by electricity. An hourly schedule will be maintained. The plans provide for the construction of a modern combined railway and vehicle bridge over the Ouachita River. The company proposes to establish a complete city system in Camden.

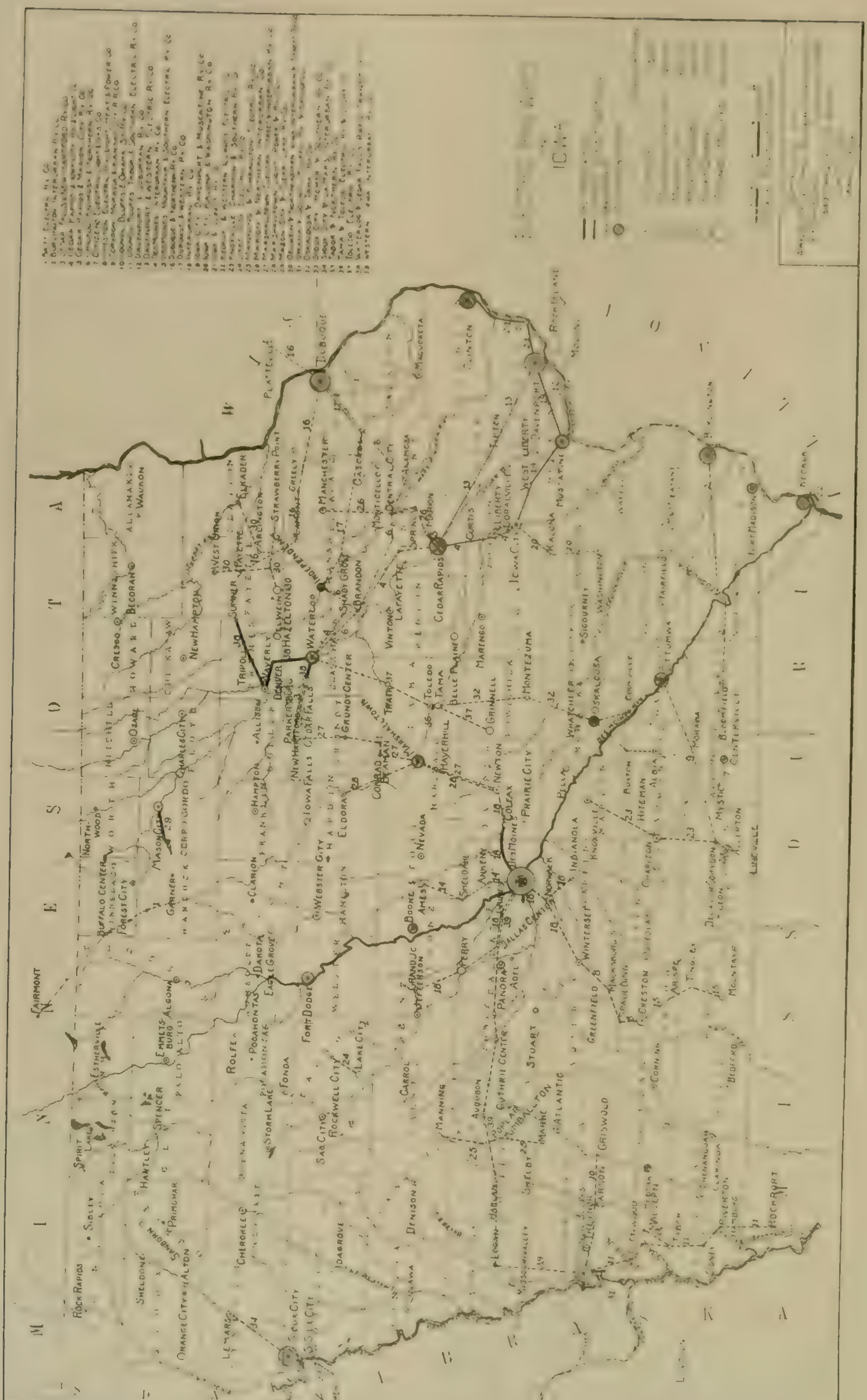
The officers of the company are: President, H. C. Homeyer, of Bearden; vice-president, C. C. Gunnels; treasurer, Charles P. Brice; secretary, J. G. McDonald.

Opening of Rockford-Freeport Line.

The opening of the Rockford-Freeport (Ill.) Electric Railway Co's. line, April 6th, was marked by an enthusiastic reception of the officials of the road, and their guests, by the mayor and leading citizens of Freeport when the first cars arrived from Rockford. The officers of the company who made the first trip were as follows: President, John Farson, of Chicago; vice-president, R. N. Baylies; secretary, J. H. Camlin; general manager, T. M. Ellis; assistant superintendent, C. C. Lines; traffic manager, J. H. Groneman. Two cars were operated on the opening trip and the distance was covered in an hour and three-quarters, which will be the regular running time. The new line is owned by the interests who control the Rockford & Interurban Railway Co., which system was described and illustrated in the "Review" for June and July, 1903, and eventually the two companies will be consolidated.

Ticket Frauds in Washington.

Some twelve men, former employes of the Washington Railway & Electric Co., are under indictment for embezzlement and awaiting trial on that charge. They are accused of defrauding the company by reselling uncanceled tickets; after collecting these on the cars they would not be registered or punched, but turned over to confederates and sold at the rate of 30 for one dollar. The work of securing proof that would justify the prosecution of the suspected parties was done by the Drummond Detective Agency.



Electric Railways in Iowa.

We reproduce on another page in this issue a new map showing the electric railway lines in Iowa. This map was compiled by the Arnold Electric Power Station Co., of Chicago, Ill. It shows the interurban lines in operation, under construction and proposed, and the city systems are also indicated. Although but 89 miles of interurban lines have been constructed and are now operated in Iowa, outside of the system at Council Bluffs, it is stated that fully 1,000 miles have been projected, much of which will be built this year.

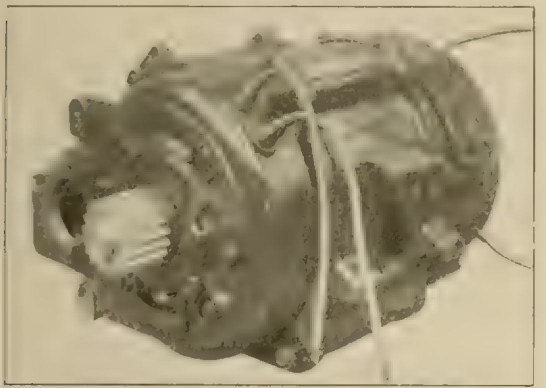
The principal interurban lines now in operation and the value of each are given as follows: Cedar Rapids & Marion City Ry., 12.6 miles long, valued at $47,000; Des Moines-Colfax Interurban Ry., 23.41 miles long, valued at $58,500; Mason City & Clear Lake Ry., 14.62 miles long, valued at $13,200; Tama & Toledo Electric Ry., 2.75 miles long, valued at $5,000; Waterloo-Cedar Falls Rapid Transit Ry., 31.20 miles long, valued at $78,000. There is also a line, 4.7 miles long, which runs into the suburbs of Boone, known as the Boone Suburban Railway Co. It is valued at $4,600.

The Waterloo & Cedar Falls Rapid Transit Railway Co. has announced that its name is to be changed to the Waterloo, Cedar Falls & Northern Ry., on account of the old name being considered unwieldy. This is, of course, the largest electric railway in Iowa.

Recent German Experiments in Monophase Traction.

BY E. GUARINI.

Some interesting experiments in electric traction with monophase motors have recently been made by the Union Electric Co., of Berlin, on two experimental lines. One of these lines which is very short, was built on the grounds occupied by the company's works.



FRONT VIEW OF MONOPHASE MOTOR

REAR VIEW OF MONOPHASE MOTOR

[illegible]

and 40 periods. The car is equipped with two motors of 40 h. p. capacity each, and the controller has the same general appearance as that of a direct current equipment. The car is also fitted with electric brakes.

The second line mentioned is that from Johannisthal to Spindlersfeld and is a single track road 4.1 km. long. Cars equipped with monophase motors have been operated there regularly for several weeks past and have attracted a great deal of attention from technical men both from at home and abroad. At the present time the trains are composed of only one motor car, but later on two motor cars and several trailers will be used in a train.

SPAN WIRE CONSTRUCTION

The motor car weighs, with its complete electrical equipment about 52 tons, the electrical equipment weighing about 6 tons. The car is equipped with two 125 h. p. motors, on the shafts of each of [illegible] are mounted in center. Controllers are mounted at both ends of the car. The control is of the multiple unit type, so that any number of similarly equipped cars can be coupled together and operated from any controller. The current is collected by means of [illegible] through an automatic circuit breaker and a fuse. A smaller transformer carried on the car [illegible] low voltage current for the compressed air pump [illegible]

BRACKET CONSTRUCTION

[illegible] permanently connected in parallel. At full speed their efficiency does not attain that of the continuous current motor, but this de-

CAR EQUIPPED WITH MONOPHASE MOTORS

fect is compensated for in the much smaller starting current which they require.

The current of 6,000 volts is only used in a portion of the exciter and in the stationary part of the motor. In the other part of the windings the difference of potential is 190 volts at the maximum. For the lighting circuit the tension is reduced to 35 volts and the lamps are connected in multiple so that any number may be used on the car. In spite of the small number of periods the lamps, which are of the ordinary kind, are free from fluctuations.

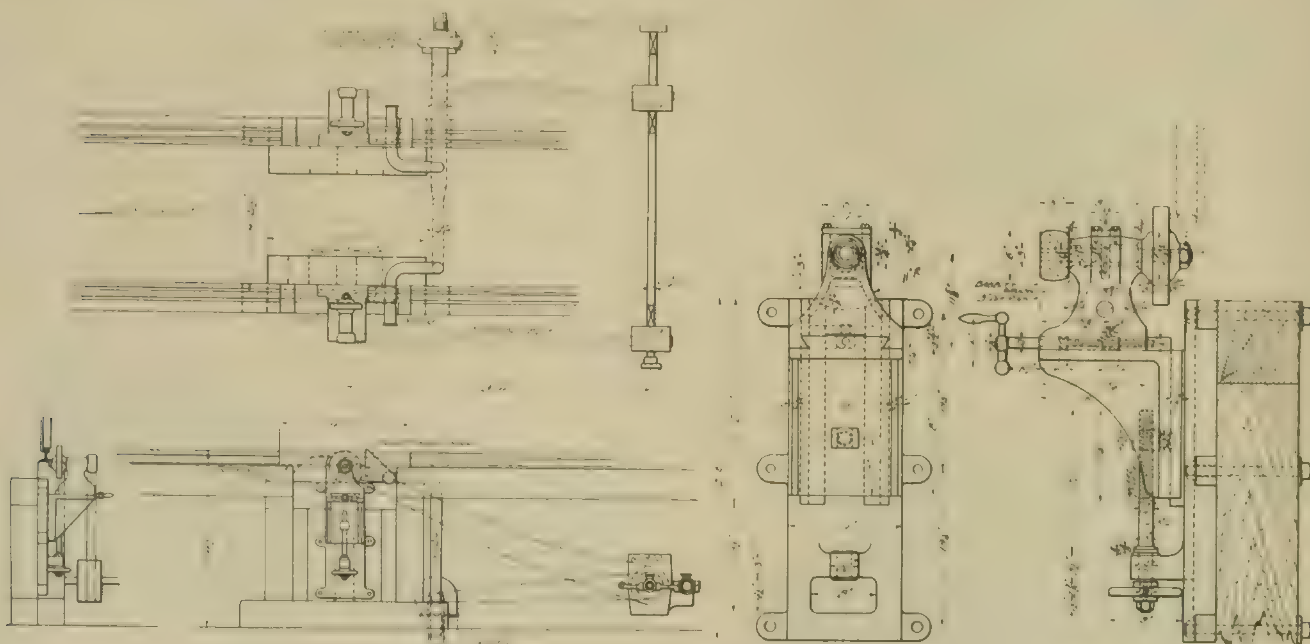
The trolley line is fed by means of a feeder carrying current at 6,000 volts and the return circuit is carried by the rails. The trolley wire is supported by a guard wire, to which it is connected at intervals of about three meters by means of thin vertical wires. On some portions of the line there are two supporting guard wires. Owing to the arrangement the danger which would be incurred in case of the trolley wire breaking is very greatly diminished, as in case of a break the hanging portion of the broken wire would always be at least 2.5 meters above the rail, and consequently out of reach of pedestrians. The use of a current of 40 periods avoids the difficulties which arise with a smaller number of periods in the case of lighting. In certain countries, however, such as Belgium for example, the use of higher frequencies are prohibited by law.

Some of the experiments made on this line were undertaken with a view of similarly equipping a road to be built in the Borinage. Unfortunately the Belgian government opposed the use of more than 450 volts, and in spite of considerable pressure brought to bear has consented only to the use of 650 volts, instead of 6,000 volts as required by this system. It is probable that these experimental equipments will find use elsewhere.

Machine for Grinding Flat Wheels.

We have received through the courtesy of Mr. E. A. Sturgis, superintendent of motive power and machinery of the Worcester Consolidated Street Railway Co., a drawing of a new wheel grinder which has been in operation at the shops of this company about two months and which is illustrated herewith. This machine has effected considerable saving during the short time that it has been in use, and the company finds that the cost of labor for grinding flat wheels is approximately 50 cents per wheel. The number of times a wheel can be ground will depend upon the previous wear which it has had as well as the depth of the flat and the general condition of the wheel.

The method of operation will be evident from the illustration. The car is placed in position over the grinder and is jacked up, the end of the truck over the grinder being blocked in position. A section of rail is then removed and the grinder is brought into position and is revolved by means of a stationary motor as shown in the illustration. The wheels to be ground are also revolved by means of power taken from the trolley wire through an adjustable resistance.



DETAILS OF MACHINE FOR GRINDING FLAT WHEELS.

April 2nd the Chicago City Railway Co. began to operate its Indiana Ave. cars by the overhead trolley system, instead of by cable, from 18th St. to the downtown district.

Hiring, Training and Handling Employes in Electric Railway Work.—II.

BY CHARLES H. COX.

In taking up the matter of training and handling men for street railway service I feel that I am grappling with a subject of great magnitude, and it is not my intention to discuss the matter in all its aspects, but simply to state a few facts that I have found to be of value in my experience.

For the purpose of defining more clearly the more important principles upon which this subject is based, I deem it advisable to separate the same into two classes, namely, training and handling, or perhaps more properly speaking, instructing and governing; and I wish to say regarding the instructing that the methods adopted by many of our larger systems in placing the beginner in a class of instruction in a school where a motor equipment is set up in working form on a skeleton car is the most practical way of imparting to green men the theory and principles regarding the same. But smaller roads cannot, owing to the limited number of men employed, expend the amount of money required for such a system, and therefore the problem with which the manager or superintendent has to deal (and surely nothing can be found in his line of duty of more importance) is the proper instruction of his men, for it is to them and their acts, individually and collectively, that success or failure in the operation of the road depends.

I have found placing in the hands of new men a book of rules and regulations for their study, together with their riding with an experienced man for at least a day to observe and get some idea regarding the work, is the best way of starting in, and after they have sufficiently familiarized themselves with the work, and having received the necessary instructions regarding the controller, brakes, etc., they are allowed to take the handles or start in taking fares as the case may be. During the period of instruction the beginner is supposed to do all of the work pertaining to the position, but the instructor, however, must be close at hand, and with a watchful eye be prepared to act promptly in case of an emergency.

As the beginner develops it is well to have the instructor appear to leave him to exercise his own judgment in the work, as he will learn more rapidly if allowed to overcome minor difficulties, rather than depend upon the instructor for everything. It is not advisable, however, to leave the beginner alone until he is thoroughly competent to do the work, at which time he should be turned in.

It is an excellent idea, and a custom in most places, to have the beginner put on with several different instructors, particularly on roads having several different lines, in which case it would be necessary for the beginner to thoroughly learn each route, thus giving him the benefit of the ideas of several experienced men, before he presents himself at the office for final examination as to his fitness for the position.

The final examination should consist of a test of his knowledge of rules, regulations, special orders, etc., and his disposition and ability to carry them into effect in the performance of his duties under all conditions and circumstances.

In the case of a motorman it is advisable to have him work several days in the pit and repair shop, thus affording him an opportunity to pick up a general idea of the parts of the equipment that require special attention, thereby placing him in a better position to act in case of a breakdown or other emergency. The knowledge and experience thus gained will make him more valuable to the company.

In relation to handling or governing men it is best to begin with the superintendent or manager, as it will be found many times that the men are a reflection of their immediate superiors, and if the superiors are inclined to be impulsive and arbitrary, in most cases the men will be found in a disturbed state of mind, with little or no respect for authority or interest in their work, and as there is no greater medium of advertising troubles or ventilating grievances than through the men on street cars, it brings the manager or superintendent close to the public in an undesirable way. Hence it is well for him to remember and practice, in his dealings with them, the principles of charity, it thus being impossible for him to do a wrong to another without first doing a greater wrong to himself, and by its very nature an injustice must be developed in him before it can reach its source. All men are so closely related by the common ties of nature that in order for one to do justice to himself, he must at all times do justice to others.

I am of the opinion that our interpretation of the word discipline has a great influence over us in dealing with our men; our understanding of the word should be to instruct, inform or educate rather than to reprimand, chastise or punish, and I have found that the closer we can get to our men, and still maintain the dignity of our positions, the easier it will be to govern them, and the better will be the results. In other words, the most humble in our employ are entitled to consideration and should not be treated as though they were of little or no account, and a quiet talk in a friendly way oftentimes is the sowing of a seed, which will develop into a great amount of good. We cannot afford to allow ourselves to believe that the most ignorant of our men do not know some things that it would be well for us to know.

Even though it becomes necessary to discharge a man for good cause, we must remember that he possesses some good qualities, and perhaps with the proper influences they would have been more in evidence, in which case dismissal from the service would have been uncalled for. Disobedience of rules, gross neglect, intoxication or carelessness call for decisive measures and such actions must not be tolerated, but even in such cases a man should be given a proper hearing before he is compelled to settle up.

All employes should be made to feel that they are an important part of the make-up of the enterprise, and that in a measure they are placed upon their honor to do the work which is laid out for them with the same degree of interest that they would exhibit if it were their own business. The mechanical method of performing their duties will not produce the best results.

The old method of suspending men frequently for minor offenses with loss of pay will not be productive of any great amount of good, as, all men being human, they are therefore occasionally liable to err, and cutting their pride sometimes hurts more than we realize, while the loss of pay ofttimes does much harm and injury to the innocent ones dependent upon them. Matters of this kind when taken to the homes of the men create an ill feeling which grows and sometimes develops in an undesirable way.

Great care should be exercised in selecting foremen and others having authority to enforce rules and discipline, as it has frequently been found that a large number of well satisfied employes have been disturbed and made to lose interest in their work by the arbitrary methods of foremen, who perhaps were doing what they considered for the best interests of the company. It will be found that raising men from the ranks to higher positions for meritorious service will encourage them to a greater degree of interest in the welfare of the company.

Reprimanding men in the presence of others will invariably do more harm than good and should not be practiced under any circumstances. A compliment to a man now and then when it is deserved will work wonders, but even this should not be given him in the presence of a third party. It is well, however, to compliment him for any special act or good work to his associates, but preferably in his absence. In reprimanding men it is a good plan to allow them to see that you realize that they have some good qualities, and that other men have some bad ones, but one must be careful and not draw the line of comparison too closely.

I have found that written suggestions from the men in relation to their different duties have been very helpful in solving knotty problems, and I have placed in the lobby a locked box (termed the "box for the improvement of the service"), from which at stated times the suggestions are taken out and carefully considered, and the men making them called into the office to talk the matter over in detail. This has a tendency to make the men more confident.

In conclusion I would say that among the ranks of street railway employes today will be found men from all walks of life, many of whom have the advantages of college training, and this has a tendency to raise the standard of efficiency. Men on street cars are continually coming in contact with all classes of people and under all conditions, thus serving to test their strength of character and other qualifications in dealing with the public, and if they enter into the work with the proper spirit, they have one of the greatest opportunities for development and advancement that is afforded in any line of work. An ambitious, energetic young man will make no mistake in applying himself to gain a practical knowledge of the street railway business.

Underground Traction in Chicago.

According to the Review for September, 1903, the purpose of the Illinois Tunnel Co., formerly the Illinois Telephone & Telegraph Co., to transport freight, express, mail, coal and ashes by [illegible] it has built over 20 miles under the downtown streets of Chicago. The company began building the tunnels about September, 1901, and so quietly has the work progressed that hardly anybody aside from the company officials and engineers knew it was being done. There were no accidents on the work and no complaint was received from the city authorities. The plan is so near completion that the company is enabled to announce that by September next it will begin operation and by 1905 it will have 200 electric locomotives and 3,000 cars in service.

Although all the contracts for equipment have not been awarded, the tunnels are being equipped with the Morgan third-rail system There is a section of experimental track, nearly two miles long, upon which the company has been making tests, using for the purpose two electric locomotives made by the Morgan Electric Machine Co., of East Chicago, Ind. The track laid in the tunnels is of 24-in. gage with 56-lb. T-rails. The rails are fastened by bolted clamps to cast-iron chairs embedded in the concrete floor of the tunnel.

The Morgan third-rail traction system has a perforated metal plate (½ in. thick and 4 in. wide) forming a rack rail which is bolted between two lines of timber stringers which serve to support the rack rail and to keep it protected. There being no wooden ties, chairs of bent steel channels of special construction are used to support the rack. The locomotive is similar to those used in mining. The rack rail serves both for traction and a conductor rail for the electric current, the current being taken up by the teeth of the driving gears and led to motors geared to the axles, with suitable controlling devices. The track rails are used for the return current.

The locomotives weigh three tons each with one motor, or five tons with two motors. Of the first 150 locomotives to be delivered 75 will be equipped with two 80-h. p. motors and 75 with one 75-h. p. motor each. The drawbar pull is about 6,000 lb. At present the company buys power from the Chicago Edison Co., but in time will build a power house.

The advantages claimed for the Morgan system include the following: No trolley pole or wire is required; great tractive power is obtained by means of the rack rail, and no sand is needed; the conductor is near the floor and is protected; starting and stopping are facilitated without slipping of wheels; the ability to haul heavy loads around sharp curves; a smaller locomotive may be used than would be otherwise possible.

The cars which it is proposed to use will be of steel and of different styles for different classes of freight. Those which the company has been experimenting with include several high-side gondola cars of 15 and 25 tons capacity. The latter weigh two tons empty. They are 12 ft. long, 4 ft. wide and 5 ft. above the rail. The company has not decided upon what makes of cars to employ, however.

The original plans called for building two sizes of tunnels, the trunk tunnels to be 12 ft. 9 in. x 14 ft. in dimensions and the lateral tunnels 6 ft. x 7 ft. 6 in. Only about a mile of the larger size has been built, however, but this can be completed and others constructed whenever necessary. The steepest grade in the tunnels is 1.75 per cent, and the grades at the railway terminals is not to exceed 12 per cent. These latter grades will form the approaches to the tunnels, the rails being about 30 ft. below the street level. There are 140 four-way intersections which have curves of 20-ft. radius; the sharpest curves on the main line are of 16 ft. radius.

The tunnels are lighted throughout by incandescent electric lamps.

In excavating the tunnels 900 tram cars were used on a 14-in double track to haul the excavated material, much of which was deposited at the lake front. These cars were 20 in. wide and 48 in. long. The tunnels were built by the pneumatic system at the rate of over a mile a month. The soil was found to be a firm clay and although 18 ft. below the level of the lake bottom no water was found and there was no trouble from dampness.

The lateral tunnels have 13-in. bottoms and 10-in. walls of concrete, while the trunk tunnels will have 21-in. bottoms and 18-in. walls. The roof is strong enough to carry the foundation of a future subway and a heavy rolling load. It was stipulated that the tunnel roof should not be nearer the surface than 24 ft. 6 in. The concrete walls are so lagged and tamped that all chance of a settlement [illegible]. For ventilation smoke stacks in adjacent basements have been tapped

In the summer of 1903 the Illinois Telephone & Telegraph Co. applied to the city for an ordinance allowing it to transfer to the tunnels owned and constructed by it the freight or parcel handling business now conducted on the surface of the streets. The ordinance, which was adopted, gives the company the full right to solicit the handling of freight for merchants by cars passing through the tunnels, departing from every station in the city and entering the basement of every large mercantile establishment, where the unloading may be directly done.

VIEW IN TUNNEL.

The ordinance gives the city as compensation 5 per cent of the gross earnings for the first 10 years, 8 per cent for the next 10 years, and 12 per cent for the last 10 years of the term of the franchise There is also provided a compensation charge of 20 per cent from the gross receipts of rental of tunnel space. It is stipulated in the ordinance that the present owner cannot sell the tunnels and that passengers cannot be carried through them. At the end of the term of the franchise the city is to have the right to take the tunnels and dispose of them as it sees fit, but the present corporation cannot be a bidder for them.

When the company first planned its telephone system its engineer, Mr. George W. Jackson, of Chicago, was commissioned to look for room in the city streets for conduits to accommodate an exchange of 100,000 subscribers. He found that the space below the paving was almost completely taken up by gas pipes, sewers and conduits for other companies, so it was decided that a tunnel system was the only practical solution of the problem in hand. A permit was obtained and the work of tunneling began at a shaft which was sunk in an alley between Madison and Monroe Sts., west of La Salle St. As the work progressed other shafts were lowered in basements hired for the purpose.

The ultimate scope of the work calls for the extension of the tunnels on the south side of the city as far as 71st St.; on the west side to Kedzie Ave., and on the north side to Fullerton Ave. Extending from the tunnels on the south, west and north sides it is the intention to build side branches covering the entire city, these side branches to be constructed by tunneling so far as practicable. Later, it is the intention to build a conduit system in the outlying districts.

There being no accurate map of the city in existence, the company made a new survey.

It is stated that the first use to which the tunnel system will be put is to take care of the coal traffic, putting it under the streets out of sight. Taking all the manufacturing establishments on both sides

of the Chicago River, over 4,000,000 tons of coal can be carried in the tunnels annually in the downtown district, while the company's cars will remove ashes from the engine rooms of the large buildings which it serves. Excavated material from sites to be occupied by new or remodeled buildings will also be removed by tunnel cars.

The company plans to do the trucking traffic for 38 trunk lines and the freight traffic of 21 retail stores and 196 wholesale houses. It is estimated that the amount of freight daily teamed between the wholesale and retail establishments and the freight depots amounts to 125,000 tons. Contracts for this service are now being signed.

The company also proposes to afford other conduit corporations now on the surface of the streets an opportunity to go permanently underground without tearing up the pavements or blockading the streets. This will open the way for asphalt pavement without danger of its immediate destruction by repairs being made to the conduits.

As stated in the "Review" for March, the Tunnel company has offered to carry the mails in its tunnels for $172,000 a year, agreeing to put 100 cars into service and build elevator connections costing $300,000. It is understood that the government views the proposition with favor.

The company has expended to date about $5,000,000 on its tunnels and the telephone exchange. Its telephones are automatic and are now used by nearly 6,500 subscribers in the downtown district, new subscribers being obtained at the rate of 150 a week. It expects to have to build and equip another exchange this season, the present building accommodating 10,000 subscribers only.

February 10th last what may be termed the formal opening of the tunnels took place, when there was a banquet in the tunnel under Jackson Boulevard under the auspices of the Chicago Press Club.

A short time ago the Illinois Telephone & Telegraph Co. sold to the Illinois Tunnel Co., which was incorporated for the purpose, all its property, including tunnels, tracks, telephone cables and automatic switchboard appliances and telephones. Accompanying the

VIEW OF RAILWAY IN TUNNEL.

bill of sale, which was recorded the latter part of January, was filed a trust deed for $[illegible] on the assets of the new incorporation to secure a bond issue. The Illinois Tunnel Co. has a capital of $[illegible] and may issue bonds to a like amount.

The president of the Illinois Tunnel Co. is Mr. Albert G. Wheeler, and the general manager and engineer of the Illinois Telephone Construction Co. is Mr. George W. Jackson, Mem. W. Soc. E.

[illegible] Co. has abandoned the sale of [illegible] than 11 ticket [illegible]

Canadian Notes.

The Toronto Railway Co. plans to build a transformer station for Niagara power on a site west of the city limits. Power will be transmitted from this station to the present power house, which will be altered for the purpose, and to a new station to be built on Yonge St. near Davenport road. The company has secured sites for the new buildings. Power will be received at 60,000 volts and transformed to 13,000 volts for the two power houses, where it will be stepped down to 110 volts for service. The Electrical Development Co. of Ontario will transmit the power. There will be four circuits and the feeders will be supported on galvanized steel towers spaced 400 ft. apart. The cross arms will be 45 ft. above the ground.

Pending the installation of its new boilers, the Toronto Railway Co. has arranged with the Toronto Electric Light Co. for power and the necessary connections and apparatus are being installed. The railway company contemplates extending its tracks over the York St. bridge and along the esplanade to Yonge St. wharf. The company has equipped a large number of cars with a momentum brake.

The Ontario Electric Railway Co. will begin construction on its line between Toronto and Kingston this season, and will ultimately extend the system to Brockville. There are 29 towns en route and it is proposed to carry passengers, express and freight. The company is capitalized at $5,000,000, one-half of which will be issued at once. The proposed road may be bonded for $20,000 per mile, the bonds extending over 30 years and bearing interest at 5 per cent. The power house will be built on the Trent River, near the Bay of Quinte. It is planned to adopt 55-ft. cars and charge a uniform rate of two cents a mile. The directors of the company are Hon. Sir Richard Cartwright, Robert J. Carson, John Carson, Cornelius Birmingham, Alfred J. Jewell, Horace N. Smith and G. E. Smith.

The South Western Traction Co. has increased its bond issue from $20,000 to $25,000. The company will build two bridges at a cost of $35,000. The road will operate from Hamilton west to Strathroy and Glencoe, passing through Brantford, Woodstock, Ingersoll, London, Delaware and Melbourne; south from London to St. Thomas and Port Stanley, and east from St. Thomas to Aylmer. The line will be built to Port Stanley and Delaware first. Mr. E. A. Welch, of London, is managing director.

The Montreal Street Railway Co. is to build at its shops 50 semi-convertible cars to cost $300,000. They will be 40 ft. over all; length over body, 30 ft. The doors will be at the side and the platforms will be 5 ft. wide, instead of 3 ft. 8 in. as at present. This company will build lines through the town of Delorimer, Que., early this season.

The Windsor, Essex & Lake Shore Rapid Railway Co. has increased its capital from $500,000 to $1,000,000, and will extend its line from Wheatley, the present terminus, to Chatham, Ont.

The Hamilton Radial Electric Railway Co. contemplates the extension of its line from Mimico to Toronto and has applied for the necessary legislation.

The Toronto Suburban Railway Co. has applied for permission to build a line from Woodbridge to Niagara Falls. Royce & Henderson, Toronto, are solicitors for the company.

Mr. Robert Stuart, of the American Cereal Co., has been granted the franchise which was originally held by the Peterboro Radial Railway Co., and will reconstruct the road which has been inoperative several years. The road is to be in operation by July 1st.

Paul Galibert, of Montreal; Aaron Weil, of New York; Jeremie L. Decarie, advocate, of Montreal; Rufus McDuffie, New York, and Charles Allard, of Chambly, have organized the Suburban Tramway & Power Co., to develop water power for electrical purposes and to build electric railways.

Louis Boyer, solicitor, has applied for a charter for the Canadian Traction & Power Co., which proposes to build an electric line from Montreal to Ottawa, with branch lines.

The St. James St. subway for the Winnipeg Electric Street Ry. is to be built this spring.

The Mount McKay & Kakabeka Falls Co. has been granted a charter for a short electric line in that district.

A bill recently introduced in the General Assembly of New York, providing that [illegible] shall designate [illegible] City has been withdrawn.

Ohio Interurban Railway Association.

In our issue for March we mentioned the organization meeting of the Ohio Interurban Railway Association, which was held at Dayton, O., February 24th. The first regular meeting of the association was held at Dayton March 31st.

The meeting was called to order at 2 p. m. by President Harrie T. Clegg, who in his address reviewed the steps by which the organization had been formed and briefly discussed the immediate details of the association and its possible scope. The first meeting had been for the purpose of trying to reach an agreement concerning interchangeable mileage for electric railways, and on the suggestion of Mr. E. C. Spring it had been decided to effect a permanent organization for the discussion of matters of mutual interest. The association was the result of an almost spontaneous movement, and the machinery has been made simple so that it can readily be adapted to meet various needs as they arise. The association, as its intentions are voiced by Mr. Clegg, will try to atone for the tardiness of interurban roads in organizing by the energetic progress it will make.

The paper announced for this meeting, "Steam Turbines," by W. H. Abbott, of Cleveland, was not presented, as Mr. Abbott at the last minute found he could not be present.

The principal subject before the meeting was that of "Interchangeable Mileage for Electric Railways." Mr. J. H. Merrill, secretary and treasurer of the association, who is the chairman of the committee on this subject, made his report submitting the form of ticket adopted and stated that 12 companies had signified their willingness to become parties to the agreement.

The ticket adopted is what is known as the Thrall patent coupon, with coupons arranged as in steam railroad mileage books, but each coupon good for a 5-cent ride. The face value of the book of coupons is $12.00, there being 240 coupons of 5 cents each, but it is sold for $10.00, a discount of 16 2-3 per cent. Each coupon bears the initials of the road issuing the book and the company collecting the tickets will bill each road for the cash value of the coupons bearing its initials, that is 83 1-3 per cent of their face value. The form of ticket having been accepted by the association, the matter of notification to conductors and the agreement between various roads as to how this mileage should be handled, was referred to the transportation committee with power to act.

A general discussion on the purpose of the association and the means of increasing its usefulness followed.

Judge Dwyer, president of the Dayton, Covington & Piqua Traction Co., who was one of the pioneers in electric railway work, commented on the advances of electricity as a motive power for railways and hoped that the interurban roads would form an organization that would bring them closer together.

Mr. E. C. Spring cited the success of the New England Railway Club and painted a rosy future for the Ohio Interurban Association if its members continued to work in the same loyal spirit.

Mr. F. W. Coen, of the Lake Shore Electric, mentioned the results obtained with limited car service between Cleveland and Toledo and on the lines of the Indiana Union Traction Co., and commended this subject to the consideration of the members. He stated that patrons greatly appreciated this service.

Mr. G. S. Davis commented on the field of work before the association and complimented the executive committee on the scheme of organization and commended its plan to have monthly meetings and discuss a single subject at each, saying he had never heard a subject more thoroughly discussed than had been that of interchangeable mileage.

Mr. Winters brought up the question of whether mileage coupons should be accepted on limited trains.

Mr. Coen believed that every form of transportation for which the company received money should be accepted on the "Limited," but no passes.

Mr. Wilcoxon urged the members to interest other railway men in the association, so that its influence might grow to be in keeping with the importance of the industry.

After a vote of thanks to those who had contributed to the entertainment of the association the meeting adjourned.

Although the entertainment features were subordinated to business, they were not entirely suppressed. Mr. H. N. Ransom, of the National Electric Co., and Mr. H. B. Gay, of the Electric Storage Battery Co., entertained the delegates at luncheon on Thursday.

At 7:30 p. m., through the courtesy of the Dayton, Springfield and Urbana Electric Railway Co., E. B. Gunn, general superintendent, the members of the Association took special cars at the corner of Third and Jefferson Sts. for a tour of inspection of the power station at Medway, Ohio, returning to Dayton at 10:00 p. m.

For those who remained in Dayton over night, arrangements were made with all the interurban lines running out of Dayton, whereby on the 9:00 o'clock a. m. cars members were given the freedom of the various roads. The Western Ohio from Piqua to Lima, upon the arrival of the cars in Piqua also extended the courtesies of the lines.

Through the courtesy of Mr. John H. Patterson members of the association visited the National Cash Register works, the party leaving at 9:30 a. m. in special cars of the Oakwood Street Railway Co.

The officers of the association are:

President, Harrie P. Clegg, Dayton; vice-president, E. C. Spring, West Milton; secretary and treasurer, J. H. Merrill, Lima. Executive Committee: E. B. Gunn, Springfield; R. E. DeWeese, Dayton; A. W. Anderson, Dayton; Howard Fravel, West Alexander; F. J. J Sloat, Hamilton, O.

Street Railway Parks in 1904.

The Pittsburg (Pa.) Steeplechase & Amusement Co. has published an attractive booklet of 16 pages, entitled "Kennywood the Beautiful, a Glimpse of Summer Fairyland," describing and illustrating Kennywood Park, which is known as "Pittsburg People's Popular Pleasure Park." This park is located 10 miles, or 50 minutes' ride, from downtown Pittsburg. It overlooks the Monongahela River and is considered an ideal place for large picnics, or church, school and lodge outings. It is easily reached by the Pittsburg Railways Co's. cars, which run through a picturesque section. Admission to the park is free and the grounds are constantly patrolled by courteous guards, making it a very safe place for women and children. Scattered through the 150 acres are a good many springs of pure water.

There are a mammoth dance pavilion, two large dining halls, shelter houses and a forest of beautiful shade trees. Lake Kennywood is a picturesque body of water, with its row boats, swan boats, electric launch and rustic bridges. It is illuminated at night by scores of arc lamps. There is a fine pony track and in addition to a large number of ponies and horses for hire a band of curio ponies has been secured, comprising all the known breeds and including "calico ponies." There is also a herd of camels in charge of Arabs. A miniature railway, merry-go-round, three-way Fig. 8 toboggan, "Ye Olde Mill" and a casino are also among the attractions.

There is a steeplechase arena, in which are scores of amusements, "funny stunts" and illusions, including an "earthquake floor," "crazy stairs," "slippery slide," "Trilby, the Flying Lady," etc. There is also a vaudeville theater in the steeplechase arena and a grewsome illusion, entitled "From Life to Death." Other features include a $15,000 open-air music pavilion, an Indian village peopled by genuine Sioux Indians, a ladies' cottage, checking rooms and other conveniences. High class Sunday concerts attract a great many visitors to Kennywood also. Last season 2,000,000 persons visited the park.

The Norumbega Park Co., of Auburndale, Mass., is building what it believes will be the finest open-air theater in America. The roof covers an area of 20,000 sq. ft., and the theater will have seating capacity for 3,000 persons. The park is operated by an independent company which is composed of several officers of the Newton Street Railway Co., the park manager being Mr. Carl Alberte. The attendance last season was 400,000, the cars carrying 325,000. The admission to the park is 10 cents, and all the attractions except the theater are free. The park is not only self-supporting, but it pays dividends. High class vaudeville is especially remunerative.

The Grand Rapids (Mich.) Railway Co. controls two pleasure resorts—Reed's Lake, which it operates, and North Park, which it leases. It desires to retain the entire control of the features at Reed's Lake, and consequently it prefers to operate the resort. The business at North Park is not very large, compared with Reed's Lake, so it can be leased as advantageously as it could be operated by the company. For next season the company plans to build a $3,500 refreshment pavilion, and will grant concessions for "Ye Olde

Mill," etc., at Reed's Lake. The admission to the parks is gratis. Seats in the theater cost 10 to 25 cents each, a charge of 5 cents is made for the roller coaster, and 5 and 10 cents are the charges at the laughing gallery. In fact, nothing is over 10 cents, except the theater and the rowboats. The theater and the roller coaster are the most remunerative. The parks are easily self-supporting. To handle the heavy traffic cars are run to either park every two minutes from all parts of the city. When necessary, three different lines can be operated to Reed's Lake. The manager of Reed's Lake is Mr. Orin Stair. The lessees of North Park are Messrs. Zindle and Hart.

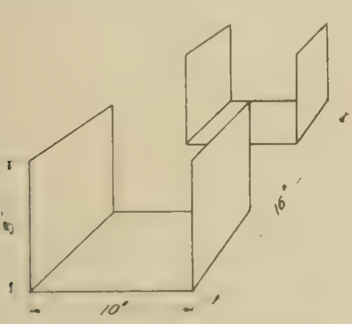
The Mansfield (O.) Railway, Light & Power Co. owns and operates Casino Park, preferring to operate it because it can be conducted in a more orderly fashion and the company can better cater to the public. No admission is charged and the park is considered as a charge on the railway traffic. There is a restaurant which pays well, but the theater is run at a loss. No improvements are contemplated for next season. Last season the attendance at the park was 100,000, of which 70,000 were carried on the cars.

The Cleveland, Painesville & Eastern Railroad Co., of Willoughby, O., owns Willoughbeach Park, which it leases, being of the opinion that it is not advisable to operate parks in connection with the railroad business. No improvements or additional attractions are contemplated for next season. Last season the attendance at the park was 45,000, of which number 44,000 were carried on the cars. The park is self-supporting, dancing and an electric merry-go-round forming the most popular attractions. For handling the traffic extra cars are run in connection with the regular service. The lessee of the park is the Willoughbeach Park Co., and the manager is Mr. G. E. Bender.

The new $65,000 power house of the New York & Long Island Traction Co. has been completed and furnishes power for operating the lines between Freeport, Hempstead, Mineola, Queens and Rockville Center, L. I. The power house is located at Rockville Center and there is a sub-station at Hempstead.

Making Car Axles from Scrap Iron.

The car shops of the Pacific Electric Railway Co., of Los Angeles, Cal., are equipped for car building, as well as repair work, and among the novel features of the shops is the making of car axles from wrought-iron scrap. Scrap metal from all departments is saved and sorted into piles of cast iron, wrought iron, or steel. No. 1 and No. 2 wrought-iron scrap is used in making the axles, the material being cut into 16-in. lengths, or less, it making no difference how small they are. The scrap is then arranged in bundles of 225 lb. each, the pieces being held together by binders made of large pieces of flat scrap, as is shown in the accompanying illustration. The larger pieces of flat scrap are laid on the bottom and sides of the binders and serve to hold the small pieces in place. The size of each bundle is 8 x 10 x 16 in.



BINDERS FOR SCRAP IRON

The scrap is heated in a decarbonizing reverberatory furnace burning crude oil, 12 bundles being worked at each heat. After attaining the proper heat the bundles are worked in a 3[illegible]-lb. steam hammer into slabs, 3 ft. 6 in. long by 6 x 2 in., and these slabs are again heated and worked into axles, three slabs being sufficient to make the smallest size axle. After being worked to the proper diameter the rough ends are cut off and finished in lathes to the proper sizes.

By making its own axles in this way the company not only uses up all of its scrap wrought iron, but it is satisfied that it obtains a better grade of axles than it can buy and that the material produced by this means possesses a ductility and fibre not obtainable in rolled bar iron.


BUNDLES OF SCRAP FOR CAR AXLES.

The furnace used in this work was designed and built by Mr. T. A. McNeal, foreman of the blacksmith shop, and aside from the special feature of burning oil the furnace is interesting on account of the disposition of the spent flame, which is used to generate steam in a boiler built directly over it. The steam thus furnished is sufficient to supply three steam hammers in the blacksmith shop.


OIL BURNING REVERBERATING FURNACE.


BIG HAMMER AT WORK.

Traction in Curacao.

[illegible]

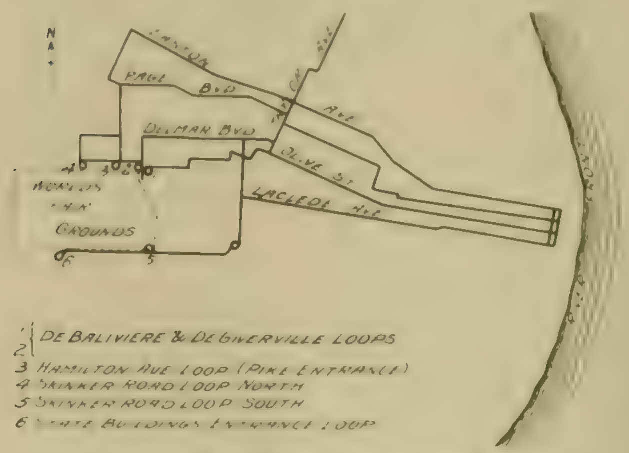
STREET CAR IN CURACAO.

on an extended trip through the West Indies, visiting Cuba, St. Thomas, Porto Rico, Martinique, Barbados, Trinidad, Jamaica and [illegible] Curacao. By courtesy of Judge Wanty we are enabled to show a view of the party on its trip over the railway of Willemstadt, Curacao, in a private car, which shows existing conditions on that island.

[illegible] Railroad Co., held at Chicago March 31st, it was voted to change the name of the company to the Chicago & Oak Park Elevated Railroad Co. The meeting was again adjourned to April 20th.

St. Louis Transit Terminals at the Fair.

[illegible] greatest interest to our readers, is the arrangement made by the St. Louis Transit Co. for terminals at the World's Fair grounds. By courtesy of the management of the Transit company we are enabled to publish details of the plans mentioned in the "Review" for



WORLD'S FAIR LINES [illegible]

March [illegible] of the company's exposition routes.

The exposition grounds are approximately one mile from north to south, and two miles from east to west; the improved portion of Forest Park extends for a mile or more east of the exposition enclosure so that access to the grounds by the Transit company is confined to the north and south sides. Forest Park is due west of the business district of the city and the regular car lines that run to the western part of the park comprising the exposition grounds are the Olive, Delmar, Page and Easton routes serving the north side, and the Market, Laclede and Taylor routes serving the south side. The haul by these several routes is from five to seven miles. The disposition of cars to care for exposition traffic is not yet determined, but probably the World's Fair cars will be operated on the east and west lines, passengers on north and south lines throughout the city being transferred at the most convenient intersections.

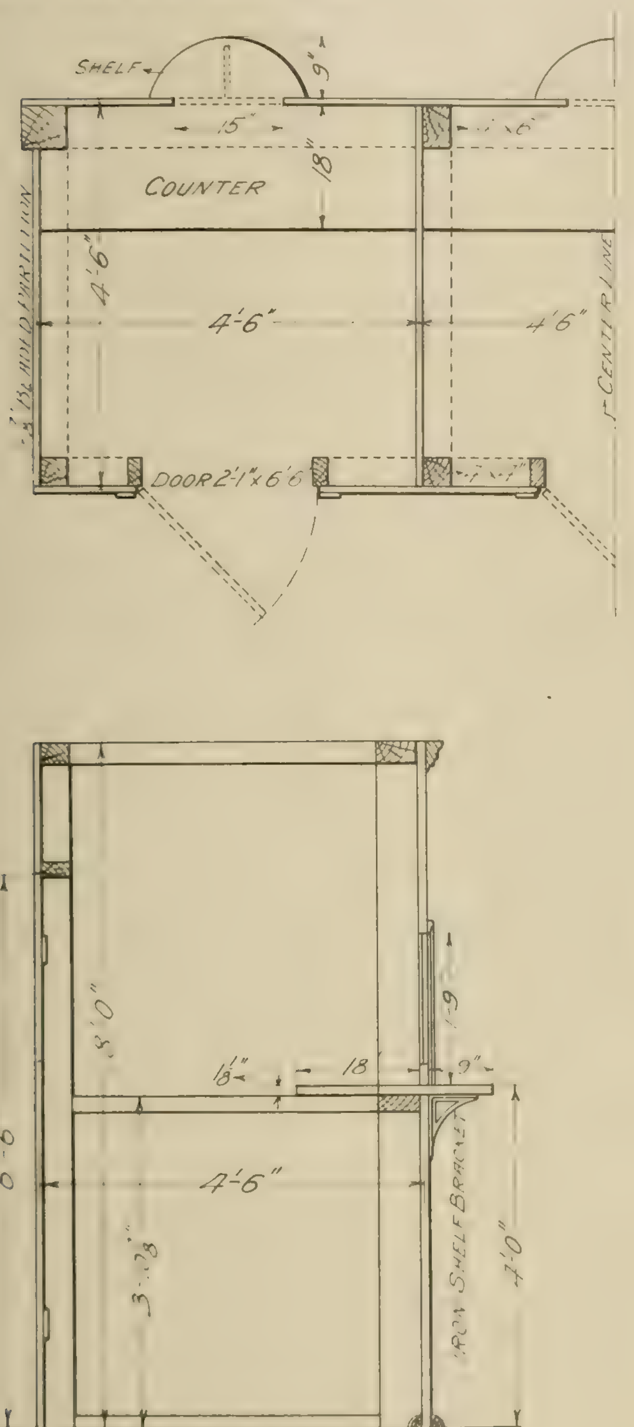
The accompanying sketch shows the location of the six terminal loops of the Transit company, and the routes of cars on the lines

[illegible] EAST CORNER DE BALIVIERE AND DE GIVERVILLE AVES.

direct to these points. We have given the several loops numbers and descriptions on the sketch which will serve to identify them.

No. 1 is just east of DeBaliviere Ave. at the Lindell or Main entrance to the fair grounds, and will be used by the Olive St. cars.

No. 2 is just west of DeBaliviere Ave. at the same entrance, and will be used by the Delmar Ave. cars.



TICKET BOOTH.

No. 3 is the "Pike" terminal and is at the Pike entrance to the grounds, and will be used by Easton Ave. cars.

No. 4 is at the "Administration" entrance on Skinker Road, and will be used by the Page Ave. cars.

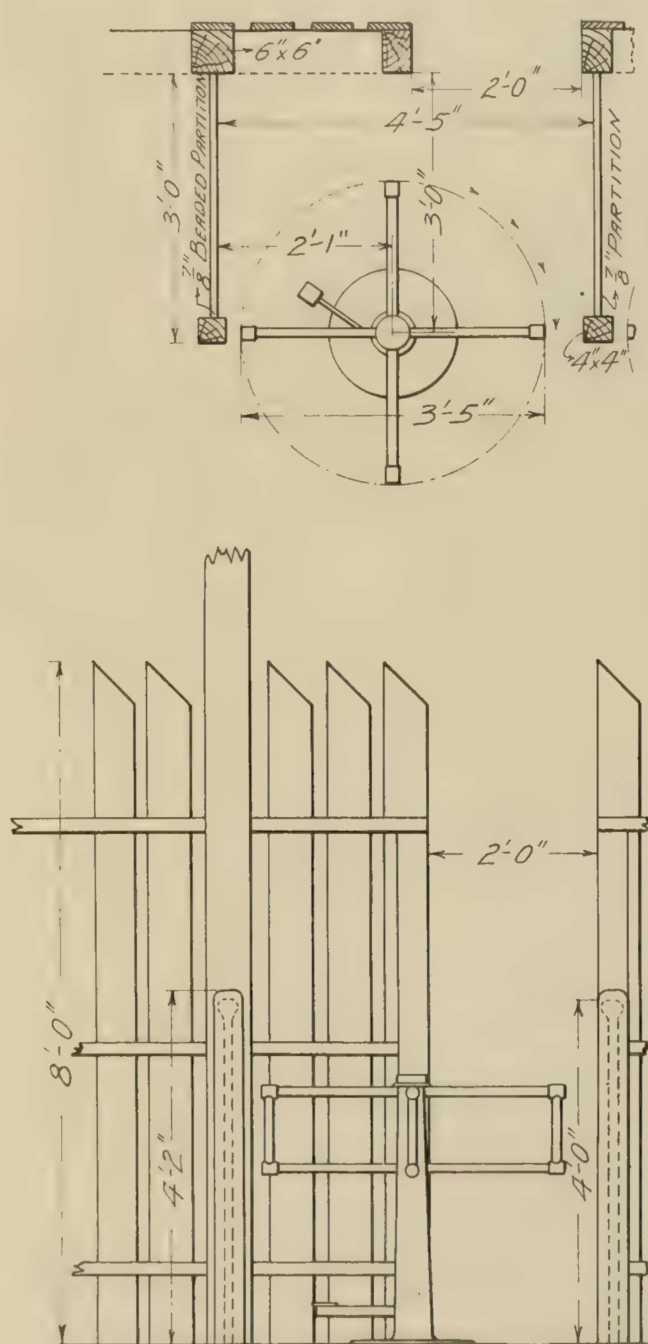
All these terminals are connected by a double track railway, which will enable cars to be shifted between the various terminal stations to meet varying requirements.

Nos. 5 and 6 are on the south side of the grounds and will be used by Laclede, Market and Taylor Ave. lines, the cars being concentrated at either loop.

The car equipment provided has been with the view to carrying 60,000 passengers per hour to the Fair grounds, and an equal number in the opposite direction.

The terminal, plans of which are shown, is that at the southeast corner of DeBaliviere and DeGiverville Aves. (No. 1).

The space available here was 400 ft. by 175 ft. and in this were laid out the tracks as shown. Twelve exit turnstiles are provided, of which ten are near the southwest corner of the terminal enclosure. Nine ticket booths and ten entrance turnstiles are placed on the



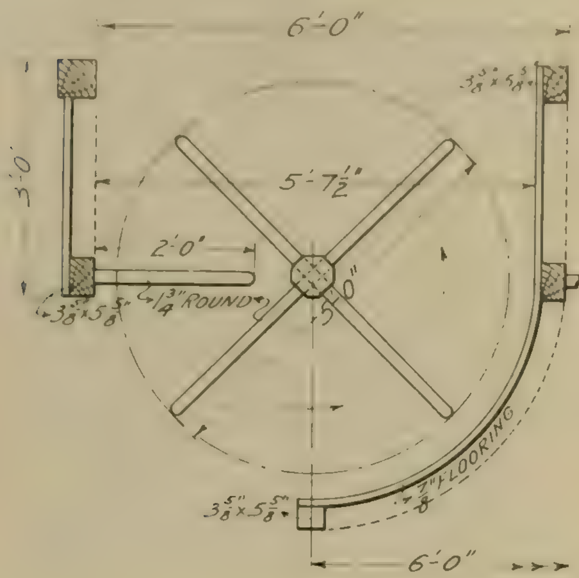
ENTRANCE TURNSTILE.

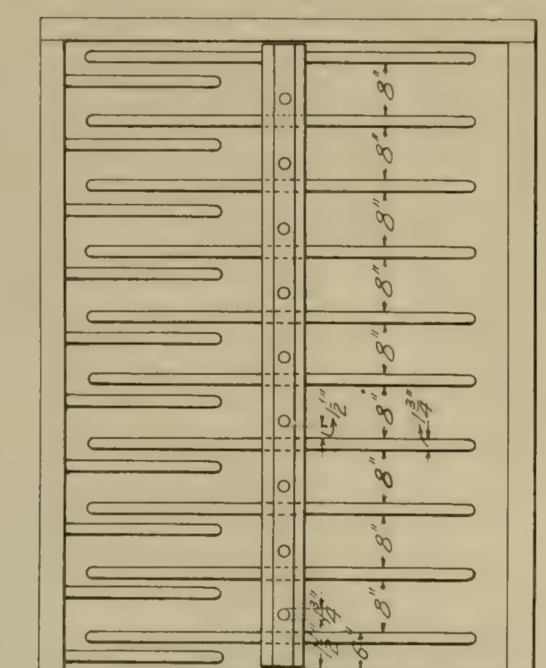
south side (next the Exposition grounds), a movable fence being provided so that the platform may be divided into two sections, in order that passengers leaving the cars will not conflict with those entering the station to board cars for the city.

The general purpose of the arrangement and the location of the entrance and exit gates is easily seen from the plan drawing, and the simplicity and flexibility of the design commend it. When traffic is in both directions the movable fence enables the two streams to be easily separated, and when traffic is all one way the whole of the platform is available if needed.

The fence enclosing the terminal is 8 ft. high, with vertical pickets of 1 x 6-in. pickets spaced 8 in. between centers and nailed to three 2 x 6-in. stringers. The stringers are supported on 6 x 6-in. square posts 9 ft. long. The posts are set 3 ft. in the ground, the lower stringer being 10 in. above the ground.

The exit turnstiles are of the usual type, the revolving portion being 5 ft. in diameter and 8 ft. high. The details with important dimensions are shown in the engraving.





EXIT TURNSTILE

Entrance turnstiles require the attendance of a ticket taker at each one and are arranged as shown, with an entrance 2 ft. wide.

Our illustration also shows a plan and vertical section of the ticket booths. The sides of these booths are of ⅞-in. beaded partition stuff, the window in the front being 21 x 15 in. and protected by a wire screen which leaves an open space of 3 in. at the bottom.

As many of the hotels and boarding houses that will be extensively patronized by the world's fair visitors are within a comparatively short distance of the grounds it would be impossible for conductors to collect fares on homeward bound cars before a considerable portion of the load would be discharged, and accordingly those seeking to board cars at the terminal will have to purchase tickets at the booths, and surrender them at the entrance turnstiles.

New Publications.

LA MACHINE LOCOMOTIVE. By Edouard Sauvage, mining engineer and consulting engineer of the Western R. R., of France. This is a practical manual, giving a description of the working parts and their functions of the locomotive, for the use of engineers and firemen. This work, which contains 379 pages, exclusive of the index, treats wholly of steam locomotives. It is bound in cloth and illustrated with views and diagrams. Published by the Librairie Polytechnique, Paris, France. Price 5 francs.

MANUAL OF AMERICAN STREET RAILWAYS. Reprinted from Poor's Manual of Railroads for 1903. Edition of January, 1904. As implied, this is a reprint in handy form of the department of city and suburban electric and other surface and elevated railways presented in Poor's Manual for last year. The page folios are the same as those in the Manual. The contents are carefully indexed and the book is bound in paper. Published by Poor's Railroad Manual Co., 68 William St., New York.

ALTERNATING CURRENTS, THEIR GENERATION, DISTRIBUTION AND UTILIZATION. By George T. Hanchett, M. E., Mem. A. I. E. E. First edition, first thousand. In the preface the author states that there are today many practical engineers in charge of power plants who have a thorough knowledge of direct current work, yet have but a vague idea of the phenomena of alternating currents and the apparatus for generation and utilization. This is especially true in connection with the polyphase systems which are becoming more generally used, and the endeavor of this book is to explain as clearly and simply as possible the phenomena and apparatus of the alternating currents in their various practical phases. 12mo, 180 pages, profusely illustrated with line and half-tone cuts. Cloth, $1.00 net. Published by John Wiley & Sons, New York; London, Chapman & Hall, Limited.

ELEKTRISCH BETRIEBENE STRASSENBAHNEN. By S. Herzog. This is a pocket manual designed to facilitate the making of estimates, planning details of construction and preparing specifications and to assist in the operation of electric street railways. It contains 470 pages of details, 377 drawings and 5 tables. Central power stations, sub-stations, overhead construction, surface transmission lines, poles, insulation, underground conduit systems, storage batteries, third-rail systems, motor cars and car barns are a few of the subjects treated of in Part 1. There are seven other parts treating in general of specifications, operating details and expense, maintenance cost, safety appliances and rules, electrotechnical tables, machine-technical tables, geometrical tables, physical tables and practical tables. The concluding parts contain the general laws and ordinances relating to the operation of street railways in Germany, and a set of mathematical tables. This book is published in pocket size, 4½ x 7 in., leather covers secured by a clasp. Published by R. Oldenbourg, Berlin and Munich. Price $2.00 (8 marks).

MUNICIPAL TRADING AND MUNICIPAL OWNERSHIP OR OPERATION OF PUBLIC UTILITIES. Prepared under the authority of a committee of the Legislative Assembly of the Province of Ontario and printed by order of the Assembly. This is an epitome of the periodical and other literature produced within the last few years on the subject of municipal or other ownership of public or quasi public utilities. The extracts included in the compilation relate principally to the municipal or other ownership of water, gas, electric light and power plants and street transportation, but there are only a few articles bearing on the question of the municipal supply of electric or other power. It has been the aim to give as nearly as possible an equal quantity of the arguments on each side, without regard to the quantity or quality of the material available. The secretary of the committee to whom the work of compiling the matter was entrusted states that he refrains from any attempt to decide whether the mass of material is preponderatingly for or against municipal ownership, and he adds that it is likely that the advocates of either side will be surprised to learn the strength of the arguments, the weight of the statistics and the depth of the feeling on the other side. Added to the report of the committee is the return ordered by the Legislative Assembly of the reproductive undertakings operated by municipalities in Ontario. The matter contained in the book is carefully indexed. Bound in paper, 246 pages. Printed and published by L. K. Cameron, Toronto.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

COLLISION OF CARS RUNNING IN OPPOSITE DIRECTIONS ON SAME TRACK EVIDENCE OF NEGLIGENCE.

Robinson vs. St. Louis & Suburban Railway Co. (Mo. App.), 77 S. W. Rep. 493. Dec. 1, 1903.

The collision of cars running in opposite directions on the same track, the court of appeals at St. Louis, Mo., holds, was prima facie evidence of the defendant's negligence. When shown, the burden was shifted on the defendant to show by a preponderance of the evidence that the collision was not due to its fault.

STATUTE MAKING STREET RAILWAY COMPANIES LIABLE FOR PRIVILEGE TAX IMPOSED UPON ADVERTISING COMPANY UNCONSTITUTIONAL.

Knoxville Traction Co. vs. McMillan (Tenn.), 77 S. W. Rep. 665. Nov. 20, 1903.

The supreme court of Tennessee holds that the provision of chapter 257 of the Acts of that state of 1903 making street and commercial railroad companies liable for the privilege tax imposed upon advertising companies conducting the business of advertising in the cars and stations of such companies is clearly unconstitutional and void, as being a deprivation of property without a hearing or due process of law.

PASSENGER NOT BOUND TO EXAMINE TRANSFER.

Moon vs. Interurban Street Railway Co. (N. Y. Sup.), 85 N. Y. Supp. 363. Nov. 30, 1903.

A passenger on a south-bound car asked for a transfer to which he was entitled to another line going south, but was given, probably through error of the conductor, a transfer to that line going north, which would have been a proper transfer if he had been proceeding north and wished to continue his journey in that direction. He did not examine this transfer, nor, the appellate term of the supreme court of New York holds, was it his duty to do so. It says that he had the right to assume that, as he was proceeding south, he would receive a transfer that would entitle him to continue in that direction.

BUT ONE FENDER, CONDUCTOR AND MOTORMAN REQUIRED FOR TWO CARS COUPLED TOGETHER

Von Diest vs. San Antonio Traction Co. (Tex. Civ. App.), 77 S. W. Rep. 632. Nov. 25, 1903. Rehearing denied Dec. 23, 1903.

A city ordinance provided that it should be unlawful to operate or run any street car unprovided with a car fender. It was also provided that no electric car should be propelled or operated within the limits of the city without having one conductor and one motorman thereon. The court of civil appeals of Texas thinks that, within the spirit of the ordinance, two cars coupled constituted one car, and a fender on the front car and one conductor and motorman were all that was required by the ordinance.

PASSENGER ACCOMPANIED BY CHILD ENTITLED TO OPPORTUNITY TO ALIGHT IN SAFETY UNDER CONDITIONS ATTENDING HER SITUATION.

Harmon vs. St. Louis Transit Co. (Mo. App.), 77 S. W. Rep. 158. Nov. 3, 1903.

The contention of the defendant, in effect, that the testimony proved beyond dispute that the car was stopped sufficiently long to enable the plaintiff individually to alight in safety, and that if she had not paused to assist her niece, a child who was with her, she would not have been injured, the court of appeals at St. Louis, Mo., says did not impress it with much force. It says that it was the duty of the servants of the defendant in charge of the car, perceiving, as they should have done, if in the proper exercise of their employment, the delay occasioned to the plaintiff in assisting her small companion to get off, to have caused the car to remain at rest to permit the plaintiff to alight in safety under the conditions attending her situation, and the law did not exact of her to abandon her youthful associate.

DUTY TO STOP, LOOK AND LISTEN BEFORE ATTEMPTING TO CROSS TRACK—WHEN LIABILITY NOT CAUSED BY TOO GREAT SPEED.

Heebe vs. New Orleans & Carrollton Railroad, Light & Power Co. (La.), 35 So. Rep. 251. June 22, 1903. Rehearing denied Nov. 16, 1903.

The recognized rule, the supreme court of Louisiana holds, is that before attempting to cross a railway track a person should stop, look, and listen, and it will hardly do to substitute for it a rule to the effect that, being at a distance from a crossing, towards which he and an electric or steam car are traveling, he may then form an opinion as to which of the two will get there first, and, acting upon that opinion, essay the crossing without giving himself further concern upon the subject. The fact that a street railway company has operated a car at too high a rate of speed will not entitle a party who is injured to recover if it appears that the fault of the company would not have caused the injury save for the supervening and greater fault of the party injured.

DUTY ON SEEING FRIGHTENED HORSE.

Knoxville Traction Co. vs. Mullins (Tenn.), 76 S. W. Rep. 890. Oct. 24, 1903.

It is not to be understood, the supreme court of Tennessee says, that the employe in charge of a moving car on a public thoroughfare is obliged, at the peril of subjecting his employer to a recovery for damages, to stop the usual methods employed in running street cars every time he sees a frightened horse in the street. But the court thinks that the safety of those who ride or drive horses along these highways requires an enforcement of the rule that, where it reasonably appears a horse is so frightened as that it is unmanageable, or is otherwise placing the one in charge or others in imminent danger, the motorman should stop sounding his gong or bell, and also stop the movement of his car, and thus prevent, if it may be, a threatened injury. To continue to run his car at a rapid rate upon the frightened animal, and to ring his gong or bell, are acts of wantonness, which should make the master liable for the injuries that result therefrom.

LIABILITY FOR ASSAULT ON COLORED PERSON AT PARK DUE TO PRESUMABLY KNOWN CONSPIRACY.

Indianapolis Street Railway Co. vs. Dawson (Ind. App.), 68 N. E. Rep. 909. Nov. 17, 1903.

Here a colored man who went to a park owned by the company and on which it maintained certain attractions was assaulted and beaten in pursuance of an alleged conspiracy of certain lawless frequenters of the park "to suppress, molest, assault, and insult colored people generally who might visit said park." The pleadings charged the company with notice of the alleged conspiracy, with acquiescence therein, and, by its guards or policemen, with passive participation in the actual assault made. The appellate court of Indiana, division No. 2, holds that demurrers to the complaint were correctly overruled, and affirms a judgment for $500 damages against the company. It holds that evidence of similar ocurrences was competent as tending to show notice of the conditions. Lastly, it says that the company and

its officers appeared to have displayed indifference to the conditions existing which it and they could not well help knowing. This may have been due to the idea, sometimes entertained, that as to acts of lawlessness it is a sufficient duty of citizenship to be indifferent. Such idea is entirely erroneous.

INJURY TO ALIGHTING PASSENGER FROM FALL OF TROLLEY POLE OF CAR—TRANSFER TICKET ITSELF NOT REQUIRED TO BE OFFERED IN EVIDENCE.

Chicago City Railway Co. vs. Carroll (Ill.), 68 N. E. Rep. 1087. Dec. 16, 1903.

As a passenger was alighting, or just as he had alighted, to go to another car, at a junction of two streets, the trolley pole from the car from which he was alighting or had just alighted fell and struck him upon the head. The supreme court of Illinois holds that it was not necessary for him to show what caused the trolley pole to fall, or that the car was run in a negligent manner with regard to speed, or was defectively or wrongly constructed. Nor does it think that it was fatal to his case, after he had testified that he had a transfer and his son had testified that when he was brought home a transfer was taken out of his pocket, that the transfer paper itself was not offered in evidence. It says that no witness denied that he had a transfer, or that he received it in the regular way. The action was not upon the transfer paper. It was a mere incident to his right. It was sufficient that the undisputed evidence showed, or tended to show, that he did receive a transfer, and in consequence of that, and by virtue of it, was a passenger on both lines of the company while making a continuous journey to his destination.

CARE REQUIRED IN CHOOSING PLACES FOR PASSENGERS TO ALIGHT—STOPPING AT SHORT DISTANCE FROM CROSSING.

Lynch vs. St. Louis Transit Co. (Mo. App.), 77 S. W. Rep. 100. Nov. 17, 1903.

What a street railway company or other carrier is bound by law to do in discharging passengers from a vehicle, the court of appeals at St. Louis, Mo., says, is to use high care to select a safe landing place, and in other ways to endeavor to land them safely. The defendant, or other carrier, should not be the least remiss in the choice of landing places, and cannot lawfully be. It must choose them with great care; and, where there is an embankment or other surface fault which enhances the peril of alighting, the place is an improper one to discharge a passenger. But the court holds that the defendant could not be held answerable from the fact that the plaintiff got hurt in leaving its car while the car was standing at a safe place, although that place was a short distance from the one where passengers usually alighted. It says that the omission of the carmen to stop the car at the crossing was not the proximate cause of the injury to the plaintiff, because, while maybe the accident would not have happened if that had been done, passengers are constantly let off cars at other places than street crossings without harmful consequences. Most other portions of streets are as safe to alight on as crossings, and varieties of cars are constantly being used which permit passengers to board and alight anywhere along one side of a car, which, of course, contemplates their doing so away from crossings.

NO OBLIGATION TO GIVE PASSENGERS FROM ONE CTY TRANSFERS TO CONNECTED LINES IN ANOTHER.

City of Montpelier vs. Barre & Montpelier Traction & Power Co. (Vt.), 56 Atl. Rep. 278. Nov. 25, 1903.

The defendant was granted the right to construct and operate a street railway over various streets of the city of Barre, conditioned that the fare for riding upon the lines of the company within the city limits should be five cents, and that the company should give transfer tickets to all of its own lines. The city of Montpelier granted to another corporation similar rights within its limits, subject to a similar condition. Subsequently the defendant acquired the rights and obligations of the other company, and the city of Montpelier granted to it the right to construct and operate a line of street railway which would connect the lines hereinbefore referred to. This last-named grant or franchise contained nothing such that by accepting and acting under it the defendant obligated itself to issue to its Montpelier patrons transfer tickets to its lines in the city of Barre, nor could the supreme court of Vermont find from the evidence taken that the defendant had in any other way become so obligated. It says that none of the rights or obligations of the defendant with respect to its road within the limits of Barre were either directly or indirectly derived from or imposed by the city of Montpelier. Neither the city of Montpelier nor its mayor nor the Montpelier patrons of the defendant's road can complain because the defendant requires of a person riding on its road within the limits of the city of Barre payment of the fare which that city permits it to charge.

REFUSAL OF CONDUCTOR TO RECEIVE MONEY MISTAKENLY BELIEVED TO BE COUNTERFEIT—LIABILITY OF COMPANY FOR TORTS OF EMPLOYES—RIGHT OF PASSENGER TO RESIST WRONGFUL EJECTION FROM CAR.

Breen vs. St. Louis Transit Co. (Mo. App.), 77 S. W. Rep. 78. Nov. 17, 1903.

A company is liable to answer in damages for the willful and malicious torts of its agents committed within the scope and course of their employment, but, the court of appeals at St. Louis, Mo., says, the honest expression of the opinion of a conductor of a car, or train of cars, that money offered to him in payment of a fare is counterfeit, and his refusal to accept it for that reason, is not a tort, though he be mistaken in his judgment of the money. The question of whether or not the company would be liable had verbal slander been charged and proven was not in the case.

To pay fare money was tendered in this case which the passenger believed was genuine and was all that he had with him, but which the conductor believed was spurious and refused to accept on that account. The court says that it is not the law that it was the passenger's duty to leave the car when he was told to do so by the conductor, in the circumstances proven in this case. The company was a public carrier of passengers for hire. The passenger was rightfully aboard its car, and had tendered and continued to tender lawful money to pay his fare, and he was at no time in the wrong, and unquestionably had the right to remain upon the car until he should arrive at his destination. Being in the right, and the conductor in error, he had a right to object, protest, and to reasonably resist his expulsion from the car, and forfeited none of his rights to recover damages by resisting, within lawful bounds, the wrong and indignity perpetrated upon him by the conductor in ejecting him from the car. It is not the law that one must submit to wrong, for fear that he will lose some of his rights. On the contrary, he may manfully assert his rights, and make all lawful efforts to maintain them.

MUTUAL CARE REQUIRED AT CROSSINGS—FAILURE TO GIVE SIGNAL OF APPROACH OF CAR UNIMPORTANT WHEN CAR IS SEEN—DUTY TO HAVE CAR UNDER CONTROL—STOPPING OF CAR NOT TO BE ASSUMED FROM ITS SLOWING UP.

Thompson vs. Metropolitan Street Railway Co. (N. Y. Sup.), 85 N. Y. Supp. 181. Dec. 11, 1903.

A man on reaching the space between two tracks at an intersection of streets looked in the direction from which a car was approaching on the farther track 8 or 10 feet from him. The car was approaching rapidly, but at this point it slowed up, and as it slowed up the man proceeded. The speed of the car was again increased, and just as the man was about to step upon the track he was struck by the side or front end of the car. It did not appear that he paid any attention to the car after it slowed up. The first appellate division of the supreme court of New York is of the opinion that the record failed to establish the negligence of the defendant, or of the man's freedom from negligence, and holds that a judgment for the plaintiff and an order denying a motion for a new trial must be reversed, and a new trial ordered. It says that whether or not a signal of the approach of the car was given was of no importance, because the evidence was conclusive upon the point that the man saw the car. He

"looked at the car," and must have known that it was approaching, because it was then only 8 or 10 feet from him. Nor was there any force in the suggestion, the court says, that he had a right to assume, because the car had commenced to slow up, that it would be so controlled that he could cross the street in safety. It was the duty of the motorman as the car approached the crossing to have it under reasonable control. But this did not give the man the right to assume that it would come to a stop, or that its speed would be so controlled as to give him time to pass over the tracks without being injured. He had no more right to indulge in this assumption, under the facts set out in the record, than the motorman had to indulge in the assumption that he would keep out of the way of the car. The man, of course, was as much obligated to look out for his own safety as the defendant was to prevent his being injured. The obligation resting upon each was mutual in this respect. Both had an equal right to the use of the street at this point, and while it was the duty of the defendant to move its car with care, to the end that the man would not be injured, he was also required to exercise the same care to prevent being injured.

PREREQUISITES TO CHARGING MORE ON CARS THAN TICKETS ARE SOLD FOR.

Kennedy vs. Birmingham Railway, Light & Power Co. (Ala.), 35 So. Rep. 108. July 10, 1903.

All the cases agree, the supreme court of Alabama says, that carriers of passengers may require persons to purchase tickets before taking passage on their cars, and to this end may adopt a rule or regulation establishing a higher rate to be paid the conductor than the rate charged for a ticket. But to justify a discrimination in the rate, the carrier must provide the proper facility and accommodation for so purchasing the ticket. If the carrier fails to give the passenger a convenient and accessible place and an opportunity to buy his ticket before entering the car, the regulation is unreasonable and void, and is no defense to an action brought by the passenger for his ejection by the conductor after he has paid the ticket rate.

In this case, the plaintiff boarded a car at or near an intersection of streets, which the conductor designated as a flag station, where the company had no depot or agent or tickets for sale. The court does not think that he should have been required to go 2½ blocks to purchase a ticket before boarding the car there, in order to have the benefit of the ticket rate. It says that if the company desires to enforce the rule or regulation at all points along its line where it receives passengers for transportation, it should have tickets on sale at those points. The keeping them on sale at one station will not justify its discrimination against passengers who take passage at other and different stations.

DAMAGES WHICH ARE NOT RECOVERABLE FOR BREACH OF CONTRACT TO RUN CARS.

Eckington & Soldiers' Home Railway Co. vs. McDevitt (U. S.), 24 Sup. Ct. Rep. 36. Nov. 16, 1903.

Assuming that the railway company might have lawfully bound itself to construct and operate the piece of road in question, the supreme court of the United States says that the question was presented as to what compensation in damages the owner of a tract of land with whom such contract was alleged to have been made and who had granted a right of way would be entitled if the company found that the traffic did not justify its further maintenance, and ceased to run its cars, or if the public interests required such changes of the lines of the road as rendered the abandonment necessary. The contract referred to did not purport to bind the company to operate its cars over the extension or piece of road in question for any designated period, but, considering its terms in relation to the right of way, the trial court held that it was bound in perpetuity, and thereupon that if it ceased to do this in whole or in part at any time, the landowner could order the tracks off her premises, and recover the difference between the value of her land with the cars running and with the expectation that they would continue always to run, and the value without the operation of the cars and with no expectation that they would run in the future. The supreme court holds that the instruction to this effect [illegible], treating the contract as a simple contract, and the refusal to run the cars as a breach which the landowner could accept as finally determining it, the court says it thinks she could not recover for deprivation of the speculative gains of a remote future. What might have been made by selling the land at a value enhanced by the operation of the tracks in perpetuity was purely problematical and not naturally in contemplation. And the more so in view of the fact that railroad companies, while private corporations, are quasi-public agencies, engaged in the performance of public duties, and that contracts which prevent them from the discharge of those duties cannot be sustained. It did not follow that the company, because it possessed the power to construct and operate this extension, could contract to operate it forever in so absolute a sense that damages could be awarded for the breach of such a contract, predicated on the expectation of its perpetual operation. Moreover, the court is inclined to think that the bearing that the landowner's demand that the tracks be removed, and the accepted and complete surrender of the right of way by their removal accordingly, might have had, under all the circumstances, on the question of prospective damages, should not have been excluded from the jury.

USE OF LOOSE-TONGUE SWITCH—APPROVAL BY CITY ENGINEER NO DEFENSE.

Birmingham Traction Co. vs. Reville (Ala.), 34 So. Rep. 981. Feb. 28, 1903. Rehearing denied July 6, 1903.

It may be, the supreme court of Alabama says, that the use of a "loose-tongue" switch on electric street railways, without a spring or other appliance to hold it in a desired position, is common and usual with well-regulated roads of that class, and that ordinarily the use of such a switch without such a spring or other appliance in the track of such roads does not constitute a defect in the condition of such track; but when a loose-tongue switch is so put into a track, or is put in at such place and for such use, that it is likely to cause derailment of cars attempting to pass, unless it is provided with a spring or other proper appliance to hold the tongue out of the way of wheels not intended to take the switch, and no spring is attached and no appliance is provided, or, if an appliance is provided, it is not adapted to and does not accomplish the purpose for which it is provided, the presence, structure, and use of such a switch without a spring or other proper appliance does constitute a defect in the ways of the company. Moreover, the court holds that if the switch here in question was defectively constructed, the fact that the city engineer thought otherwise, and approved it as being properly constructed, would be no defense to an action for damages for injuries to a conductor from a derailment on account thereof.

WHEN TRACTION COMPANY A TRUNK RAILWAY—CHARTER AND NOT MOTIVE POWER DETERMINES CHARACTER OF COMPANY—TRUNK RAILWAY DEFINED.

Diebold vs. Kentucky Traction Co. (Ky.), 77 S. W. Rep. 674. Dec. 17, 1903.

A traction company that is a railroad corporation organized under the general statutes of Kentucky having power and authority, under its charter, to construct and operate an electric line from Louisville, Ky., to Nashville, Tenn., and to be a common carrier of both passengers and freight, when in operation, the court of appeals of Kentucky holds is a trunk railway under section 164 of the constitution of that state, which requires that all franchises included within its language be sold to the highest bidder, but is not to apply to a trunk railway. It is said that whether a railway is a street railway or a trunk railway, it will not be contended, it is apprehended, depends on the motor power employed by it in propelling its rolling stock over and along its tracks. It certainly can make no difference whether the cars of a railroad company are propelled by the agency of steam, or of gasoline, or of electricity, compressed air, liquified air, or any other agency which science and the inventive genius of man may in the future bring into use. Rather the character of a railroad company is determined by the nature and extent and limits put upon its operation by law or otherwise, and by the character and object of its corporate creation as shown by its charter. Again, it is said that it seems to the court that it is the charter of a company which places it in the class to which it belongs, whether

street railway or trunk railway, and not the character of the motive power which it employs. It is believed that the following is the correct definition of the phrase "trunk railway": "A trunk railway is a commercial railway, whose main line, whether operated by steam, electricity, or any other motive power, connects towns, cities, counties, or other points within the state or in different states, and which railroad company, under its charter, or under the general law, has the legal capacity of constructing, purchasing, and operating branch lines or feeders connecting with its main stem or trunk, the main or trunk line bearing the same relation to its branches that the trunk of a tree bears to its branches or the main stream of a river bears to its tributaries." Under section 842a of the Kentucky Statutes of 1903 it is provided that an interurban electric railroad company, in order to be under the same responsibilities, and to have the same rights, powers, and privileges as railroad corporations existing under the laws of this commonwealth, must, under its charter, be authorized to construct a railroad 10 or more miles in length. The statutory requisite must, of necessity, be incorporated into the above definition of a trunk railway when applied to interurban electric railroad companies in this state.

LIABILITY FOR INJURY SUSTAINED BY PASSENGER IN ALIGHTING—DOCTRINE OF ASSUMPTION OF RISK NOT PERTINENT—CONTRIBUTORY NEGLIGENCE A GOOD DEFENSE—WHEN DUTY OF EXTRAORDINARY CARE BEGINS AND ENDS.

Fillingham vs. St. Louis Transit Co. (Mo. App.), 77 S. W. Rep. 314. Nov. 17, 1903. Rehearing denied Dec. 1, 1903.

The plaintiff, in alighting from a car which was run beyond the station platform and where the ground was three or four feet below the running board and rough, was injured. The court of appeals at St. Louis, Mo., after discussing somewhat the nature of the doctrine of the assumption of risk, says it fails to discern how it could be pertinent. It says that the word "assumption" imports a contract or some kindred act of an unconstrained will. That Mrs. Fillingham's agreement with the defendant for carriage contemplated and covered the risk of alighting at such a place as she did, would not bear argument; neither would the contention that, because she made no demand to have the car returned to the platform, she took to herself the risk incident to getting off at the point selected for her by the car operators. She was justified in relying to some extent on their judgment and skill; and, though she might do so in circumstances that would debar her from recovering damages, it would be on the score of contributory negligence.

But in considering the relevancy of the doctrine of assumption of risk to this case it must be remembered above all that the law forbids a carrier to contract against the consequences of any negligence it may be guilty of in conveying passengers. Hence, if the injury to the plaintiff occurred from the carmen's inattention to duty, the defendant would be liable even if she had assumed the risk of injury in alighting by an express agreement. On the other hand, if the accident did not arise from the fault of the employes, but was either purely fortuitous or caused or contributed to by the plaintiff's own carelessness, the defendant, as suggested above, was exonerated from responsibility by legal rules entirely distinct from the doctrine of assumption of risk, namely, by the rule that a defendant is not answerable for an accident unless caused by his tort, or if the plaintiff's own negligence was an active cause. As the plaintiff was full of mental and physical competency, if the car was stopped at her command, in order that she might get off, and she had suffered an injury in getting off, possibly it could be argued that she assumed the risk by an implied contract, or according to the maxim "Volenti non fit injuria" (an injury is not done to the willing); but on such facts it might be argued with equal cogency that the carmen were innocent of negligence.

The contract between a carrier and passenger, the court further states, continues not only during the interval of time consumed in transporting the passenger from his starting point to destination, but during the period needed for a safe exit from the vehicle. The degree of care required of the carrier for a passenger's safety while he is leaving the vehicle is as high as that required while he is in transit; that is to say, the extraordinary care imposed by the law on carriers of passengers begins when the contract of carriage takes effect on the rights of the parties, and continues unimpaired until that contract ends with deposit at destination; thus protecting passengers as they get on and off conveyances. Part of this duty to safeguard passengers while leaving a car or other vehicle consists in taking care to put them off at a reasonably safe place. This rule is to be distinguished from the one holding a carrier only for lack of ordinary dilligence in respect to platforms and approaches in actions for injuries resulting before the relation of carrier and passenger began or after it ended.

CARE REQUIRED OF CARRIER AND OF PASSENGER PROPORTIONATE TO DANGEROUSNESS OF PLACE OCCUPIED BY LATTER—RISKS ASSUMED BY PASSENGER—RISK OF CARRIER'S NEGLIGENCE NEVER ASSUMED—CONTRIBUTORY NEGLIGENCE.

Parks vs. St. Louis & Suburban Railway Co. (Mo.), 77 S. W. Rep. 70. Nov. 25, 1903.

Traveling on a street car in a great city, the supreme court of Missouri, division No. 1, says, is always attended with danger, whatsoever position in or on the car the passenger may assume. But if it is a position that the carrier offers to the passenger, or a position which the carrier assents to his taking, and knowingly assumes to carry him in that position, then it becomes the duty of the carrier to carry him safely in that position, if it can be done by the exercise of that high degree of care which the law requires the carrier to observe for the safety of its passengers. The degree of care to be observed by the carrier in such case must be in proportion to the danger which the passenger's position entails. The more dangerous the position, the greater the care the carrier is bound to observe. And at the same time the law imposes on the passenger in like case the duty of observing for his own safety the care that a man of ordinary prudence under like circumstances would observe, and that care, too, must be in proportion to the apparent danger. The more dangerous the position, the more care a prudent man would be expected to observe.

It is the duty of a carrier who has undertaken to carry a passenger in such a position to carry him safely, if it can be done by the exercise of the degree of care above mentioned; and it is correspondingly the duty of the passenger, after he has taken that position, to observe such care for his own protection as an ordinarily prudent man in a like position under like conditions would naturally be expected to observe. Under those circumstances, if the passenger is injured from a cause arising out of or incident to the position itself, without failure of duty on the carrier's part, the carrier is not liable. And though in such case the carrier fail to perform its duty, and that failure results in the accident, still, if the passenger fails also in his duty as above defined, and his failure contributes to bring about the result, he cannot recover. But in judging the conduct of both carrier and passenger we must look only to conduct after the passenger has assumed the position, not charging the position itself to either as an act of negligence, but requiring both to keep in mind the peril incident to the position, and regulate their conduct in reference thereto.

Again, the court says that the passenger never assumes the risk of the carrier's negligence. There is always a risk of personal injury to a person traveling, even if there be no negligence either on his own part or on the part of the carrier. That risk is incident to the act of traveling, and is greater or less according to the circumstances and conditions. That risk the passenger assumes. But if to the danger incident to the act of traveling under the circumstances and conditions of the particular case is added a danger caused by the negligence of the carrier, the passenger does not assume the risk of those combined dangers. If the catastrophe in question did not result from the danger incident to the act of traveling under the given circumstances and conditions, but resulted because to that danger was added the consequence of the negligent act of the carrier, there was no such assumption of risk as would relieve the carrier from liability. Assumption of risk is one thing, and contributory negligence is another.

The new superintendent of the York County Traction Co. and the York (Pa.) Street Railway Co., Mr. S. M. Manifold, has abolished the system of having cars wait in Center square and elsewhere to make connections and each car now runs on its own schedule and need not wait when other cars are late. The old arrangement caused annoying delays.

Financial.

March 28th the Binghamton (N. Y.) Railway Co. declared a 2 per cent dividend, payable April 11th.

A mortgage has been filed by the Kanawha Valley Traction Co., of Charleston, W. Va., for $250,000, in favor of the Citizens' Savings & Trust Co., of Cleveland, to secure a 5 per cent bond issue of like amount.

The receiver of the Atlantic Coast Electric Railroad Co., of Asbury Park, N. J., reported that for the year ending Jan. 31, 1904, the receipts of the road amounted to $309,521; disbursements, $302,064; balance, $47,456.

The gross earnings of the North Shore Railroad Co., of San Francisco, Cal., for January, 1904, showed an increase of about $6,000, but the net earnings decreased nearly $11,000, the company showing a net deficit for the month in excess of $24,000, an increase of $13,500 over the deficit for the corresponding month last year.

Of the total issue of $7,500,000 bonds of the Northern Ohio Traction & Light Co., only $5,750,000 are outstanding.

The passenger earnings of the Northern Texas Traction Co., of Fort Worth, Tex., for March amounted to $44,052, a gain of more than 25 per cent over the corresponding period last year. The best month the road ever had was October, 1903, when the gross earnings were $47,000. The company has additional earnings from package freight, express and mail carriage, and from the sale of light and power.

The United Traction Co., of Albany, N. Y., has issued new mortgage bonds amounting to $6,500,000, the mortgage being executed in favor of the Central Trust Co. To take up present bonds at maturity $4,421,000 will be reserved. About $900,000 will be used to pay for property already acquired, and the rest will be issued as extensions and improvements require.

SOUTH SIDE ELEVATED R. R. CO.

The stockholders of the South Side Elevated Railroad Co., of Chicago, held a special meeting April 7th and voted to increase the capital from $10,323,800 to $17,550,500, to pay for extensions and a third track which the company proposes to build for express service. The extensions proposed consist of 3.8 miles of single track and 6.8 miles of double track. Foundations for the third track are already in. The extensions will include lines to the Stock Yards and packing house district, to 42nd St., near Lake Michigan; to Englewood, westward to a point between Center and Ashland Aves.; to Englewood, southward to a point between 68th and 72nd Sts. The third track will be built from 12th to 43d Sts. The company will issue $7,226,600 of new stock, which will give seven [illegible] for each 10 shares outstanding.

METROPOLITAN WEST SIDE ELEVATED.

The annual report of the Metropolitan West Side Elevated Railroad Co., for the fiscal year ending Feb. 29, 1904, was submitted to the stockholders at the annual meeting held April 4th. The statement of income account shows that the passenger earnings were $2,065,701; miscellaneous earnings, $87,453; total earnings, $2,147,154; operating expenses, $1,042,338; net earnings from operation, $1,104,816; other income, $6,031; net income, $1,110,847; charges, $853,395; other deductions, $41,351; surplus for year, $216,101; add surplus from previous year, $10,856, making total surplus Feb. 29, 1904, [illegible].

The general balance sheet shows assets amounting to $30,109,409, including cost of road and equipment $29,249,758. The liabilities include $9,000,000 preferred capital stock, and $7,500,000 common stock, $10,000,000 first mortgage 4 per cent bonds, and $3,000,000 extension 4 per cent.

The report of the president, Mr. D. MacAllister, shows the number of passengers carried during the year to have been 41,372,338 against 39,548,354 the previous year, an increase of 1,823,984, or 4.6 per cent. The mileage operated and the equipment remain the same as the previous year. A new coal handling plant has been constructed at 40th Ave. on the Garfield Park line. Progress was reported on the new terminal station at Fifth Ave., between Van Buren St. and Jackson Boulevard, but this work has been retarded because of inability to get possession of the property on Franklin St., and also because of the delay in getting material. The improvement will be completed during the summer, however.

The report also states that the traffic delivered to the company by the Aurora, Elgin & Chicago Railway Co. has shown a satisfactory increase during the year, partly due to that company having put in operation last May a branch line from Wheaton to Elgin. The operating expenses, as shown by the report, were comparatively high, owing to the increased cost of supplies, fuel and labor. In view of improvements made and contemplated, and in view of the present general financial conditions, which would forbid the sale of bonds on adequate terms, the directors deemed it advisable to pass the dividend this year.

UNITED RAILWAYS CO. OF ST. LOUIS.

The annual report of the United Railways Co. of St. Louis for the year ended Dec. 31, 1903, shows that the total payment of dividends amounted to $852,203, of which $264,428 was paid to the St. Louis Transit Co. on stock owned by it. The income account shows a balance of $220,041. The assets of the company amount to $104,233,044, which includes $77,952,303 total property and plant. The total amount of reserved securities is $25,051,400. The total capital stock of the company amounts to $45,000,000; total bonded indebtedness, $58,688,000. The rental of the St. Louis Transit Co. amounts to $872,701. The total net expenditure for construction, equipment, betterments and improvements for the year was $1,868,931. The total net construction and equipment expenses from the organization of the company to and including Dec. 31, 1903, amounts to $11,069,722. The annual report of the St. Louis Transit Co. was published in part in the "Review" for March.

INDIANA UNION TRACTION CO.

The Indiana Union Traction Co., of Anderson, Ind., reported for 1903 as follows:

Gross earnings	$1,118,951
Operating expenses	620,136
Net earnings	498,815
Fixed charges	358,511
Net income	240,304

TOLEDO RAILWAYS & LIGHT CO.

The Toledo (O.) Railways & Light Co. reported for February as follows:

	1903.	1904.	Increase.
Gross earnings	$115,148	$124,037	$ 8,889
Operating expenses	61,115	71,952	10,837
Net earnings	54,033	52,085	*1,948
Fixed charges	39,564	41,590	2,026
Surplus	14,469	10,495	*3,974
Operating ratio	.5307	.5801	.0494

*Decrease.

The high water of the Maumee River flooded the company's power house so that on February 1st it practically had no service until evening, and during the first few days of the month it was impossible to maintain the regular schedule. This materially reduced the earnings and necessitated extra expense. The passenger earnings for the first 29 days of March amounted to $91,549, against $86,078 for the same period last year.

TWIN CITY RAPID TRANSIT CO.

The Twin City Rapid Transit Co., of Minneapolis, Minn., reported for February as follows:

		Increase.
Earnings from operation	$313,358	$30,758
Operating expenses	159,752	19,303
Net earnings	153,606	11,455
From January 1st		
Earnings from operation	644,770	50,332
Operating expenses	316,253	27,229
Net earnings	328,517	23,103

CHICAGO & MILWAUKEE ELECTRIC RY.

The comparative statement of the Chicago & Milwaukee Electric Railway Co. for March is as follows:

	1903	1904	Increase
Earnings from operation	$ 13,355	$ 22,839	$ 9,484
Operating expenses	6,317	10,093	3,776
Net earnings	7,038	12,746	5,708
For three months:			
Earnings from operation	$ 36,035	$ 59,873	$23,838
Operating expenses	18,705	31,489	12,784
Net earnings	17,330	28,384	11,054

SPRINGFIELD RAILWAY & LIGHT CO.

The Springfield (Ill.) Railway & Light Co. reported for February as follows:

	1903.	1904.	Increase
Gross earnings	$ 42,045	$ 46,713	$ 4,668
Operating expenses	26,376	31,250	4,874
Net earnings	15,669	15,463	*206
From January 1st			
Gross earnings	$ 85,720	$ 98,926	$13,206
Operating expenses	53,864	65,290	11,426
Net earnings	31,856	33,636	1,780

*Decrease.

COLUMBUS, BUCKEYE LAKE & NEWARK.

Following is the comparative statement of the total receipts and expenditures of the Columbus, Buckeye Lake & Newark Traction Co. for February:

	1903	1904.	Increase.
Total receipts	$ 7,330	$ 9,407	$ 2,077
Total expenses	7,031	8,319	1,288
Balance	299	1,088	789
Statement for January:			
Total receipts	$ 8,716	$ 9,455	$ 739
Total expenses	7,490	8,886	1,396
Balance	1,226	569	*657

*Decrease.

UTICA & MOHAWK VALLEY RY.

The Utica (N. Y.) & Mohawk Valley Railway Co. reported for the quarter ending Dec. 31st as follows:

	1902	1903.	Increase.
Earnings from operation	$141,331	$170,340	$29,018
Operating expenses	94,114	113,350	19,156
Net earnings	47,137	56,999	9,862
Other income	679	1,006	327
Charges	37,099	40,589	3,490
Surplus	10,716	17,416	6,700

The assets of the company are $7,959,032, including cost of road and equipment, $5,404,381; capital, $2,500,000; funded debt, $2,700,000; loans and bills payable, $2,239,879; profit and loss surplus, $361,-666.

ELGIN, AURORA & SOUTHERN.

Following is the comparative statement of the Elgin, Aurora & Southern Traction Co., of Aurora, Ill., for February: .

	1903	1904.	Increase
Earnings from operation	$ 30,023	$ 33,132	$ 3,109
Operating expenses	18,918	21,999	3,081
Net earnings	11,105	11,132	27
Charges	9,216	9,133	*83
Net income	1,889	1,999	110
For eight months:			
Earnings from operation	$287,154	$310,087	$22,933
Operating expenses	165,929	184,339	18,410
Net earnings	121,225	125,748	4,523
Charges	72,730	73,507	777
Net income	48,495	52,240	3,745

*Decrease. Operating expenses include an accident appropriation equal to 2 per cent of gross receipts.

NORTHERN OHIO TRACTION & LIGHT.

The comparative statement of the Northern Ohio Traction & Light Co., of Akron, O., for February is as follows:

	1903	1904	Increase
Gross earnings, railway	$ 44,747	$ 46,479	$ 1,732
Gross earnings, light	9,954	10,405	451
Total gross earnings	54,701	56,884	2,183
Operating expenses, railway	28,907	30,419	1,512
Operating expenses, light	3,507	3,735	228
Total operating expenses	32,414	34,154	1,740
Net earnings	22,287	22,729	442
Fixed charges	21,226	22,667	1,441
Surplus for stock	1,061	63	*998

*Decrease. The passenger earnings for the first 29 days of March were $47,466, against 48,101 for the same period last year.

LAKE SHORE ELECTRIC RY

Following is the February statement of the Lake Shore Electric Railway Co., of Cleveland, O.:

	1903.	1904.	Increase.
Earnings from operation	$ 32,030	$ 32,140	$ 110
Operating expenses	26,251	36,908	657
Net earnings	5,778	*4,767	**10,545
Interest	20,370	20,404	34
Deficit	14,592	25,171	10,579

*Deficit. **Decrease.

The weather conditions were such during February that a large mileage of the system was practically inoperative for some time.

MONTREAL STREET RAILWAY CO.

The comparative statement of earnings of the Montreal Street Railway Co. for February follows:

	1903	1904.	Increase.
Passenger earnings	$139,065	$167,023	$27,958
Miscellaneous earnings	2,735	1,662	*1,073
Total earnings	141,800	168,685	26,885
Operating expenses	108,803	131,421	22,618
Net earnings	32,997	37,264	4,267
Fixed charges	15,716	16,940	1,224
Surplus	17,281	20,325	3,043
Operating ratio of car earnings	.7823	.7868	0045
October 1st to date:			
Passenger earnings	$831,256	$929,570	$98,314
Miscellaneous earnings	14,332	8,251	*6,082
Total earnings	845,589	937,822	92,233
Operating expenses	533,379	618,258	84,879
Net earnings	312,210	319,564	7,354
Fixed charges	81,706	85,788	4,082
Surplus	230,504	233,775	3,272
Operating ratio of car earnings	.6417	.6651	.0234

*Decrease. Interest on Montreal & Park Island Railway Co's. bonds not included.

INTERNATIONAL TRACTION CO.

Following is the income account of the International Traction Co., Buffalo, N. Y., for January:

	1903	1904.	Increase.
Gross earnings	$291,490	$296,970	$ 5,480
Operating expenses (ex. taxes)	166,051	201,389	35,338
Net earnings	125,440	95,581	*29,859
Fixed charges	129,195	136,703	7,508
Net income (deficit)	3,756	41,122	37,367
Net income July 1st to date	145,725	172,421	26,696
Operating ratio (ex. taxes)	.578	.687	.109
For month of February:			
Gross earnings	$272,067	$284,349	$12,282
Operating expenses (ex. taxes)	158,563	199,661	41,097
Net earnings	113,504	84,689	*28,815
Fixed charges	118,246	126,492	8,245
Net income (deficit)	4,743	41,803	37,060
Net income July 1st to date	140,982	130,618	*10,364
Operating ratio (ex. taxes)	.592	.712	.120

*Decrease.

DETROIT UNITED RY.

The Detroit (Mich.) United Ry. reported as follows for February:

	1903.	1904.	Increase.
Earnings from operation	$283,034	$284,056	$ 1,022
Expenses and taxes	177,106	205,028	28,822
Net earnings	105,928	79,028	*26,900
Other income	2,649	3,390	741
Total income	108,577	82,418	*26,159
Charges	81,048	89,788	8,740
Deficit	**27,529	7,370	34,899
From January 1st:			
Earnings from operation	$596,018	$592,586	*$ 3,432
Expenses and taxes	373,044	432,031	58,987
Net earnings	222,974	160,555	*62,419
Other income	10,810	7,201	*3,609
Total income	233,784	167,756	*66,028
Charges	162,205	177,354	15,149
Deficit	**71,579	9,598	81,177

*Decrease. **Surplus. The loss of the Detroit United for the first 21 days in March was $1,109, and of the Rapid Ry., $2,943. The Sandwich, Windsor & Amherstburg showed a gain of $1,056. The loss of the entire system for 21 days was $2,997.

CLEVELAND ELECTRIC RAILWAY CO.

Following is the comparative statement of earnings of the Cleveland Electric Railway Co. for the year ended December 31st:

	1902	1903.	Increase.
January	$321,407	$360,937	$39,529
February	290,474	328,088	37,614
March	337,937	373,214	35,276
April	332,433	380,172	47,739
May	372,179	415,746	43,566
June	364,574	403,854	39,279
July	390,848	405,408	14,559
August	393,640	404,062	10,421
September	374,883	385,758	10,875
October	382,356	385,022	2,666
November	369,312	355,822	*13,490
December	376,442	362,023	*14,419
First Quarter	$ 949,818	$1,062,240	$112,421
Second Quarter	1,069,188	1,199,773	130,584
Third Quarter	1,159,372	1,195,299	35,856
Fourth Quarter	1,128,111	1,102,868	*25,243
First Half	$2,019,006	$2,262,013	$243,006
Second Half	2,287,484	2,298,007	10,613
Total	$4,306,491	$4,560,111	$253,620
		1904.	Decrease
January		$332,090	$28,537
February		317,399	10,689

*Decrease. Officials of the company state that the company lost $200,000 through low fares and universal transfers since last summer.

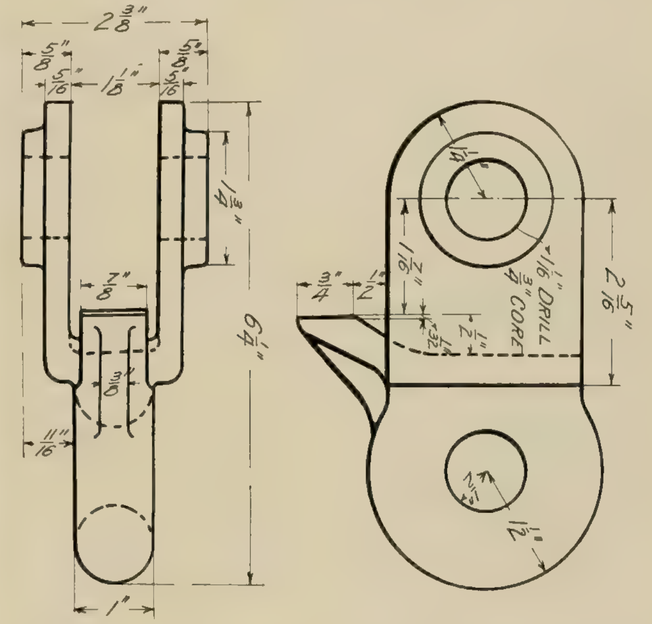
CINCINNATI, NEWPORT & COVINGTON.

Following is the condensed statement of the Cincinnati, Newport & Covington Light & Traction Co. for February:

	1903	1904	Increase.
Gross receipts	$ 86,263	$ 94,477	$ 8,214
Operating expenses	34,897	39,783	4,886
Damages, taxes, rents and tolls	16,346	16,578	232
Total expenses	51,243	56,361	5,118
Net earnings	35,020	38,116	3,096
Interest on bonds	20,917	20,917	......
Interest on temporary loans	79	38	*41
Total fixed charges	20,996	20,954	*41
Net profit	14,024	17,161	3,137
Operating ratio	.4044	.4210	.0166
Same inc. damages, taxes, etc.	.5940	.5965	.0025
From January 1st:			
Gross receipts	$180,475	$193,797	$13,322
Operating expenses	75,995	82,776	6,781
Damages, taxes, rents and tolls	33,186	33,484	298
Total expenses	109,180	116,260	7,080
Net earnings	71,294	77,537	6,243
Interest on bonds	41,833	41,833	......
Interest on temporary loans	148	533	385
Total fixed charges	41,981	42,366	385
Net profit	29,313	35,171	5,858
Operating ratio	.4210	.4271	.0061
Same inc. damages, taxes, etc.	.6049	.5999	*.0050

Clevis for Brake Rigging.

The accompanying engraving illustrates an improved form of clevis, designed by Mr. W. O. Mundy, master mechanic of the St. Louis Transit Co. and used on the cars of that company. The improvement consists in the addition of the lug shown at the bottom of the elevation. When the brake chain is slack this lug rests against the



lever and prevents the clevis and attached chain from falling against the motor. When stress is put on the chain the pull is in a direction to throw the lug out of contact with the beam so that it does not interfere with the action of the brake.

Women Charged With Swindling Companies.

March 31st three women were arrested in New York at the instigation of the Interborough Rapid Transit Co. and the Public Service Corporation of New Jersey, one being charged with swindling the companies, another with being an accomplice and the third being held as a witness. It is thought that the principal is connected with a band of men who have been swindling the railroads for a long time. One of the women claimed to be an actress; the others are colored, one being a nurse. In two instances the companies had paid money to the women, who pretended to have been injured in collisions. If the principal was out when the company's physician called, the accomplice posed as the injured woman. On one occasion the nurse had corroborated the pretended sick woman's story of the collision in question. The principal and her accomplice were each held in $1,000 bonds for appearance before a higher court.

The office building of the Jersey City, Hoboken & Paterson Street Railway Co., at Hoboken, N. J., will be torn down to make way for a new station to enclose the entrance of one of the lateral tunnels which will connect with the New York & Jersey Railroad Co's. tunnel under the Hudson River to Christopher and Hudson Streets, New York City. It is the plan to bring the entire trolley service in the northern part of Hudson County, N. J., directly into the tunnel at a central point.

Personal.

MR. EDWIN W. RICE, JR., has been elected a director of the General Electric Co. to succeed the late William C. Whitney.

MR. E. L. FULLER, general manager of the New York & Queens County Railway Co., has been elected vice-president of the company.

MR. HENRY FRESH, president of the Emergency Car Brake Co., of Cumberland, Md., was a recent caller at the "Review" office.

MR. WILLIAM L. SAUNDERS has been elected president of the Ingersoll-Sergeant Drill Co., of New York City, to succeed Hon William R. Grace, deceased.

MR. ALEXANDER GORDON has been appointed superintendent of the Richmond (Ind.) Street & Interurban Railway Co., vice Mr. C. A. Denman, who resigned April 4th.

MR. MALCOLM C. LUDLAM has resigned as general manager of the Camden, Gloucester & Woodbury Railway Co., of Gloucester, N. J., to go to Newark. He was with the Gloucester company four years.

MR. C. T. MURDOCK has been appointed superintendent of the Terre Haute Electric Co's. railway and lighting plant at Brazil, Ind. He was formerly electrician for the street railway company at Terre Haute.

MR. J. W. M'COYL has been appointed roadmaster of the Evansville & Princeton Traction Co. He was formerly in the employ of the Illinois Central Railroad Co., and before that was connected with the Southern Ry.

MR. FRANK M. LAY, of Kewanee, Ill., has been elected secretary of the Galesburg & Kewanee Electric Ry., and has also been admitted to the directorate of the company. Mr. S. E. Robb has retired as a director and officer of the company.

MR. EDWARD B. STOWELL has been appointed superintendent of the Rockford, Beloit & Janesville Railroad Co., with headquarters at Beloit, Wis., to succeed Mr. W. Nutt, resigned. Mr. Stowell was formerly located at Rockford, Ill., in charge of the construction department of the company.

MR. J. J. O'BRIEN, who for more than 14 years has been in the auditing, accounting and financial departments of the Chicago office of the General Electric Co., for the last few years as cashier and chief clerk, has resigned to become general auditor for the engineering firm of H. M. Byllesby & Co., Chicago.

MR. H. A. WALDRON has been appointed assistant superintendent of the Danville, Urbana & Champaign Railway Co., vice Mr. E. I. Klem, who has been transferred to the Springfield division of the Illinois Central Traction Co. Mr. Waldron was formerly assistant superintendent of the Chicago & Joliet Electric Railway Co.

MR. C. A. DENMAN has resigned as superintendent of the Richmond (Ind.) Street & Interurban Railway Co., to which position he was appointed last summer. He was formerly general manager of the Toledo, Bowling Green & Southern Traction Co.; also of the Toledo & Maumee Valley Railway Co. and the Toledo, Waterville & Southern Ry.

MR. C. C. STARR has been appointed representative in the Maritime Provinces of the Canadian Westinghouse Co., Limited, of Hamilton, Ont. His headquarters are at 134 Granville St., Halifax, N. S. The Maritime Provinces are included in the district covered by the company's Montreal office and Mr. Starr will consequently be considered an attache of that office.

MR. GEORGE M. HOADLEY, who has been connected with the Bemis Car Truck Co. more than 20 years, has entered the employ of the Peckham Manufacturing Co., as salesman, and has been assigned the entire southern territory. Besides being thoroughly familiar with every detail of the truck business, Mr. Hoadley has a very wide and influential acquaintance.

MR. JOHN A. NESTER has been appointed general superintendent of the Cleveland & Southwestern Traction Co., vice Mr. E. W. Coe, resigned. The appointment became effective April 1st. Mr. Nester has heretofore been the company's agent at Norwalk, O., and was also manager of the electric light and gas plants of that city. Formerly he was connected with the Wheeling & Lake Erie R. R. His headquarters are at Elyria, O.

MR. BENJAMIN S. HANCHETT has been appointed general manager of the Grand Rapids Railway Co., to succeed Mr. G. Stewart Johnson, deceased. In 1883 Mr. Hanchett entered the employ of the Street Railway Co. of Grand Rapids as office boy. In 1888 he became chief clerk and was soon advanced to paymaster. Next he was appointed secretary of the old horse car system and when the Valley City Street & Cable Co. purchased the street car lines he was made secretary and assistant treasurer of the consolidated system. In 1900 the present company purchased the system and Mr. Hanchett became secretary and treasurer of the company.

CAPT. ALEXANDER R. PIPER has been appointed general superintendent of the American Railway Traffic Co., a constituent company of the Brooklyn Rapid Transit Co., which was organized for the purpose of transporting freight over the Brooklyn trolley lines. Captain Piper was formerly second deputy police commissioner of New York City and previous to that was superintendent of final disposition in the New York street department.

MR. MATHEW C. BRUSH, who was last summer appointed assistant to the president of the Boston Suburban Electric Companies, has been appointed general manager of the following companies which are controlled by the Boston Suburban Electric Companies: Newton Street Railway Co., Newton & Boston Street Railway Co., Lexington & Boston Street Railway Co., Wellesley & Boston Street Railway Co., Commonwealth Ave. Street Railway Co., Westboro & Hopkinton Street Railway Co., and the Norumbega Park Co. Mr. Brush will also have charge of purchasing supplies for these companies.

MR. R. C. ARNOLD, secretary and treasurer of the Arnold Electric Power Station Co., of Chicago, was married April 5th to Miss Hazel McLane, daughter of Mr. George A. McLane, of New York City. After a short trip east, Mr. and Mrs. Arnold are to return to Chicago, and for the summer will take up their residence in Lake Bluff. Mr. Arnold has for several years been connected with the Arnold company, of which his brother, Mr. Bion J. Arnold, is president, and has formed a very wide acquaintance among the electrical and mechanical interests of the East and middle West, who extend to him their heartiest congratulations on this occasion.

MR. ARTHUR WARREN has been appointed manager of the Department of Publicity of the Allis-Chalmers Co., with headquarters at Milwaukee, Wis. Mr. Warren was formerly in charge of the Westinghouse Companies' publication department, which he organized. He was born in Boston, Mass. Mr. Warren joined the staff of the Boston Herald in 1883 as a special writer and critic and in 1888 went to London, Eng., as the Herald's special correspondent, where he remained nine years. His reputation as a foreign correspondent of high ability is world-wide. He is also an author of note. In 1897 Mr. Warren returned to America at the request of Mr. George Westinghouse and organized the Westinghouse Publication Bureau. Coincident with his connection with the Boston Herald, he was assistant editor of the Beacon, a Boston weekly, and from 1886 to 1888 was editor of the Boston Home Journal.

MR. B. H. WARREN, formerly second vice-president of the Westinghouse Electric & Manufacturing Co., has been elected president of the Allis-Chalmers Co., of Chicago, to succeed Mr. Charles Allis, resigned. Mr. Warren was born in Boston, Mass. He graduated in the engineer corps at the United States Naval Academy in 1874 and was in active service in the United States Navy until 1878. From 1878 to 1890 he was connected with the Hancock Inspirator Co., of Boston, two years as mechanical engineer, four years as London manager and six years as superintendent. From 1890 to 1895 Mr. Warren was manager of the hoisting machinery and pulley block department of the Yale & Towne Manufacturing Co., Stamford, Conn. When the business of that department was sold he went with the Pratt & Whitney Co., of Hartford, Conn., as temporary assistant secretary and treasurer. From 1896 to 1902 Mr. Warren was associated with the Westinghouse Electric & Manufacturing Co., for 10 months as assistant general manager in charge of manufacturing, and then as second vice-president of the company. Mr. Warren is a member and an ex-vice-president of the American Society of Mechanical Engineers; a member of the Society of Naval Architects and Marine Engineers; a member of the Society of Naval Engineers; a member of the University Club, of New York, and also of the Engineers' Club. Mr. Warren's headquarters will be at No. 71 Broadway, New York City, in the Empire Building.

As a result of the protest made against the near-side ordinance the New York board of aldermen passed a resolution repealing this provision of the "rules of the road" April 13th.

Obituary.

Hon. William R. Grace, president of the Ingersoll Sergeant Drill Co., of New York City, died recently, and at a meeting of the company's directors, March 24th, a resolution was adopted conveying an expression of appreciation of deceased's qualities as official, counselor and friend.

Peckham Trucks.

The Peckham Manufacturing Co. has now upon the market a center bearing swing bolster maximum traction truck which embodies various improvements that are the result of investigations of the operation of maximum traction trucks in service. This truck, which is shown in the accompanying engravings, is known as the Peckham 14-D-5 and is designed for use under cars of from 30 ft. to 37 ft. in length over all, in city and suburban service.

Four hundred trucks of this type recently ordered by the Brooklyn Heights Railroad Co. have the following dimensions and weight: Wheel base, 4 ft. 6 in.; diameter of wheels, 30 or 33 in. drivers, 17 or 22 in. pilot; axles, 3¾ or 4 in. for drivers, 3¼ or 3½ in. for pilot wheels; weight without motors, 5,200 lb.; carrying capacity, 25,000 lb. per truck.

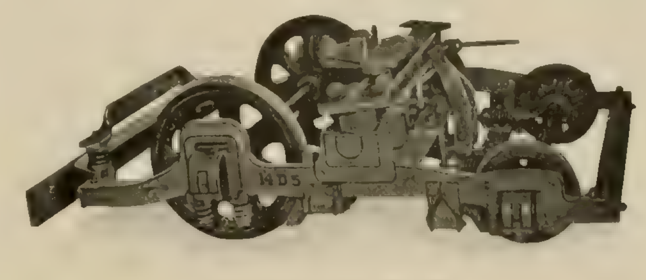
The principal features of construction to which especial attention is directed are:

The truck frame extends around the four sides of the truck. The angle bar and sections are machine fitted to the ends of the side frames and provided with braces at the inside corners of the ends, and at the center to keep the frame square and save undue wear on the wheel flanges and special track work.

The swing bolster which carries the car body is center bearing and is constructed upon the same principles as high speed steam railway passenger trucks. The bolster is supported upon springs (spiral and elliptical) that are in turn supported upon spring planks that are suspended by forged steel links from the transom bars. These link hangers allow the bolster to move endwise when rounding curves, and relieve the car body and wheel flanges from side thrust [illegible]. The bolster is located so near the center of the truck that sufficient weight is placed upon the small wheels to prevent them from climbing the track, without the use of auxiliary springs or other devices for this purpose.

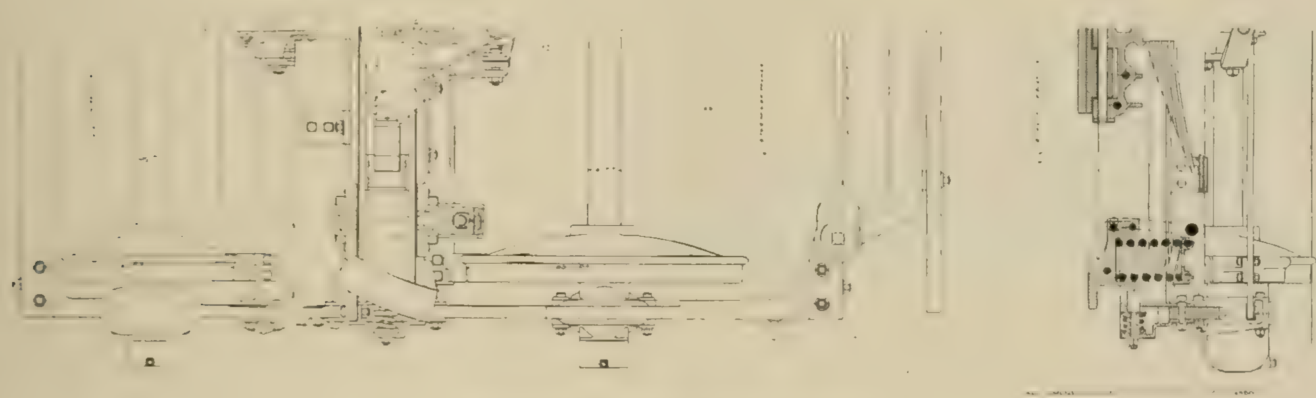
The brake mechanism is so arranged that the brake shoes are applied to the inner side of the wheel and that all four brake shoes are applied simultaneously, the pressure upon the large and small wheels being so graduated that each wheel receives pressure proportional to the weight carried. All four brake shoes can be adjusted at the same time by turning one bolt only.

All wearing parts are machine fitted, brake bolts machine turned and bolt holes reamed to an exact size to insure a tight fit of bolts. The pedestals are machined to size of journal boxes and provided with wearing strips. The journal box covers are machine fitted to render them dust tight and arranged for either self-lubricating wicks or wool waste as preferred. The driving wheels are provided with Taylor non-chattering brake hangers.



PECKHAM 14-D-5 TRUCK

The 14-D-5 truck is presented to the public as the only maximum traction truck having a center bearing swing bolster and with an all around frame, and that places enough weight on the small wheels without special devices being used.


HALF PLAN OF PECKHAM 14-D-5 TRUCK

Another of its trucks to which the Peckham company is directing special attention at this time is known as the No. 9 A, which is provided with a truss extension for open cars. The cantilever extension side frame is of double bars of low carbon steel fitted to the pedestals in machined grooves and fastened by hot-driven rivets. The side frame is supported from underneath by a cantilever truss extending from end to end of the top members; the portion of the truss beneath the journal boxes is divided into sections which are accurately machined to fit the sides of the pedestal jaws and secured by bolts, an arrangement which permits the axles to be removed easily.


PECKHAM 9 A TRUCK

[illegible] supporting the car body on the truck there are four elliptic springs which take nearly the entire weight when the car is empty, and helical springs (four in the standard truck and eight in the extra long type) which come into action as the load is increased. For preventing oscillation of the car body tension springs (under stress when the car body is empty) are placed under the end helical springs; these tension springs at one end act when one end of the car goes down suddenly, the resisting force being the weight of the truck frame and the motors which are hung from it.

The ordinary brake mechanism of this truck is for four brake shoes, but the truck can be arranged for the Peckham compound safety brake which has a leverage of 180 to 1 or for the Peckham auxiliary wheel or track brake. Another attachment added when ordered is the Peckham life and wheel guard. The guard is attached to the truck so it will not oscillate and closes the open space between the car fender and truss.

Crocker-Wheeler Co. Increases Capital.

A doubling of its capital stock, which has been $1,000,000, is announced by the Crocker-Wheeler Co., manufacturer and electrical engineers, of Ampere, N. J. The company was organized in 1892 by Dr. Schuyler Skaats Wheeler and Prof. Francis B. Crocker, on a relatively modest basis. It now has 15 branch offices from Boston to San Francisco and does one of the largest businesses in the world in electric power apparatus. The capitalization was several times increased until in 1899 it was made $1,000,000. In view of the rapidly expanding business the stockholders have now decided to increase this amount to $2,000,000.

Steel Fired Wheels for Electric Railways.

In response to numerous inquiries made by electric interurban railroad companies for a wrought iron plate steel-tired motor wheel with a removable tire, the Railway Steel-Spring Co., of 71 Broadway, New York, has placed on the market a wheel of this description, which is shown in the accompanying engraving Fig. 1.

The spoke type of wheel heretofore used to some extent is objected to on account of the large amount of the dust that it raises, the claim being made that a wheel of this type acts as a fan and draws the dust towards the motor, which results in rapidly worn out motor bearings. With a plate wheel there is no such trouble, and the saving in wear and tear on the motor is very considerable.

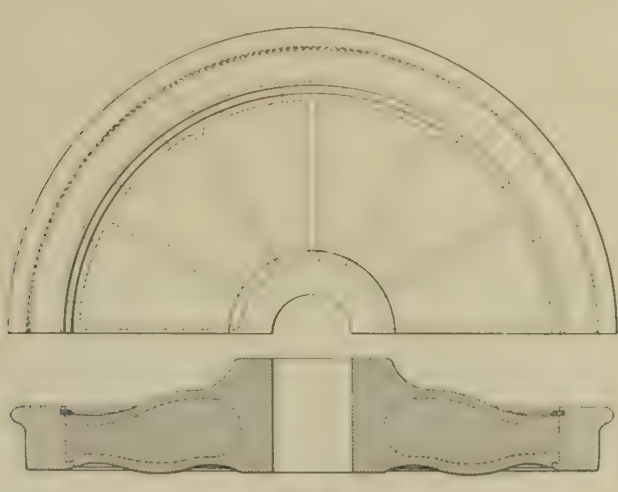


FIG. 1

The center of the wheel shown in Fig. 1 is made from a solid hammered forging, there being no welding whatever, and it is readily seen that this is one of the strongest types of wheel that can be made. With the facilities of a modern railroad shop, it is possible for the railroad company to renew the tires on these [illegible] at a small cost without removing them from the axles.

The plate wheel shown in Fig. 2, manufactured by the Railway Steel-Spring Co., has a cast iron center with the same tire section as shown in Fig. 1. The tires on these wheels can be renewed in the railroad company's shop by removing the retaining ring.

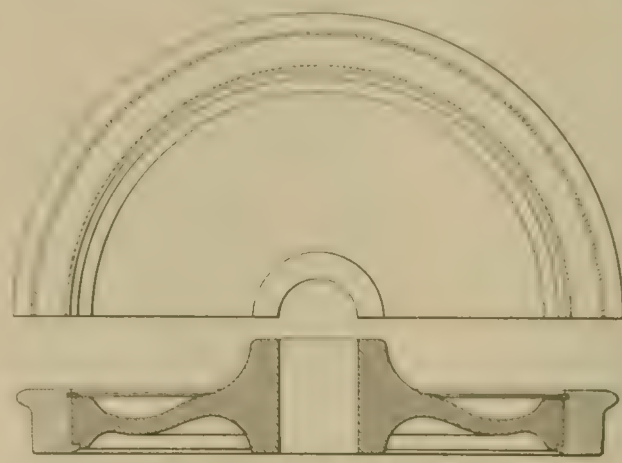


FIG. 2

heating the tire and drawing it towards the end of the axle. This is a method now practiced by various electric railroads.

The centers and tires are turned and bored to standard gages and are interchangeable. Tires can be procured from the makers finished, ready to apply to the centers. When adopting steel-tired wheels to take the place of chilled cast iron wheels, allowance should be made for the amount of the tire wear. Steel-tired wheels should be specified with a larger diameter, so as to allow for the turning of the tire on the thread and flange, in order that the diameter of the wheel itself will not be reduced, and made too small to meet the requirements of the railroad before the tire is worn out

In all cases where steel-tired wheels are used for electric interurban service, and especially where the cars are run into terminal cities, the manufacturers should know the service which the wheels will be called upon to perform, so that tires of special chemical composition can be furnished, and the mileage of the tire increased and the exacting requirements of the railroad fully met.

International Traction Co. Barn Burned.

The car barn and paint shop of the International Traction Co., of Buffalo, N. Y., located at Cold Springs, together with 38 cars, were destroyed by fire April 12th. The loss was variously estimated at from $100,000 to $200,000.

Strikes of the Month.

March 24th the conductors, motormen and power-house employes of the Camden Interstate Street Railway Co., of Huntington, W. Va., went out on strike because the company refused to reinstate a motorman and conductor who had been discharged. About 200 employes struck, tying up the entire system. April 1st the company began operating cars on all its lines with the aid of nonunion men.

April 2nd the conductors and motormen in the employ of the Cleveland & Southwestern Traction Co., of Cleveland, O., struck. The men demanded the resignation of the general manager, the rearrangement of schedules, the abolition of extreme penalties and the reinstatement of a former superintendent. April 5th the strike was declared off. The men withdrew their request for the dismissal of the manager and the other points in dispute were amicably adjusted.

The Citizens' Electric Railway Co's. car barns on Merrimac St., Newburyport, Mass., were burned March 28th, together with 28 cars and snow plows. The loss was placed at $60,000.

The "Photoscope" as an Attraction.

We illustrate herewith a photograph made by the "Photoscope" automatically. The "Photoscope" is a self-operating nickel-in-the-slot machine, which takes pictures continuously as fast as a person can pose in front of it. It is recommended to street railway managers as a money making device of especial value as a park attraction, or it may be profitably employed wherever the patrons of the road congregate. It delivers a perfect photograph, neatly framed, in less than one minute, and it will operate regardless of the weather, or make as perfect a likeness under an electric light as on a sunny day.

The simplicity of the "Photoscope" is a feature to which especial attention is called. Every movement of its parts is a rotary one, which insures the least friction and the least liability to get out of order. By removing the top of the cabinet the mechanism is entirely exposed to view and all parts are easily accessible. An obvious advantage which the "Photoscope" possesses over other nickel-in-the-slot machines is that its novelty is not likely to wear out, and, furthermore, it gives a permanent value for the nickel invested.

The capacity of the "Photoscope" is from six to eight exposures a minute, but as it takes some time to seat each person it has been found that three pictures a minute is a fair estimate for practical operation. During each exposure others which preceded are being developed and finished inside of the machine.

At a low estimate 70 per cent of those who purchase pictures desire them framed in brooches to wear on the coat or waist, and the company furnishes these brooches at prices which permit them to be sold as low as five cents apiece, although some cost more.

As an indication of the pecuniary merit of the "Photoscope" it is pointed out that taking an average of three pictures per minute for 10 hours (day and evening) the net profit will be $63.00, allowing $27.00 as the cost of the plates. If the five-cent brooches are sold with 70 per cent of the pictures the profit on the brooches will amount to $44.10, making the total net profits for the day $107.10.

Wherever the "Photoscope" is set up it always attracts a crowd. The Photoscope Co. has been granted the exclusive right to install and operate the "Photoscope" on the World's Fair grounds during the Exposition. The company's main offices are at 114 W. 32nd St., New York City. It has an office at 1001 Vandervенter St., St. Louis, Mo., and after the World's Fair opens will be found in the Liberal Arts Building.

Fireproofing for Electrical Cables.

The H. W. Johns-Manville Co., 100 William St., New York City, has devised an insulating covering for electrical cables for the purpose of fireproofing them, thereby preventing, in case of one cable becoming short circuited, the ignition of others in proximity to it. The new material was first used by the Niagara Falls Power Co., hence it is called "Niagrite." It is made in thicknesses of 3-32 in., 1/8 in., 1/4 in. and 3/8 in., and is supplied in strips 36 ft. long and 3 in. wide. Sufficient fireproof glue is sent with the strips with which to coat them ready for application.

"Niagrite" is bound spirally around the cable which is to be protected. It will dry out under ordinary conditions in about 24 hours, becoming very hard and, it is stated, absolutely fireproof. The application is easy and the expense nominal, compared with the protection afforded. The Niagara Falls Power Co. has given orders for about 1000 ft. of "Niagrite" and expects to order 5000 ft. more to complete the protection of the cables in the plant. The Falls Power Co., of Buffalo, N. Y., also uses it.

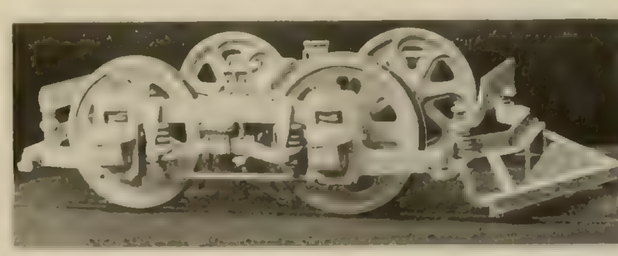
The Cincinnati Foundry & Forge Co. [illegible]

Brill Narragansett Car for Peru.

The J. G. Brill Co. has shipped the "Narragansett" type of car shown in the engraving to the Ferro Carril Electrico Lima y Callao through W. R. Grace & Co. of New York. Callao is a city of about 35,000 population half way down the coast of Peru, and is the port of Lima, the capital and chief city. The electric lines connect the two cities, between which there is a large amount of travel. The type of car is well known to our readers, but it may be mentioned as the photograph does not show it clearly, that instead of the lower flange of the Z-bar sills extending to form the upper steps, it is but three inches wide, and has between each pair of posts a malleable iron bolt step 7½ in. wide. The step heights are 17 in. from rail to running board, 13 in. from running board to sill step, and 7½ in. from sill step to floor. The posts have a deep setting in brackets through which they are bolted to the sills. The sweep is 5 in. From center to center of posts is 2 ft. 6 in., and between corner posts and first side posts, 3 ft. 5 in. From the center of corner posts over crown pieces is 4 ft.; length of the car over crown pieces, 40 ft. 4⅜ in. The corner posts are 3⅝ in. thick, and the side posts 2¾ in.; width over sills, 7 ft. 9½ in., and over posts at belt, 8 ft. 7½ in. The crossings are of white oak, 3¾ x 5⅞ in., substantially bracketed to the side sills and braced with diagonal crossings, 2¾ x 4½ in. Angle iron bumpers of the builder's patented make are bolted to heavy castings at the ends of the side sills, and arranged at the center to resist blows by a backing which transmits the force of contact to stringers secured to the body bolsters and

NARRAGANSETT CAR FOR PERU—J. G. BRILL CO.

terminating at braced crossings. Truss rods with king posts 5 ft. 9 in. apart strengthen construction. The running boards are divided at the center as the length of the car is too great for convenient handling in a single piece. Having 15 benches with capacity of five adult passengers to a bench, the total for the car is seventy-five. The curtains can be drawn to the floor as the seats are provided with round corner seat end panels. Among other patented specialties with which the car is equipped, are Brill sand boxes, radial



BRILL NO. 27-G-1 TRUCK.

draw bars, ratchet brake handles, platform and conductor gongs and gravity catches which hold the guards when raised. The car is mounted on Brill No. 27-G-1 trucks, with 4-foot wheel base, 33-in. wheels, 4¼ in. axles, and equipped with four 50 h. p. motors.

The Union Electric Co., of Dubuque, Ia., contemplates improvements to cost $200,000 this season.

The Brooklyn Rapid Transit Co. is constructing a new terminal station and train yard at Coney Island. The company expects to handle its car trains on a two-minute headway.

Portable Westinghouse Instruments.

A portable power factor meter has recently been put upon the market by the Westinghouse company, which consists of a single instrument and which operates with equal facility and accuracy on either a leading or lagging current. It also indicates whether the current leads or lags, whether power is delivered to or by the circuit, and the power factor. In addition to the inconvenience of the ordinary method of ascertaining the power factor of a poly-phase circuit by means of a comparison of the indicated volt-amperes, there is a great liability of error caused by the number of operations required to obtain the result. The new instrument illustrated herewith indicates directly upon a scale the power factor of the circuits showing the angle of phase difference and giving the actual power in percentage of the apparent power.

This instrument contains two sets of coils, one of which has a separate series winding for each of the phases in the circuit, and the

WESTINGHOUSE PORTABLE POWER FACTOR METER.

other a potential winding connected across one phase of the circuit. The series coils produce a resultant rotating field. An iron vane passing through the potential winding forms movable pole pieces for this winding. This takes a position in the rotating field depending upon the phase relation of the current producing this field and the impressed voltage of the potential winding. The pointer is attached to the shaft carrying the vane and indicates the angle between the current and the voltage. Should the power factor of the different phases differ from each other, the instrument indicates the average power factor. Different instruments are provided for two-phase and three-phase circuits.

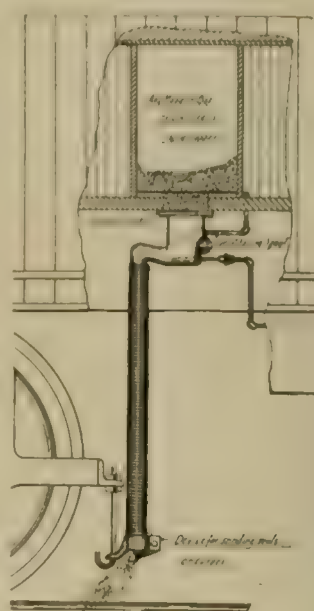
The portable series and voltage transformers made by the Westinghouse company are made to adapt the voltage of currents to be measured to the capacity of the measuring instrument to be used, so as to permit readings to be taken from the most legible portion of the scale of the instrument. The series transformer is made in two sizes, one of which is designed for primary currents up to 100 amperes, in which the ratio is changed by plugs as in the Wheatstone bridge. In the other type, which is designed for larger capacities, there is a circular opening through the transformer and the conductor is passed through this opening forming the primary. In this type the ratio is changed by the number of turns made by the conductor, passing it through the aperture once giving a ratio of 400 to 5, twice the ratio of 200 to 5, and four times the ratio of 100 to 5.

The voltage transformers are furnished in various capacities up to 750 volts primary, the standard secondary voltage at the maximum primary voltage being 150 volts. The terminals on the primary are arranged so that a number of primary voltages may be obtained, although they are not usually required in a great range of capacities as with the series transformers. All of these instruments are mounted in mahogany cases with carrying handles.

The last eight of the 105 new electric cars ordered by the Chicago Union Traction Co. some time ago were put into service April 4th.

New Air Sander.

The accompanying illustration shows the device for sanding rails by means of air which has has been perfected by the Ham Sand Box Co., of Troy, N. Y. The success of this company's sand boxes is considered to be due largely to the means for thoroughly ventilating them that are provided, thus preventing the dampening of the sand in the box by moisture following up the sand spout. In the air sander a shelf is provided in the upper part of the box which prevents the sand from packing in the bottom over the air jet, and underneath this shelf is an empty space from which a pipe extends up through the car floor. This pipe acts as a chimney or escape for any moisture and has been found to overcome one of the greatest troubles with air sanders.



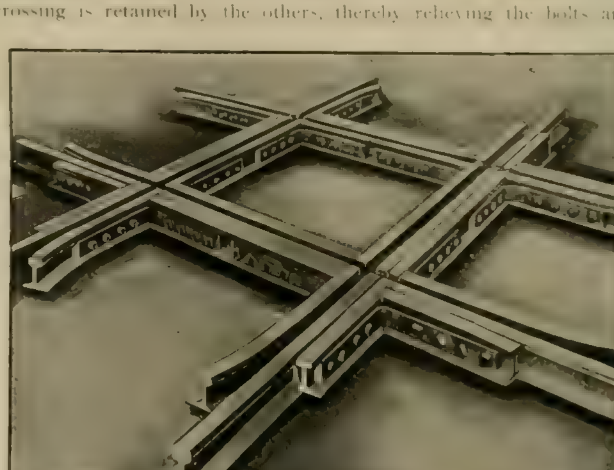
HAM AIR SANDER

The illustration also shows the Ham company's device for sanding the rails on curves.

The Stuart-Howland Co. is Boston agent for the sand boxes and other specialties of the Ham Sand Box Co.

"Self-Contained" Crossings.

The accompanying illustration shows a "self-contained" crossing, built by the Indianapolis Switch & Frog Co., which is especially designed to meet the requirements of heavy traffic for steam and interurban lines. It is constructed so that each section of the crossing is retained by the others, thereby relieving the bolts and



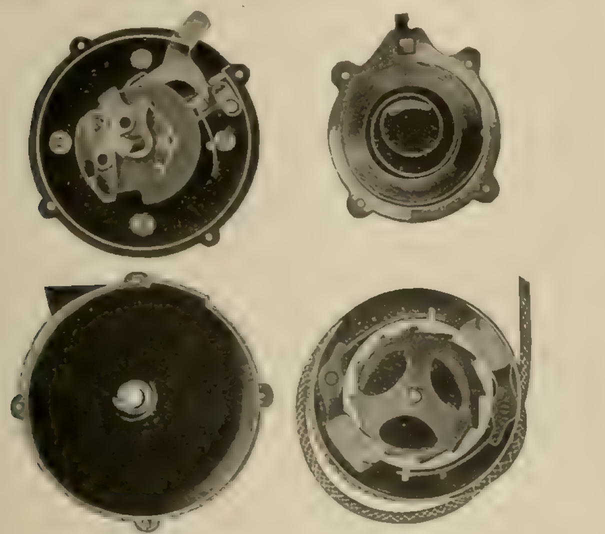
SELF-CONTAINED CROSSING

corner irons of direct strain, and reducing the cost and labor of maintaining alignment. This crossing is built with easer or reinforcing rails, the third rail serving to reinforce or stiffen the main running rail and to carry worn wheel tires over the intersections, preventing striking the abutting ends of the intersecting rails. The three rails are continuous without joints in one track and the only joints in the other track are where the abutting sections connect to the main sections, at which point they have solid and supported base and side bearing. From the standpoint of cost and durability it is claimed that this is the most economical design made.

Moving household goods by trolley is becoming popular in Lancaster, Pa., where recently two families availed themselves of the privilege.

New Design of Knutson Trolley Retriever.

The Trolley Supply Co. of Canton, Ohio, manufacturer of the Knutson trolley retriever, which it has successfully introduced during the past eighteen months or two years, is now putting upon the market its new retriever No. 3, the details of which are shown herewith, which it claims is the most perfect retriever that has ever been turned out. Retriever No. 2, which has been in general use for a long time, has been the medium through which the company has established in a practical way the economic value of the retrieving principle in trolley catchers, but realizing the need for



PARTS OF KNUTSON TROLLEY RETRIEVER

a smaller and less costly retriever for city and suburban service, the No. 3 was built, and carefully experimented with and perfected until every chance of defective mechanism was eliminated.

Style No. 3 is 6 in. in diameter, 7 in. deep, weighs 18 lb., and can be easily carried from end to end of car if desired. It is built upon the same mechanical principle as the No. 2 and the unique and valuable feature of a retrieving mechanism that is set automatically without touching the machine has been preserved. The advantage of this is that when the retrieving mechanism is once set it cannot fail to act accurately, and there is no chance of its being rendered inefficient because of carelessness in setting on the part of the operator. The mechanism is reset, after the trolley has jumped the wire and been retrieved, by allowing the trolley-pole, slightly aided by the hand, to pull out rope until the wheel has been guided upon the wire, when the operator, by pulling out a few inches more of rope, brings the mechanism to a point where it locks itself automatically.

It is claimed in regard to devices that have to be set by pressing a button on the machine, that if the operator, in his hurry, puts the trolley back upon the wire without setting the retriever, it will not act; or, if he does not set it just right it will retrieve too far, or not far enough, inefficient service being the result.

The W. R. Garton Co., of Chicago, Ill., has made arrangements to represent the Trolley Supply Co., of Canton, O., for the sale of the Knutson trolley retriever.

Striker Convicted of Rioting.

April 12th a jury at Bloomington, Ill., returned a verdict of guilty against a striking street car employe, who was charged with disorderly conduct during the riot of Sunday, January 3rd. Thirty arrests and indictments followed the rioting early in January during the strike of the Bloomington & Normal Ry. employes, mentioned in the "Review" for January and February. The strike has not been declared off and the strikers announce that they will begin to operate an automobile line again in May. Meanwhile the [illegible]

Injunction proceedings were begun at New Orleans to prevent the consolidation of street railways by the New Orleans Railways Co.

The Eureka Trolley Wheel and Harp.

A little calculation shows that a great deal is required of trolley wheels used on interurban cars making high speeds. Thus a 6-in. trolley wheel on a car operating at an average speed of 35 miles runs at an average of 2,000 revolutions per minute, and a maximum of over 3,000 r. p. m., the total revolutions for a day being easily over a million. The need for efficient and constant lubrication is apparent, and to meet this requirement the Eureka Trolley Co., of Ironton, O., has designed a self-lubricating wheel and harp which is known as the "Eureka."

The lubricant is grease which is placed in a cup formed in the shank of the harp. The harp is of bronze in two pieces joined by a male and female screw threaded for two inches. The cavity in the shank of the upper portion is 2⅜ in. deep by about 1¾ in. internal diameter, and is filled with grease, and screwed onto the lower section of the shank which is riveted to the trolley pole. The top of the piece which has the male thread is turned out forming a cavity 1½ in. in diameter by about 2 in. deep, and fitted with a leather packed piston, behind which is a spiral spring. As the top of the harp is screwed over this the grease is forced into the cavity below and presses the piston down, so that when the harp is in place the grease is in a tight cup under pressure from the piston below it. One fork of the harp is drilled with a hole which enters the grease cup, and at the top connects with the pin carrying the trolley wheel. This pin is ⅝ in. in diameter and hollow, with a hole near the middle point of its length through which the grease reaches the wheel bearing.

The compression grease ensures a positive feed and enables the wheels to make long runs. Ten thousand miles is reported as only a fair life and trials have resulted in over 20,000 miles made by one wheel. In city service the grease cup should be filled once a week; on interurban lines, every two or three days.

The "Eureka" wheels have been adopted by the railway companies at Newark and Delaware, O., and by two of the interurbans running out of Columbus, and numerous other roads have installed them on trial.

The officers of the company are: R. N. Fearon, president and general manager; H. J. Smith, secretary and treasurer. M. G. Fearon represents the company on the road.

The "Tuxeda" Union.

The accompanying illustration shows a special pipe fitting that has been designed to meet the demand that has arisen within the last few years for a pipe union that would be satisfactory under the higher pressures now common. This is made of "Tuxeda" bronze, an alloy of high tensile strength, uniform in structure and free from defects. The shape appeals to engineers and steam fitters, as the ends are both hexagonal, making it easy to use an ordinary wrench instead of pipe tongs, to screw it on the pipes. There is enough metal to prevent spreading when screwed to the pipe, and the fitting can be used many times without leaking. The joint is made by a tapered seat, to which is fitted a ball nose well ground in. The surface of contact is small and self-seating, adjusting itself to any disalignment of the pipe.

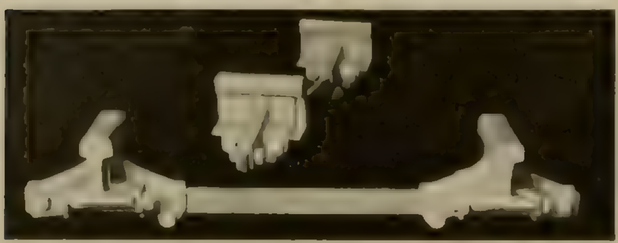
"TUXEDA" UNION

These unions have been used long enough to demonstrate that they can be relied on to remain tight under any pressure necessary to run a modern plant. It is stated that superheated steam, which is so destructive to ordinary brass, has no bad effects on "Tuxeda" bronze. These unions cost more than the old style, but as the modern demand is for quality and not price, this objection is not a serious one. The "Tuxeda" union is manufactured exclusively by Franklin Williams, 39 Cortlandt St., New York City.

The St. Joseph (Mo.) Railway, Light, Heat & Power Co. is building a loop in what is known as the Hansen Hill district. This will give a cross city line.

To Prevent Rails Spreading.

[illegible] side and the anti-spreading device on the other. The combination [illegible] in this connection are applied at every joint, with the regular anti-



ATKINS ANTI-SPREADING DEVICE.

spreading device at [illegible], or two of each type every thirty feet, the length of one rail. The regular set is especially designed for curves or at any point where the strain is great, but is applicable to any rail on either steam or electric roads. The device may be installed at any time without disturbing traffic and requires no additional outlay, outside of the actual application.

For 80-lb. rails the bill of materials is approximately as follows: 4 malleable shoes, 20 lb.; 1 steel bar, ¾ x 2 in., 30 lb.; 8 bolts, 8 lb.

This device is manufactured by George M. Stowe & Co.

New Fare Registers.

As is well known, the Ohmer Fare Register Co., of Dayton, Ohio, has manufactured registers of various sizes for registering and indicating, separately, different classes of fares collected, and printing a record of each class at the finish of each half-trip, together with the register number, trip number, day and date, and the badge number of conductor.

The Ohmer company has added to these two new machines, known as the No. 5 and No. 6, for use, exclusively, on city lines.

The No. 5 register is arranged to register and indicate, separately, three or four different classes of fares, and at the end of each half trip it prints a record of each fare collected, registered in its own specific class, and it also prints a record showing the total of all the fares collected on each half-trip, irrespective of the class. Besides printing the month and the day, it prints the time by hours and minutes that each car is put into service, and the time by hours and minutes that both conductor and motorman take and leave the car, and the time by hours and minutes are printed at the termination of each half-trip. The direction in which the car moves is also printed, as "Up and Down," "East and West," etc. If the car should be an extra, the record will print "Extra;" if a special or chartered car, the record will so indicate. It also prints perfectly the condition of the weather, and makes a notation of other miscellaneous data as may be desired to record, a detailed list of which data we show below. The No. 5 machine is so complete in its operation that with its use the ordinary trip slip used by conductors may be dispensed with, and all data pertaining to the service by the conductor is recorded and indelibly printed with the No. 5 register. This printed report cannot be tampered with nor removed, save by the inspector or car starter in authority, who removes the statement in duplicate at the finish of the car run, one copy of which record is sent to the treasurer or auditor of the company; or, if desirable, the conductor may be permitted to remove his own record, in which case the inspector would remove the duplicate record showing all the totals for the entire day by one or several conductors. The No. 5 register, with all its accomplishments, is simple in operation, and is no more complicated than the other more simple registers made by the Ohmer company.

Its new No. 6 register in some respects is similar to the No. 5, with the exception, however, that it has a limitation for two kinds of fares, and is particularly designed for large city properties collecting universal 5-cent cash fares and transfers only. Both Nos. 5 and 6 are arranged to be operated with cord or rod, and the operating devices of either are susceptible to being attached to the register rods found in the ordinary street car.

With these two machines, the company is now thoroughly equipped to take care of the largest city roads, and provide for them the most valuable service, which cannot be acquired with any other system of registering devices.

Both these machines, like all other registering devices manufactured by the Ohmer Fare Register Co., are patented in the United States and abroad.

The No. 5 machine is designed to print the following detailed information:

Extra	Snow	Work train	Fuse out
Special	Hail	Late	Wires down
Chartered car	Sleet	Accident	Washout
Hot	Fair	Collision	Railroad blockade
Cold	Base ball	Off track	Railroad crossing
Rain	Circus	Motor Impaired	Passenger put off

Advertising Literature.

THE WESTERN ELECTRIC CO. has issued Bulletin No. 2,015, "Type L Direct Driven Generators for Power and Lighting."

THE BALDWIN LOCOMOTIVE WORKS, Philadelphia, Pa., has issued Catalog No. 46, treating of compressed air locomotives. It contains 40 pages, 6 x 9 in., and is illustrated.

THE BULLOCK ELECTRIC MANUFACTURING CO., of Cincinnati, O., has issued Bulletin No. 1,023 (superseding Nos. 1,021 and 1,022), "Bullock Type B Motors". Also Bulletin No. 1,025, "Bullock Transformers".

THE LUMEN BEARING CO., of Buffalo, N. Y., issued a very handsome monthly calendar for April, the upper half of which frames a colored reproduction of a painting by H. Bolton Jones, entitled "The Awakening of Spring".

THE B. F. STURTEVANT CO., Boston, Mass., has issued Catalog No. 115 (second edition, 1904), treating of engines, motors, generating sets, forges, steam heating apparatus and other products of the company. This is a condensed catalog containing 48 pages, 4 x 9 in. It is illustrated.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING CO. has issued the following publications: Circular No. 1,077, "Type L Motors, Direct Current, Series Wound." Circular No. 1,078, "Westinghouse No. 91 Single-Phase Railway Motor and Car Equipment". Large editions of these circulars have been printed and can be had upon request.

THE GENERAL ELECTRIC CO. has issued the following publications: Bulletin No. 4,367 (supersedes No. 4,312), "Fuse Plug Cabinet Panels". Bulletin No. 4,368, "Continuous Current Motor Controlling Panels". Also notice regarding Bulletins Nos. 4,339, 4,338 and 4,360. Also supplement to Supply Catalog No. 7,569, superseding pages 6 and 7.

A. G. HATHAWAY & CO., Cleveland, O., have issued a 24-page catalog, 5 x 7 in., treating of air-brake pins, knuckle pins, boiler rivets, railroad spikes, tank and tinned rivets, upset rods, tie rods, foundation bolts, turn-buckles, wrought and cast washers, machine bolts, track bolts, heavy nuts, wall and joist hangers, M. C. B. forgings, oil and gas furnaces, etc. It is illustrated and nicely compiled.

THE GARTON-DANIELS CO., of Keokuk, Ia., has just issued the second edition of Catalog No. 40, showing the company's full line of lightning arresters. The first edition of this catalog was practically exhausted within a few days of issuance and the company reports that both the requests for catalogs and orders for arresters are coming in finely. The business for the first three months of this year shows a large increase over any similar previous period.

THE JOSEPH DIXON CRUCIBLE CO., of Jersey City, N. J., reprints in the April Graphite a paper by Mr. John A. Walker, vice-president of the company, on "How Is the American Boy to Get Along?" This article was written by Mr. Walker for "American Industries". In it the subject is handled in a new and exceedingly interesting fashion from the standpoint of one who has succeeded admirably along the lines laid down for the guidance of young people in business, and it is well worth everybody's while to read it, whatever his age. Incidentally it may be remarked that Graphite, which is issued in the interests of Dixon's graphite productions, is one of

the best trade publications that come to hand. To get it, it is only necessary to send for it.

THE SIMPLEX ELECTRIC HEATING CO., of Cambridge, Mass., has just issued a very complete catalog of its electric heating specialties. The catalog contains more than 80 pages fully illustrated and listing almost every form of cooking utensil, as well as a large variety of other appliances such as glue pots, soldering irons, curling-iron heaters, heating pads, instrument sterilizers, radiators, foot warmers, laundry and tailors' irons, etc. The catalog will be sent upon request.

THE S. A. WOODS MACHINE CO., Boston, Mass., has issued a folder describing and illustrating its full automatic knife grinder, known as No. 221, for wood-planer, paper, veneer, leather-splitting and other straight knives. This grinder is built to grind blades up to 30, 36 or 42 in. in length, and the company makes another grinder, known as No. 222, which is built in various sizes up to 78 in. The folder also contains a brief article on "The Importance of Accurate Grinding".

THE FEDERAL MANUFACTURING CO., of Cleveland, O., has issued a folder entitled, "Will It Pay You to Change to Electric Wagons? How to Find Out." The folder was prepared by the advertising department of the company for the purpose of enabling firms or individuals who are contemplating a change from horse-drawn to electrical wagons to ascertain if such a change will pay them. The folder is issued in the name of Hayden Eames, of Cleveland, who is the selling agent for all the company's automobile products with the exception of steel balls and chains.

THE C. & G. COOPER CO., of Mount Vernon, O., has issued a set of nine excellent half-tone views showing installations of corliss engines built by the company, as well as a standard girder frame engine, which was built by it, and also a group picture showing a 2,500-h. p. complete steam plant furnished and installed by the company. Two of the views show cross compound condensing corliss engines directly connected to railway generators, and one shows a like unit directly connected to a three-phase alternating current generator. The illustrations are printed on cards 8 x 11 in. in size.

THE ALLIS-CHALMERS CO. has just issued the second edition of Catalog No. 54, treating of the Sederholm boiler. It is illustrated and contains 58 pages, 6 x 9 in. The contents include, besides a comprehensive description of the boiler, tables showing the properties of saturated steam, factors of equivalent evaporation, steam and coal required to raise 100 gallons of water 100 ft. per minute for 24 hours, weight of water per cubic foot, temperature of fire, contents in cubic feet and U. S. gallons of pipes and cylinders one foot in length, mean effective pressure in cylinder of non-condensing corliss engines, measures of work, power and duty and barometric readings.

THE RODGER BALLAST CAR CO., of Chicago, has issued a four-page circular describing and illustrating "the ideal construction, ballast and maintenance car", known as the Hart convertible car, Class F. H., especially designed for electric railway service. This car combines in one car all the valuable features of the Rodger center-dump ballasting car and is convertible in from 10 to 15 minutes into an ordinary flat bottom flat car. The circular contains half-tone views showing ballasting done by means of these cars, and also testimonials which have been received from such roads as the Ft. Wayne & Southwestern Traction Co., the Detroit, Monroe & Toledo Short Line Co., American Railways Co., and many others.

THE HERSCHELL-SPILLMAN CO., of North Tonawanda, N. Y., has just issued a 32-page illustrated catalog, 4½ x 7½ in., treating of its standard merry-go-rounds. This is designated as Catalog "B". For a frontispiece it has a view of the front of the company's factory. Other views include a portrait of the president of the company, Mr. Allan Herschell, a cross section of the two-[illegible] merry-go-round, carved side of the most popular form [illegible] a group of attractive horses, new style of rocker which does away with bolts, military band organs, boiler and engine used with these merry-go-rounds, and [illegible] showing the Herschell-[illegible] at work in Illinois, Mexico, Brazil and Olcott Beach, N. Y. There is also a view of one of the company's miniature railways. The descriptive matter is terse and emphatic. Park managers should send for one of these catalogs at once.

THE UNDER-FEED STOKER CO. OF AMERICA, Marquette Building, Chicago, in the Publicity Magazine for March, publishes [illegible] R. S. Webb & Co., [illegible], Mo., 400 h. p.; Syracuse (N. Y.) Lighting Co., 2,100 h. p.; Tivoli Brewing Co., Detroit, Mich., 100 h. p.; Berlin Mills, Berlin, N. H., 2,000 h. p.; Eagle Rolling Mills (2nd order), New Ulm, Minn., 300 h. p.; Standard Oil Co. (Atlas Works), Buffalo, N. Y., 600 h. p.; American Locomotive Co., Dunkirk, N. Y., heating furnace; Cruickshank Bros. Co. (2nd order), Allegheny, Pa., 100 h. p.; Bagley Land Co., Ltd. (2nd order), Detroit, Mich., 125 h. p.; St. Louis & Suburban Railway Co. (3rd order), St. Louis, Mo., 533 h. p.; Dunkirk Pumping Station, Dunkirk, N. Y., 250 h. p.; Peerless Rubber Manufacturing Co. (3rd order), New Dunham, N. J., 125 h. p.; John F. Meyer & Sons, Springfield, Mo., 625 h. p.; Eastman Kodak Co. (2nd order), Rochester, N. Y., 250 h. p.; Anchor Brewing Co., Tarentum, Pa., 250 h. p.; Berlin Mills (2nd order), Berlin, N. H., 334 h. p.; St. Louis & Suburban Railway Co. (4th order), St. Louis, Mo., 4,800 h. p.

THE INTERNATIONAL REGISTER CO., of Chicago, Ill., has just issued Catalog No. 4 of International and New Haven registers and railway supplies made and sold by this company. It contains 135 pages, including a comprehensive index, handily arranged, and is attractively printed and illustrated, and bound in flexible board covers, the front cover being adorned with a neat design which frames a view of a fare register, the colors used on the cover being red, white and black. While this catalog does not equal in volume the catalogs issued by dealers in general street railway supplies, it is in every respect the most complete catalog issued by a manufacturer of fare registers for street cars. It contains not only full and complete illustrations of all the International and New Haven registers made by this company, but also very carefully prepared illustrations, to scale, of repair parts, and it also includes a full line of car fittings used in the installation of fare registers. Many pages are likewise given up to illustrations of Heeren badges, waterproof trolley rope, bell cord, conductors' punches, Barrett jacks, etc. It is by all means a very desirable catalog and should be obtained by street railway managers and purchasing agents everywhere.

Trade Notes.

THE ST. LOUIS CAR CO., St. Louis, Mo., has changed the name of its brake shoe, which has attained a wide reputation for excellence, from the "Diamond K" to the "O. K." brake shoe.

SARGENT & LUNDY, engineers, of Chicago, announce that about May 1st they will occupy their new quarters on the 17th floor of the Railway Exchange, Jackson and Michigan Boulevards, Chicago.

THE BROWN CORLISS ENGINE CO., of Corliss, Wis., has just received an order from the Phillips Insulated Wire Co., of Pawtucket, R. I., for one 14 and 28 x 42-in. tandem compound condensing corliss engine and one 18 and 36 x 48-in. tandem compound condensing corliss engine.

J. R. M'CARDELL & CO., of Trenton, N. J., advise us that they have just shipped to a large electric railway in Belgium two of their well-known Trenton trolley wagons, the order having been received through Mr. Victor Dourin, of Paris, France. They also announce the recent receipt of orders from Durban, South Africa, and Aukland, New Zealand.

THE JAMES G. WILSON MANUFACTURING CO., of New York City, maker of wood and steel rolling doors for street car barns, reports an excellent trade throughout the country and states that it is receiving a great many inquiries for wood rolling doors from street railway companies. The company has just closed contracts for steel rolling doors for the new car barn of the Newport & Providence Street Railway Co., at Middletown, R. I.

THE UNDER-FEED STOKER CO. OF AMERICA, Marquette Building, Chicago, announces that after May 1st its advertising department, which is in charge of Mr. W. A. Keen, will be located in No. 847 Marquette Building, directly across the corridor from No. 838, which latter is the entrance to the company's main offices. The contemplated change will bring the advertising department into closer touch with the main office, besides being a more convenient arrangement all around.

THE BULLOCK ELECTRIC MANUFACTURING CO., of Cincinnati, O., has just received an order from the Denver Gas & Electric Co., of Denver, Col., for one 1,500-kw., 2,400-volt, 3-phase, 100-r. p. m., 60 cycle, fly-wheel type generator, this being a duplicate of a generator which the Bullock company installed for the

Denver company over a year ago. The Denver company has also installed four 600-kw. 3-phase 2,300-volt alternators, which makes a total of 6000 kw. in Bullock alternators installed by it.

GILES S. ALLISON, manufacturers' agent for street railway supplies, 27 Broadway, New York City, in addition to being a direct representative for the Security Register Co., is also selling agent for the following concerns: Valentine & Co., the well known varnish house; A. E. Holaday Manufacturing Co., trolley wheels; J. W. Bliss Co., gears and pinions; Detroit Trolley & Manufacturing Co., manufacturer of the well-known ball bearing base; and the Ham Sand Box Co., manufacturer of sand boxes and trolley catchers.

THE LAGONDA MANUFACTURING CO., of Springfield, O., sends us a letter from the superintendent of the Oahu Sugar Co., of Waipahu, Oahu, H. I., which reads as follows: "The two Cleaners with the special grade of hose which you furnished us, are working to my entire satisfaction. The beauty about them is, that they will not go through a tube until the latter is cleaned, and as I have Chinese for boiler cleaners (who don't know when a tube is clean, but who will obey orders and put the cleaner through every tube), it saves me lots of trouble and worry."

THE CONSOLIDATED CAR HEATING CO., of Albany, N. Y., reports the recent receipt of orders for electric heating equipments as follows: Brooklyn Heights Railroad Co., equipments for 100 new cars, 65 reconstructed elevated cars, 610 heaters for motormen's cabs in elevated cars of which 435 are of a special size of the panel type, 149 switchboards for elevated cars; International Railway Co., equipments for 35 interurban cars, heaters of the truss plank type to extend the full length of the cars; Westinghouse, Church, Kerr & Co., 10 equipments for the Lackawanna & Wyoming Valley Railroad Co.

THE ALLIS-CHALMERS CO. anounces that in connection with the great extension of its business by becoming builder of gas engines, steam turbines, hydraulic and electrical machinery, in accordance with the announcement in the "Review" for March, it has organized a Department of Publicity, of which Mr. Arthur Warren has been appointed manager, and the company requests that all communications referring to publicity in any form connected with the Allis-Chalmers Co., including the Bullock Electric Manufacturing Co., which it has acquired, will in the future be addressed to the Department of Publicity, Allis-Chalmers Co., Milwaukee, Wis.

THE CHICAGO ENGINEERING & CONSTRUCTING CO. announces that on or about April 25th it will remove its offices to Suite 1301-05, Great Northern Building, No. 77 Jackson Boulevard, just east of the Great Northern Hotel, Chicago. The company will be pleased to receive its friends in its new quarters, where it will have more room to expand its business as necessity demands. It is significant that this company, which was organized only about a year ago, has become a prominent factor in its field and its business has increased to the extent that larger quarters and better facilities have become imperative. The company is fully equipped to carry on the actual construction of electric railways, electric lighting plants and steam railways, and it will assist in financing attractive propositions.

THE GOULD STORAGE BATTERY CO., of New York City, advises us that it has recently closed the following contracts: Chambersburg, Greencastle & Waynesboro Street Railway Co., Greencastle, Pa., one 242-cell floating battery type O-11 and one 244-cell floating battery type O-9; Lexington (Ky.) Railway Co., additional plates increasing the output to 352 kw.; Elder & Johnson, Dayton, O., 60 cells of 400 amperes discharge, with Gould C. E. M. F. booster, for elevator regulation; Bank of Montreal, Montreal, Can., 61 cells of 960 amperes discharge, with motor-driven end cell switch. Recent orders for isolated and residential plants include those from C. C. Williams, Cohasset, Mass.; W. T. Smith, Elko, Nev., and the U. S. Navy Yard, Brooklyn. The company has also received orders for six different central battery system telephone plants.

THE H. W. JOHNS-MANVILLE CO., 100 William St., New York, recently received a letter from the master mechanic of the Chicago & Alton Railway Co. relative to the merits of Kearsarge gaskets, a well-known product of the Johns-Manville company. Part of the letter reads as follows: "I beg to advise you that I applied four Kearsarge gaskets to two different engines; that is, I applied two Kearsarge and two rubber gaskets in each engine. Up to date the Kearsarge gaskets have each outlasted 15 rubber ones and have therefore given more satisfaction. I find we can continue to use them [illegible] the necessity of removal, that they do not [illegible] blow out. I have recommended [illegible] adopted by the Chicago & Alton Railway Co., and the recommendation has been approved by the superintendent of motive power."

THE NATIONAL BRAKE CO., of Buffalo, N. Y., has been reorganized and incorporated with a capital stock of $50,000, with the following directors: G. S. Ackley, [illegible]; O. S. Ackley, Pennsylvania; W. D. Brewster, Syracuse, N. Y. The new corporation acquires the business of the old company, which was formerly conducted by John L. Peacock and Griffin S. Ackley under the name of the National Brake Co. In addition to all of the patents in street car brake mechanisms formerly advertised by the old company, the new corporation acquires Letters Patent issued to John L. Peacock March 15th, 1904. This brake is an improvement on the original "National" brake on account of the extra amount of stack chain that can be taken up and still maintain the same degree of speed and power obtained by the other brake. The company will have headquarters at 682 Ellicott Square, Buffalo, N. Y., after May 1st.

W. F. WARDEN, president and manager of the Burt Manufacturing Co., Akron, O., sailed April 15th for an extended trip abroad in the interest of his company. Mr. Warden will visit his company's agents in England, France, Germany, Belgium, Norway, Sweden, Denmark and Russia and if time permits those in Switzerland, Greece and Spain also. In his absence J. Asa Palmer, secretary of the company, will be in charge. The Burt Manufacturing Co. has placed its "Cross" oil filters and Burt exhaust heads in steam plants in all parts of the world and among recent foreign orders is one received from its agent at Durban, South Africa, for 30 gross of oil filters and an order from its agent at St. Petersburg, Russia, for oil filters for the Russian government. The company has recently published an interesting picture showing a 30-in. exhaust head made for the Jones & Laughlin Steel Co., at Pittsburg, Pa. This head is 10 ft. high, 9 ft. 4 in. in diameter and weighs 2,700 lb.

THE STANDARD UNDERGROUND CABLE CO. announces the recent opening of a branch office or headquarters in the Security Building, St. Louis, Mo., in charge of Mr. W. A. Caldwell, who was formerly connected with the Chicago office of the company, but more recently with the home office at Pittsburg. Mr. Caldwell had a number of years' experience with the company in both the construction and sales departments. This company has now seven district or branch offices throughout the country, covering the whole of it from Maine to California, namely: Northeastern Sales Department, Delta Building, Boston; Eastern Sales Department, 56 Liberty St., New York City; Southeastern Sales Department, Betz Building, Philadelphia; Central Sales Department, Westinghouse Building, Pittsburg; Western Sales Department, Rookery Building, Chicago; Southwestern Sales Department, Security Building, St. Louis; Pacific Coast Sales Department, Crossley Building, San Francisco.

THE STANDARD VITRIFIED CONDUIT CO., of No. 39 Cortlandt St., New York City, since completing its plant at South River, N. J., has factories which for perfect equipment and size rank among the foremost in the world. Owing to the great demand for conduit manufactured by this company, the plant has been run continuously since beginning operations in 1902, and in this time the company has gained an enviable reputation for promptness in delivery and strictly high-grade material. Forty million feet of conduit annually can be produced by the company's factories. Among the largest buyers of the Standard vitrified conduit are: The Bell Telephone Co., New York, Boston and southern states; Rapid Transit Subway Construction Co. (New York tunnel); Manhattan (elevated) Ry.; Metropolitan Street Ry.; New York Edison Co.; Brooklyn Edison Co.; Brooklyn Rapid Transit Co.; Boston Elevated Railway Co.; Philadelphia Edison Co.; Philadelphia Rapid Transit Co., New York Tunnel Co.; Westinghouse, Church, Kerr & Co.; United Engineering & Construction Co.; Western Electric Co.; Standard Underground Cable Co.; Safety Insulated Wire & Cable Co.; Pennsylvania Railroad Co.; Baltimore & Ohio R. R.; New York Continental Jewell Filtration Co.; Hudson River Water Power Co.; Niagara Falls Power Co.

STREET RAILWAY REVIEW

Vol. XIV | MAY 20, 1904 | No. 5

Manchester Traction, Light & Power Co.

Electrical Power Generation and Distribution from the Water Powers Along the Merrimac and Piscataquog Rivers.

For several years the Manchester Traction, Light & Power Co. has been developing an extensive scheme of electric power generation and distribution along the Merrimac and Piscataquog Rivers in the vicinity of Manchester, N. H. This company now owns and operates a comprehensive system of generating stations which include a steam driven central station in the city of Manchester, a water power plant at Garvin's Falls on the Merrimac River, a water power plant at Hooksett on the Merrimac, a water power station at Gregg's Falls on the Piscataquog River, and a water power plant with steam plant auxiliary at Kelley's Falls on the Piscataquog River. With power generated at these various points and distributed through an elaborate network of interconnecting feeders the company is now operating all the electric railway lines of the Manchester Street Railway, operating in the city of Manchester and suburbs, the entire electric lighting of the city of Manchester, all the electric lighting in Suncook, Hooksett, Goffstown and Grassmere, and is furnishing power from its Hooksett sub-station for operating a portion of the electric railway connecting Manchester with Concord, N. H. The four water powers of the company probably represent a greater combined capacity than any similar development in New England, the company having a total available output exceeding 10,000 h. p.

A portion of the current generated at each station is used in the immediate vicinity of that station, but in order to secure the greatest benefits from the single ownership the five stations have been tied together by ample feeder lines, so that they all feed into one common sub-station at Manchester, where the current is transformed and sent out in various forms to serve the several power, lighting, and electric railway circuits. The arrangement also permits any station to draw energy from any of the other stations at times when its machinery is not in operation or when low water at any point renders the power inadequate for the service required.

At Garvin's Falls and Gregg's Falls three-phase current is generated at 60 cycles, 11,000 volts and transmitted direct to the Manchester sub-station. At Hooksett current is generated at 1,000 volts, a portion being changed at a rotary sub-station located at this point for use on the Concord-Manchester electric line and the rest is stepped up to 11,000 volts for transmission to the Manchester sub-station. At Kelley's Falls two-phase current is generated at 6,000 volts and transmitted to the Manchester sub-station, where it is changed into three-phase current at 2,080 volts. By means of transformers located at the Manchester sub-station the voltage of the current from the water power plants is reduced so that it reaches the switchboard at the same potential as current from the alternating generators in the Manchester steam driven plant (known

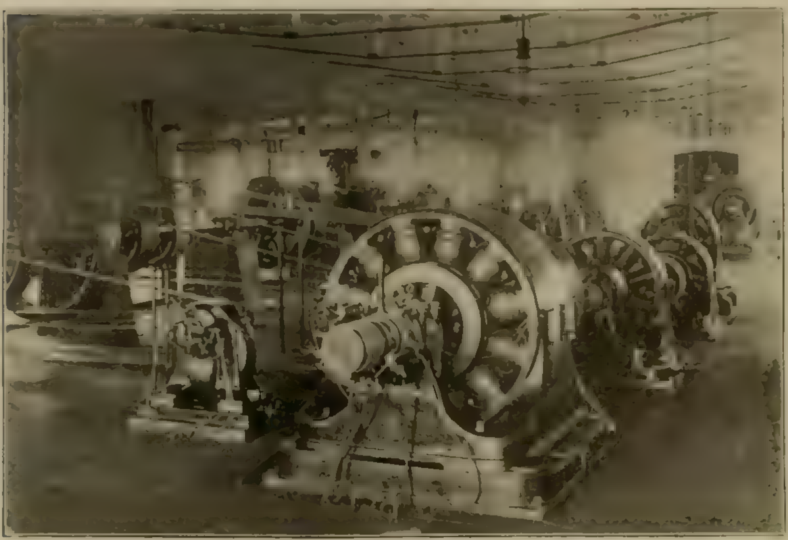
VIEW OF KELLEY'S FALLS STATION, WATER AND STEAM POWER PLANT

as the Brook St. station), that is, three-phase 60 cycle current of nominally 2,080 volts.

As each main line from generators or transformers to the switchboard terminates there in a triple-pole, double-throw switch, connecting with either the upper or lower bus-bars, and as the lower set of bus-bars can be divided by switches into as many sections as there are main supply lines from generators and transformers, each of these lines may be connected in multiple with other similar lines on the upper set of bus-bars, or may be put onto an isolated bus-bar section of the lower set. Each main distribution line coming to the switchboard terminates there in one of the triple-pole, double-throw switches, and may be connected through this switch either to the upper set of bus-bars or to one of the sections of the lower set. Each section of the lower set of bus-bars that connects with the switch of a supply line from a generator or transformer also connects with the switch of a distribution circuit. As switches are provided that may be used to unite any or all of the sections of the lower set of bus-bars consecutively, a single main supply line may be connected to a number of these sections. The

utility of these arrangements of upper and lower bus-bars and switches is that any particular transformer or generator may be devoted to the supply of certain distribution lines.

As the distribution service from the sub-station includes three-phase induction motors of large capacities, one of the Manchester mills supplied using 400 h. p., and another 1,200 h. p. of these motors, the loads on some of the distribution lines are subject to rapid and



INTERIOR OF KELLEY'S FALLS STATION

large variations. It is often undesirable to allow such variations to occur in the loads of the transformers or generators that are supplying circuits for commercial lighting, because of the resulting fluctuations of pressure at the lamps. The sections of the lower set of bus-bars allow one or more transformers or alternating generators at any time to be devoted exclusively to one or more of these variable loads, thus avoiding its undesirable effect, if connected to the general distribution system. Obviously the arrangement of the bus-bars and switches mentioned makes it possible to operate all of the generating stations in parallel on the alternating distribution lines, through the sub-station, or to supply any particular distribution line from either station. It is also possible to operate the local service from any water-power station, as that of Hooksett and Suncook, by energy from any one or from all of the other stations, when the generators at the station from which the local service starts are shut down. This result is reached through the transformers in the sub-station, which may be employed to draw energy from either set or section of the bus-bars at 2,080 volts, and to deliver it to the transmission line running from the sub-station to the non-operative water-power station at 10,000 or 6,000 volts, as the case may be. At this water-power station the energy from the sub-station is then reduced in pressure by transformers to 2,080 volts for the local distribution lines.

The equipment and methods of operation outlined make it possible to supply the entire alternating-current load of the Manchester system from the four water-power plants.

All the power houses, substations, car houses and depots of the company are connected by a private telephone system with the main offices, permitting a centralized control in the operation of the system.

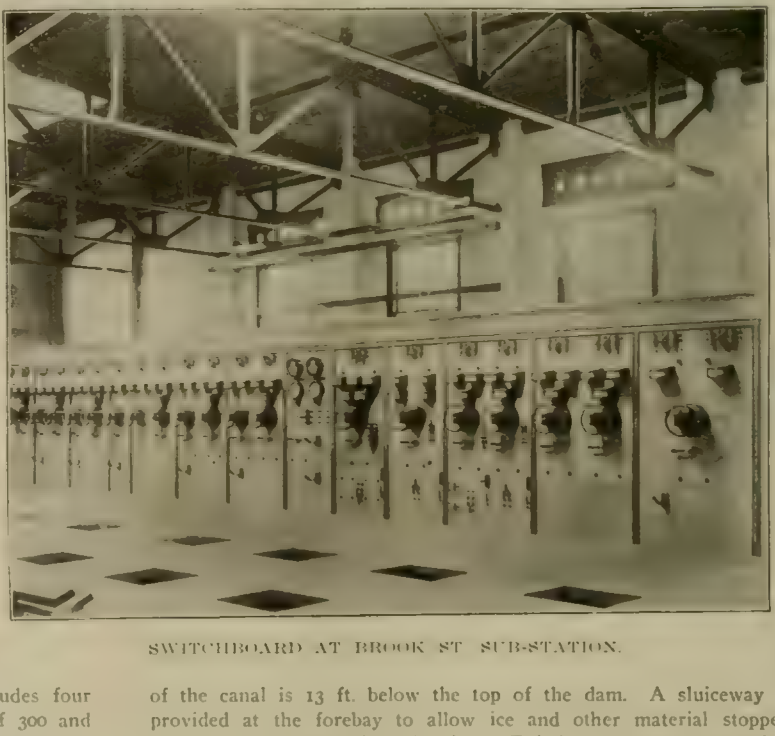
At the Brook St. station the electrical equipment includes four 500-volt generators for railway work—two of 500, one of 300 and one of 200 kw. capacity. At this same station are also two direct current 500-volt generators for stationary motor service, one being 100 kw. and the other 60 kw.

The alternating generators at this station are four in number, three of 250 kw., and one of 650 kw., all being three-phase 60 cycle machines of General Electric make, delivering current at 2,080 volts. The four alternating machines are belted to the main shaft which drives the generators carrying the railway and stationary motor load, and when running as generators are driven by the steam engines connected to this shaft. These three-phase machines can, of course, operate either as generators or as motors, and when used as motors, they are capable of driving the main shafting, and nearly all of the direct current generators at the Brook St. station, except the single railway generator, which is now belt-connected to an independent engine. These alternating machines being connected to triple-pole double-throw switches on the switchboard in the sub-station may be supplied with current from either set of bus-bars, and thus drive the other dynamos connected to their shaft, as soon as the combined water-power capacity is great enough to carry the entire load.

The Garvin's Falls plant is destined to be the largest and most complete of all those operated by the company. Exclusive water power privileges were recently acquired and a station of 1,300 kw. capacity erected. Extensions are now being made and are rapidly approaching completion to increase this capacity to 4,000 kw. These include a large extension to the present building, a new canal and the replacing of the present dam with a more substantial structure located further down the river and nearer the power station.

The new dam is about 20 ft. in height above the river bed and is built on a foundation of bed rock. The central core is of concrete, faced with granite blocks 18 in. thick, the headers projecting 4 ft. into the core. The down stream side is gently curved to throw the water away from the base of the dam. The dam is 11 ft. thick at the top and about 30 ft. at the base and has a total length of 550 ft. and will furnish a head of 30 ft. of water at the wheels.

The canal between the head gate and the forebay is about 500 ft. long and a little over 60 ft. wide at the bottom. The sides are built of stone and have a batter of 6 in. per foot. The bottom



SWITCHBOARD AT BROOK ST. SUB-STATION.

of the canal is 13 ft. below the top of the dam. A sluiceway is provided at the forebay to allow ice and other material stopped by the racks to escape into the river. This is a necessary precaution in a mountainous section where freshets are usually heavy.

The wall between the wheel room and the forebay is from 7 to 10 ft. thick, with six steel penstocks 12 ft. in diameter built into it. A decided advantage is obtained in this way, as the mass of

moving water whose velocity must be checked is comparatively small.

These penstocks are closed by gates which may be operated either manually or by an electric motor, the machinery for this being located in the gate house just above the station. The penstocks have each two draft tubes and will contain three wheels each, two sets having been already installed, two to be installed immediately and the remaining two will be placed in position in the near future.

The wheels installed are 39-in. McCormick turbines with cylinder gates made by the Rodney Hunt Co.; they are of 500 h. p. each and run at 180 r. p. m. The thrust of two of the wheels are balanced one against the other and that of the third wheel is taken up by a specially connected thrust collar.

Two Lombard governors are employed to regulate the wheels

STANDARD CAR MANCHESTER STREET RY

now in use and Sturgess governors will be used for the remaining sets.

The dynamo room will contain six 650-kw., 11,000-volt, three-phase, 60 cycle General Electric generators, of which two are already in operation. There will also be three exciter sets of 50 kw. each, two being driven by 75-h. p., form K General Electric in-

CAR BARNS MANCHESTER STREET RY

duction motors, and the third set by an independent water wheel. Each exciter has sufficient capacity to excite four generators.

The walls of the station are water proofed to the height of 8 [illegible] above the [illegible] room floor which renders impossible any damage to the machinery from freshets.

A [illegible] is provided, made by the Whiting Equipment Co. It has a [illegible] span and a [illegible] hoist and can easily handle all [illegible] in the room.

The switchboard is of blue Vermont marble divided into panels. Two sets of bus-bars are provided so that any generator or any high tension feeder can be connected to either set.

The feeder panels are each equipped with automatic oil circuit

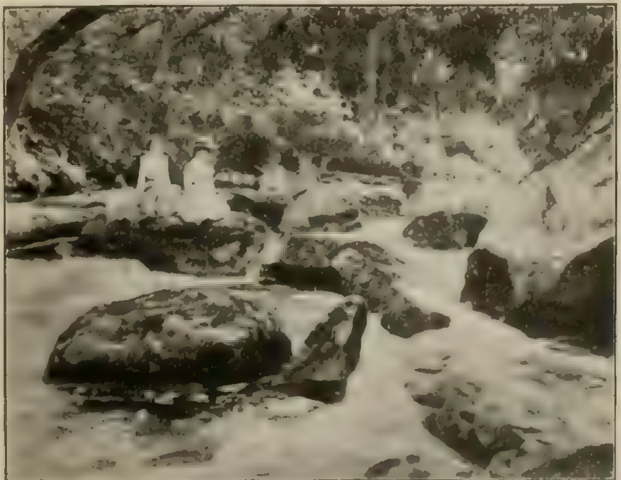
GREGG'S FALLS STATION.

breakers, voltmeter, ammeter and indicating wattmeters. Panels are also provided for the exciter sets, there being two sets of exciter

THEATER AT MASSABESIC LAKE.

buses, so that excitation current for any machine can be drawn from either set.

On the front of the station is a clock with a 32 in. dial and on



VIEW IN PINE ISLAND PARK.

the inside is a 24 in. dial, both being driven by the same movement.

At Kelley's Falls the station is a combined steam and water power station. The steam plant is used only in cases of emergency and during

low water. A timber dam, stone filled, with masonry wings, spans the river and gives under ordinary conditions a head of 24 ft. at the wheels. The wheels are two in number, 33-in. McCormick horizontal turbines, and are enclosed in a steel penstock 11 ft. in diameter; they are belted directly to the main shaft.

The generating machinery consists of one 24-pole, 60-cycle, 450-kw., two-phase, 6,000-volt Stanley generator, running at 300 r. p. m., and two small Stanley generators of 200 and 180-kw. capacity, respectively. These latter generate current at 2,200 volts, two-phase, and are connected to the transmission line by step-up transformers, no transformers being required for the 450-kw. machine.

The boiler room contains five 200-h. p. upright Manning boilers which furnish steam, slightly superheated, to two engines, one a 400-h. p. vertical cross compound Woodbury engine, and one a 500-h. p. Westinghouse compound engine. The stack is built of iron and is 80 ft. high and 5 ft. in diameter.

The Gregg's Falls station is a one-story brick building located on the Piscataquog River about three miles above the Kelley's Falls station. At this plant is obtained an exceptional head of 51 ft. by means of a stone-filled timber dam with masonry wings. The power house is located just below the dam.

Two penstocks 10 ft. in diameter furnish water to two sets of horizontal turbine wheels. One set consists of three 27-in. McCormick turbines, and the other two "Hercules" turbines made by the Holyoke Machine Co. One set is direct connected to each end of the generator shaft.

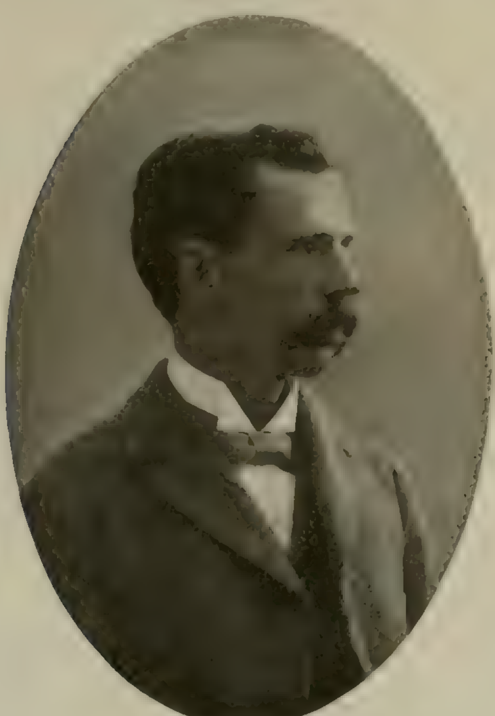
The generator is a three-phase, revolving field type, General Electric, 1,200-kw., 11,000-volt machine which runs at a speed of 327 r. p. m.

The gates and all of the wheels are connected to a single Sturgess governor. This governor is of the quick-acting type and operates the gates by admitting oil under pressure on either side of a rotating piston. It is provided with a special mechanism for increasing or decreasing the diameter of its pulley in order to prevent any tendency to hunt. A Tyrrill regulator for more perfectly controlling the voltage of the generator will be installed in the near future.

There are transformers for reducing the 11,000-volt, three-phase to 2,080-volt current for supplying lighting service to the villages of Goffstown and Grassmere.

The switchboard is of blue Vermont marble furnished by the Condit Electrical Co., with instruments of the horizontal edgewise type.

PAVILION AT MASSABESIC LAKE



J. BRODIE SMITH

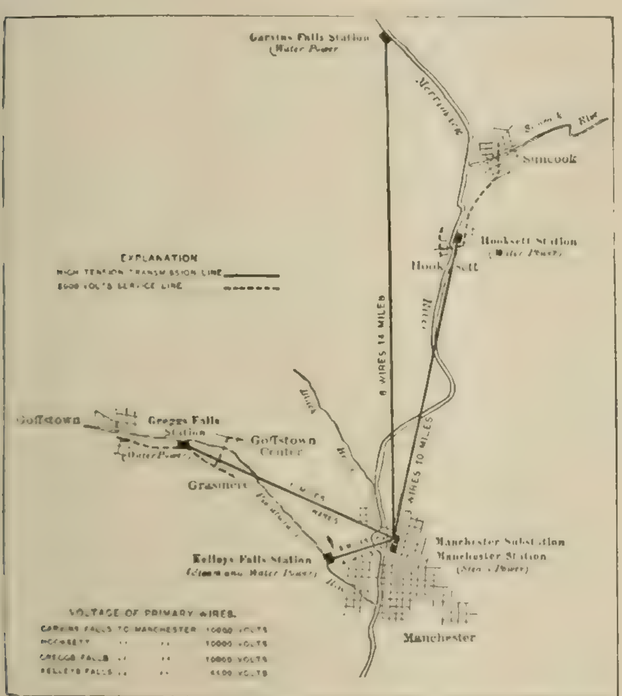
W. A. MALONEY

At Hooksett the station is located on the Merrimac River, about ten miles north of Manchester. Here, as at all its other water power stations, the company has acquired exclusive water privileges, and the whole flow of the river at a head of 17 ft. is available. The power is only partly developed and additions can be made, when the supply of current is insufficient for the demand, to the present capacity of the station.

The turbines are of the vertical type with beveled gears. They are supplied from a short canal and the power developed is conveyed by means of a rope drive to two General Electric three-phase 1,000-volt generators. Part of the power is used to run the mill in which the wheels and generators are located and part for two 300-kw., 550-volt, 60-cycle Westinghouse, synchronous converters which supply current for the electric branch of the Boston & Maine R. R. between Manchester and Concord. The rest of the current is stepped up to 11,000 volts and sent over the transmission line to the Brook St. sub-station at Manchester.

The Manchester Street Railway property includes 36 miles of electric railway track and about 100 cars. The lines serve the city of Manchester and suburbs, and the transportation facilities offered are exceptionally good for a city of this size.

Most of the cars purchased recently have been supplied by the



MAP OF MANCHESTER TRANSMISSION SYSTEM.

Laconia Car Company Works, of Boston. The standard closed car is 25 ft. over body, 35 ft. 3 in. long over all, and 8 ft. 4 ¾ in. wide over all. The cars have steam car type roof with monitor full length over vestibules. The interior finish is red birch, with ceilings of quartered oak. The seats are upholstered in crimson plush and extend longitudinally full length of the car. The bodies are mounted on Laconia high-speed double trucks with patented swing bolster, fitted with 4-in. steel axles, and Laconia 33-in. wheels with 2½-in. tread and ⅞-in. flange. The fittings include Kilborn sand boxes, Neal headlights, International registers, Wilson trolley catchers, Henderson illuminated signs, and Consolidated electric heaters. The cars are equipped with G. E. No. 67 motors and [illegible] brake.

[illegible] from Manchester the company [illegible] resort known as Pine Island Park, which is very [illegible] much used [illegible] attractions.

At Lake Massabesic the company has another resort, where an extensive pavilion and theater has been erected, and the usual park attractions installed. The accompanying illustrations show views [illegible]

Mr. J. Brodie Smith, the general manager of the Manchester Traction, Light & Power Co., and of the Manchester Street Railway, went to Manchester in 1880 and engaged in the drug business. Having an unusually keen liking for mechanical affairs, however, he retired from the drug business about 1885, and began to devote all his time to electrical studies and work. He was elected superintendent of the fire alarm telegraph system of Manchester, and when the Ben Franklin Electric Light Co. was organized in opposition to the Manchester Electric Light Co. Mr. Smith was chosen as its superintendent, and continued in that capacity until just before that company was consolidated with the Manchester Electric Light Co., when he became superintendent of the latter company. After the consolidation, he continued in the same capacity until he resigned in 1896, and took a trip of several months to Europe. On his return from abroad he was elected general manager of the Manchester Electric Light Co., which position he has since filled with great success. Mr. Smith was born at Richville, N. Y., Apr. 6, 1861.

In addition to his connection with lighting and traction interests in Manchester, Mr. Smith is treasurer of the Brodie Electric Co. of Manchester, which company manufactures a number of electric specialties, including insulators, fuse-boxes, automatic motor switches, etc., all of which are the inventions of Mr. Smith.

Mr. William E. Maloney, superintendent of the Manchester Street Railway, was born at Rutland, Mass., in 1866. At an early age he moved to Worcester, Mass., and in 1888 entered the employ of the Worcester Consolidated Street Railway Co., when that road had but 28 miles of track. He occupied various positions, gradually rising until in 1898 he was given charge of transportation. Early in 1901 all the Worcester companies were consolidated into one system, comprising about 125 miles of track. Mr. Maloney remained with the company until November, 1901, when he resigned to accept the position as superintendent of the Manchester Street Railway. Since he was appointed superintendent the system has been greatly extended and the schedule changed and improved, the rolling stock greatly increased and improvements and betterments carried out in all departments and the wages of the employes increased. In his work at Manchester Mr. Maloney has been unqualifiedly successful and has won the good-will and support of the entire force under him.

The Growth of an Electric Railway.

BY L. E. GOULD

Introduction.

On no two of the many electric railways which have been brought to completion within the last few years have the same methods of promotion, engineering, construction and operation been used. This is conclusive proof that each proposition is unique, and methods applicable to one would be inefficient when used for another. Such conditions call for a wide knowledge of methods and many carefully considered decisions concerning details. These are taught best by the greatest of instructors, "Experience."

The writer of this article does not wish to assume the position of instructing others how to build a railroad, but will endeavor to place some of his experience in a form which may be of value to the many readers of this magazine.

In order that this may be done in a systematic way, let us start at the birth of a proposed electric railway, and endeavor to explain in a general manner its growth and life up to the date of its operation. Meanwhile on the way to the point of its usefulness, the writer will try to make clear some details which have come before his eyes and those of his worthy colleagues. As one engineer says:

"The birth of railway enterprises has generally been in the private office of some one, who has noticed in the daily paper that the price of steel rails has dropped and he immediately multiplies the price per ton by the number of tons per mile—a light rail of course—and that by a number of miles from X to Y, and he can then in his mind's eye see trains running between the two points at the rate of sixty miles per hour—with his special car attached! He calls in his partner, along with the president of a local bank, a shoemaker, a wagonmaker and a farmer, and the lawyer, I must not forget, must be in the play, as he has to draw up the corporation papers, get the bonds voted, right-of-way donated, etc. All these men are well-to-do and a success in their own line.

"Behold now the great array of transportation talent, seated around a table with a map spread before them, about to build a railway!

"The first meeting develops the fact that they are not quite ready to run trains, and it dawns on some one that they should have a survey made, more especially to get the exact distance between the two points. In all probabilities the county surveyor is called in, as he has the instruments and he will do to make the survey. He is shown a map and instructed as to where the line is to be located, and in all instances where possible to follow the section line, as it will make the right-of-way easier to obtain. In the meantime while the survey is being made, the bonds voted, subscriptions to capital stock obtained, etc., the president is authorized by resolution of the board of directors to obtain the services of an engineer, in order that they may be prepared at the proper time to rush the work."

Preliminary Office Work.

The first actual engineering work for a proposed railway consists of a very careful collection and tabulation of the resources possessed by the country adjacent to the possible route, upon which is to be based a statement of the feasibility of the proposition.

All preliminary work should at the start be placed in the hands of a well established firm of consulting engineers. The reasons for such action are plain. These firms make a business of drawing up reports for just such promoters' prospectuses as this, and they are so equipped with both experience and capacity that the results of their work will be much more correct than if done by any local engineer. They have no enthusiasm to be weighed on either side of the balances, hence any opinions or conclusions which they may give as to the possibilities of a proposed road will be unbiased. Such a firm, if well chosen, is chiefly valuable to the promoters because of the weight which its report gives to the bankers or investors whom the promoter wishes to interest with himself in the financial organization of the proposed road. The value of a proposition from a financial standpoint, and the readiness with which money can be secured for it, and construction thus be assured, depends largely upon the conclusions drawn at the close of the consulting engineer's preliminary report.

This report should embody an accurate and conservative estimate of the probable income of our road, as well as an estimate of the probable cost. The revenues for a proposition are derived from one or more of the following sources.

1. Passenger receipts.
2. Freight receipts.
3. Mail and express.
4. Amusements, such as parks, and excursion business.
5. Electric lighting.
6. Sale of power.
7. Sale of waste heat.

The first requisite towards estimating the income of our proposed railway is a map. If possible sheets of the United States Geological Survey, encompassing the locality of the intended route, should be obtained. These maps are very carefully made at a great expense, and will furnish a most useful base upon which to outline the proposed route of an electric railway.

Such maps, being drawn to a large scale, show plainly the topographical features of the land. In comparatively level country, contours are drawn at intervals of five feet in difference of elevation. In rougher country the contour interval is twenty feet. All streams, large or small, are traced to their very sources. The existing railways, highways, and private roads, together with their angles and intersections, as well as all other boundary lines, are clearly shown. The location of every farm house is indicated by a dot. By means of cross-hatching and various colorings and conventions, the geographical nature of the territory and its products are shown.

After sketching the proposed route upon such a map as above described, we can at once obtain a very close idea of the right-of-way alignment permissible, the physical features to be surmounted and inter-relation of our road with nearby lines, and the total population served both urban and rural.

To obtain a correct population estimate, only the latest census reports should be used. The engineer will now carefully ascertain the probable number of passengers that will ride, and from this number and the proposed rates of fare obtain an approximate amount of passenger revenue for the proposed road. In doing this it should be observed that the proportionate amount of riding done by the inhabitants of the smaller towns is greater than that done by the people in the larger cities. In computing the rural population served the inhabitants of a zone five miles wide, that is two and one-half miles on either side of the railway, should be counted, noting of course any such features as a parallel river or railway, which would destroy accessibility or abstract any traffic.

The probable amount of revenue to be derived from freight is more difficult to estimate. A careful study must be made of the existing freight business between the towns served by our road. Then with the advantages and disadvantages which electrically hauled freight would possess clearly fixed in mind, the approximate amount of revenue to be expected from this source can be added to our probable income. In relation to probable freight receipts an engineer must recognize the fact that the freight traffic on nearly all electric railways is of the so-called parcel or express order. When a road is located across an agricultural district, a milk business will greatly help to swell receipts.

The receipts which may originate from the light and power business are also greatly dependent upon the policy and energy of the railway management. If taken care of in the original design, then at a very small additional first cost our proposed railway power equipment may be so arranged that a satisfactory light and power sales business can be carried on with large profit. Current which the generating station will furnish at a cost from one to two cents per kilowatt hour can be sold at prices ranging from five to twelve cents. The size of this item will depend entirely upon the vigor with which the business is pushed.

Regarding probable receipts, one thing should be plain; it is this: Traffic will not come to any road which does not make it a policy to get out and hustle for business. The steam roads find it efficient to keep expensive solicitors on their pay-rolls. If such a course is so profitable to the steam roads, and no one questions that fact, why should not the electric roads be better equipped for such business, and be more energetic in soliciting their share?

With the data as above described, well tabulated, the engineer can now form an idea of what magnitude the proposed railway must be in order that it may best meet the needs of the probable traffic.

Bearing this in mind, we will now seek for a check on the probable financial results of his proposition. This is found by tabulating the yearly reports of railways as nearly similar to the one under consideration as it is possible to find. This similarity should exist not only in the tributary population per mile, but in as many general characteristics as can be found, such as the nature of manufactures and agricultural interests, parks and other amusement centers, riding habit, competing lines, etc. Such reports are printed from time to time in financial pages of this and other magazines, but, as above explained, they must be used with caution. Our engineer, having such a table at hand, can, by averaging the quantities and applying them to the road in question, obtain a very close check upon the probable revenues and operating expenses.

If these calculations show that our project is worthy of completion, our engineer should now proceed with the preliminary survey of the route.

Preliminary Field Survey.

The next epoch in the life of our railway is a preliminary field survey.

A preliminary survey consists of an instrumental examination of the country along the proposed route. This is carried on with the aim of gathering details of distances, elevations, topography, etc., to be used in preparing maps and profiles of the route, making approximate estimates of construction cost, and furnishing data to be used in deciding upon the final alignment and grade of the road.

With all possible information and maps in his possession, our engineer will now commence his tour of reconnaissance. Starting at one end of the proposed route, he will by careful personal observation, gain all possible knowledge of the nature of the country to be traversed, natural features to be overcome, such as rivers to be crossed, hills and valleys to be circumvented, and watchfully keep notes of all features which later will have any possible weight in causing detours to be made, or the deflection of the railway from a straight line between the two termini. He will also keep careful notes of all his observances relating to probable business both im-

mediate and future. During reconnaissance, the economies of construction and operation must be ever present in the observer's mind. He will be continually confronted with the problem of deciding whether it will be more profitable to the investors that extra expense be incurred in order to serve an adjacent community or that the distance be kept as short as possible, and trust that traffic will seek the railway rather than the railway seek the traffic. The responsibility of the entire proposition now rests upon the shoulders of the engineer, and every detail must be carefully weighed before any decision is given.

The natural lay of the land decides very definitely what the make-up of the survey party will be. When reconnaissance has been thorough, and one route has been approximately decided upon, the survey assumes a more accurate class of work, and a closer examination of the engineering features to be overcome. In rough country knowledge of the topography of the adjacent land will be absolutely necessary in deciding upon the most economical location. Preliminary work should be pushed with as much speed as is consistent with general accuracy, no delays being made for the purpose of correcting minor details. The organization of a party for the general location will be as follows: A chief engineer, who is well acquainted with the previous reconnaissance work, assistant engineer, two chain men and a stake man, a topographer and a flag man, plus what laborers may be needed to clear the line of sight and assist in other ways, and a leveler with one or two rod men.

The chief engineer will be in active charge of the party. He will precede the party, stationing the head flag man or otherwise directing the line of march. He records in his notebook data relating to lands passed over, such as value and owners' names. Noting also the conditions of each waterway to be crossed and approximate size of bridges required. He should keep the line of survey as nearly as possible confined to the location which will finally be used. He should at all times strive to be on friendly terms with property owners upon whose lands he may trespass. The good will of these people may sooner or later have a large value in dollars and cents to his company.

The assistant engineer has charge of the instruments and the chain and stake men. In rough or wooded country he will find that work done with the compass, the compass usually having a better needle than the transit, will serve the purpose as well as that of a more accurate transit line. Stakes indicating the station numbers will be set on the center line of the proposed right of way. All angles between center line of right of way and intersecting fences and highways will be recorded, together with the station numbers and the pluses to such intersections. Every particle of data which might be of any possible future use must be carefully noted and recorded.

The leveler with his rod men follows the transit or compass party. Good instruments are essential for this work. A self-reading rod with prominently marked divisions is best for the preliminary work. A reading should be taken at every station, and at all breaks in the profile of the center line. The elevations of both low and high water marks should be taken and recorded for future use in determining the location and sizes of bridge work. In case of steep side-hill work, a line of levels should be taken on either side, and about fifteen or twenty feet distant from the center line. Such additional profiles will be necessary in approximating the earth work. Bench marks should be made every half mile, and in rough country every quarter mile. It is a good rule to always use a bench mark as a turning point. This makes the bench mark a part of the through line, thus doing away with any possible error in an extra bench mark rod reading. The instrument heights and turning point elevations will be calculated at each set up. On turning points the rod should be read to hundredths of a foot. But for stations and pluses, readings to the nearest tenth of a foot will be found accurate enough.

The levels are the most essential part of this survey, so much care should be taken in the use of both the instrument and the rod. Data for foundation work and soundings of streams to be crossed are made and kept by the level party. The leveler should endeavor to follow closely upon the transit or compass party, that his work may be of more advantage to his chief.

Each night when the party returns to the boarding place all transit and level notes should be checked and then transferred to books kept in some safe place. This will insure against any retracing of the line being necessary in case notebooks are lost while on the work. The profiles secured during the day should also be plotted so that the chief engineer may observe how the possible grades and alignment are running.

Where rough country requires some topographical work, the sketcher will be furnished with all elevations obtained by the level party, he following directly behind the leveler. The instruments necessary for his work are a hand level, sight alidade, a compass, an aneroid and a 50-ft. tape, or such work is more often done by the stadia method. He should not hesitate to sketch a sufficiently wide strip on either side of the center line. Such data will be useful in the location of the barrow pits, if not essential in the locating of the line. He will locate all adjacent buildings by three intersecting lines, using the plotted center line as a base, and his sight alidade to obtain his intersections. The contour interval should be five feet on this work, except in exceptional cases when it may be enlarged or lessened to suit circumstances.

Office Work Following Preliminary Survey.

With the completion of the preliminary survey comes the office work based upon the data obtained in the field. This consists of the paper location of the track alignment and the placing of grade lines. The preliminary field survey and the office work connected with it should under no circumstances be done in a careless manner.

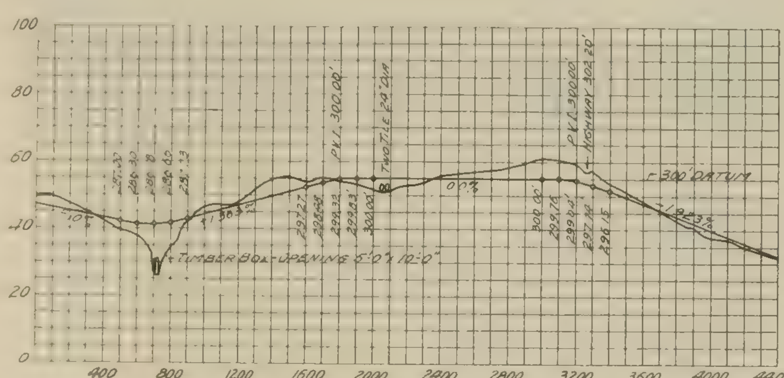


FIG. 1.

There are few electric railways at the present date operating upon their own right of way in which the location could not have been materially bettered in many places by a further and more careful study. The great cause for trouble at the time of the preliminary work is the anxiety of the promoters to have their right of way descriptions and their estimate ready for actual use. As soon as the engineer gets in the field they start pushing and hurrying him until he is forced into finishing but one line, where in many instances it would be policy to have complete preliminary work extending over several locations. Railroad location is an equally fine art with that of the selection of the designs for equipment and power distribution, and there are many illustrations of the fact that errors in location will cause a much greater financial loss during the operation period than errors in the first named details.

Having the results of a preliminary survey now at hand, the next work of the engineer is the drawing of the location maps. If United States Geological Survey sheets, as described in an earlier part of the article, are to be had, they will be found a great help in this work. Maps will be platted to a scale of two hundred or four hundred feet to the inch on paper twenty to twenty-five inches wide. Upon these sheets will be traced all available contours and other data now collected, and which is to be used by the locating engineer in connection with his work. The station numbers and bearings of all lines intersecting the railway center line should be shown. In fact this map should exhibit all the information necessary to enable another person to fully identify any locality along the route. Indicate upon the map true and magnetic meridians where both are known.

Profiles are usually made upon specially prepared paper. The most commonly used paper has a horizontal scale of four hundred feet to the inch, and a vertical scale of twenty feet to the inch

This ruling is done upon transparent paper, so that prints may be made as the work progresses and the drawings are changed from time to time. The profile scale is distorted for the purpose of more clearly showing the breaks in the surface line. Fig. 1 is a section of profile on an electric railway paralleling a highway.

Profiles must show the surface line as given by the preliminary levels, or as interpolated from the topographer's contours, if the final line has been swung away from the original traverse. The fixing of grade lines is one of the most important operations in location work and should be done by the engineer in charge of the locating party, he being best acquainted with the lay of the land and detailed requirements of the line. The proposed grade line, together with the amount of earth or rock work in each cut or fill of any size, the height above datum where any break occurs in the grade line, the rate per 100 feet of all gradients, the point of curve, point of tangency, rate of all curves and the true bearing of all tangents and intersecting center and fence lines should also be given. Proposed bridges, culverts and trestle work will be noted and placed in their proper location on this profile.

The datum should be so chosen that space will be left at the bottom of the profile paper in order that a rough right of way map may be drawn there and the track alignment better shown. On this part of the sheet will be shown the general characteristics of the country, such as the prominent natural features, governing points and survey reference points, drainage, etc. From such a profile one should be able to make a complete bill of the material needed

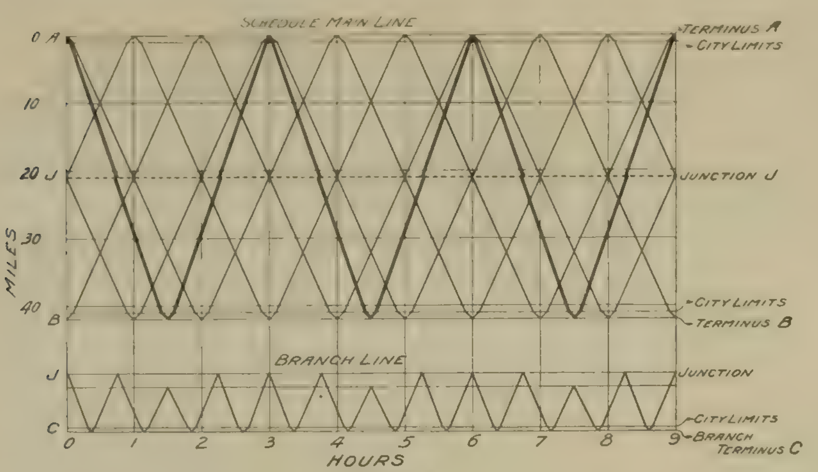


FIG. 2.

and the work to be done, the map showing where the material is to be placed and how the work is distributed.

From time to time during steps in the work as above described the engineer has continually added to his stock of information concerning the probable business to be handled upon the tracks of his company. His original data should now be corrected where necessary.

With all this corrected data well in hand, he will now arrange a schedule of train movements, and from it obtain an estimate of the power and distribution system needed. The speed at which passengers and freight are to be hauled will depend entirely upon circumstances. Competition with existing lines will largely control the speed of passenger cars or trains, whichever they may be, while grades, alignment, and final arrangement of the passenger schedule will affect the speed of the freight trains. In deciding upon a given schedule speed for any run, due regard must be given to the ratio between speed and power consumption.

"The schedule speed may be a large factor in determining the commercial successes or failures of an enterprise. As an illustration, the watt-hours per ton-mile, allowing a stop every two miles, required for a 40 mile per hour schedule, are 142, while for a 35 mile per hour schedule there are required about 99 watt-hours per ton-mile. If we assume, as an average, a road 30 miles long, over which are made 100 round trips per day, with cars weighing 45 tons each, and assuming a loss of 25 per cent between the motors and the main power station board, and taking the cost of energy at 6-10 of a cent per kilowatt hour we have

$$\frac{100 \times 30 \times 2 \times 45 \times 0.006 \times 365 \times 142}{0.75 \times 1{,}000} = \$111{,}952.80$$ as the cost of operating the 40 mile per hour schedule with single car units, and

$$\frac{100 \times 30 \times 2 \times 45 \times 0.006 \times 365 \times 99}{0.75 \times 1{,}000} = \$78{,}051.60$$ as the cost of operating the 35 mile per hour schedule with single units.

"The difference between these costs is $33,901.20, which at 5 per cent is the interest on $678,024; for a road 30 miles in length, the time between termini for the 35 mile schedule would be 51.4 minutes, while the time for the 40 mile schedule would be 45 minutes; a difference per trip of 6.4 minutes." (See page 205, Electric Railway Economics, by W. C. Gotshall.)

If our road is in direct competition with some steam railway having a high schedule speed, then on examination the engineer will undoubtedly find that a limited as well as a local schedule will be an economical feature. Many such schedules have been devised. Most of them consist of a single "limited" car, leaving one of the termini one headway behind a local car, and the relative speeds of the two cars so arranged that one headway period is gained by the limited car by the end of the run or on reaching a passing point for meeting cars from the opposite direction. The expense per car-mile of operating a limited schedule is very much less than that of a local, due to the loss of time and power at the frequent stopping on the local schedule. Limited service where it has been tried in actual operation has paid well. The fast cars seem to be the means of originating traffic peculiar to themselves, probably gaining it for the most part at the expense of their steam competitors.

A combination schedule showing both limited and local service designed for the use of a road having a through line and a branch line with a junction near the center is shown in Fig. 2. The author is indebted to Mr. Ernest Gonzenbach for this novel scheme. This schedule indicates regular local cars of one hour headway, making the run between the termini A and B in two hours. Allowance is made for a slower schedule while on the city tracks at the terminals. Every three hours there start from the main line terminals at A and B, directly ahead of a local car, limited trains of two cars each, capable of making the entire run in one and one-half hours. In each train one of the two cars making up the unit is a through car destined for a run from one end of the main line to the other. The other car of the train is destined for the terminus of the branch line at C. On arriving at the junction J the car for the branch line is set off while the car from the branch line terminus C, which is destined for the main line terminus, is picked up. This limited service calls for a schedule speed of twenty miles per hour with stops averaging eight miles apart, and provides for the carrying of passengers from one terminus to any other, without requiring them to change from the car they first entered. While the through car could be hauled as a trailer by this schedule, the high schedule speed of approximately thirty miles per hour would preclude any such an arrangement. This schedule then necessitates all cars being equipped with motors and a multiple unit system of control.

The above illustration is only one of the many possible combinations which may be used in the schedules of cars and trains. Each road has physical features peculiar to itself, and so will demand a schedule unique for its own operation. I wish to again repeat the thought before stated, namely, that great care and mature judgment must be used in designing any schedule so that its success can be assured for any individual situation.

(To be continued.)

The United Railways Co. and the St. Louis Transit Co. secured an order from the United States Circuit Court citing the city to show why the companies should not secure an injunction to prevent the collection of one mill for each paid passenger. The complainants stated that the tax would cause the payment of $150,000 illegally and would violate an agreement whereby the company is to pay the city $100,000 in annual payments.

Narrow-Gage Road from Lausanne to Mondon.

BY E. GUARINI.

A narrow-gage electric railway has recently been put in operation between Lausanne and Mondon, Switzerland. The road was constructed by Rieter & Co., of Winterthur, and is one of the most interesting in the Helvetian Republic. In addition to the main line, which is about 14¼ miles long, there is a branch line running from Marni to Savigny, a little over three miles long, giving a total length of the road of about 17½ miles. Of this distance 5½ miles is located on private right of way, the rest being built upon the highways. There is a difference in level of a little over 900 ft. between the termini, and this required the construction of grades from 6 to 7 per cent and the minimum radius of curves on the line is 270 ft. The roadbed is built with T-rails laid on oak ties, and the rails are bonded with "Columbia" rail bonds.

The rolling stock consists of seven motor cars, three having double trucks and four with single trucks, and three express and freight cars. The double truck cars are 7 ft. 6 in. in interior width and are 47 ft. 8½ in. long over the buffers. The carriage is divided into four separate compartments; third-class, smokers, second class, and baggage. The three passenger compartments contain altogether 30 seats and there is further room for standing passengers on the platforms and in the baggage compartment. All the windows can be opened and further ventilation is secured through the skylights. The lighting and heating of the car is done by electricity. The wheel base of the bogie trucks is 5 ft. 11 in. and the distance between the centers of the trucks is 24 ft. 8 in. The cars are provided with hand brakes having eight shoes, and also with a Hardy brake. The latter is used when the train includes a baggage car. The double truck cars are equipped with four motors, each of 35 h. p. capacity, but which are capable of developing 50 h. p. for short periods without destructive heating or sparking at the commutators.

DOUBLE TRUCK COMPARTMENT CAR.

DEPOT AT MEZIERES

In starting the motors are connected in parallel series of two and at full speed they are used all in parallel. This is probably the first use of the series parallel control with voltages ranging from 750 to 900. The motors are of the four-pole type, the armatures having a diameter of 16 in. and a length of 8 in. The armature winding is made on formers and there are 37 coils fitted into slots in the armature coils. These slots are ½ x 1 1-5 in. in section and contain 30 conductors, each 1-10 in. in diameter. The pole pieces are laminated. The efficiency at full load is 87 per cent, including the losses in the reduction gear, which is in the ratio of 1 to 4.93, and the armature runs at a speed of [illegible] revolutions, which corresponds to a car speed of about 7½ miles per hour for a normal load and with a drop of 20 per cent in the voltage. On level roadbed and with minimum drop in voltage the revolutions of the armature reach 1,060 per minute, corresponding to a speed of 22 miles per hour. The starting resistance and the resistance for the brakes, which are arranged underneath the car, are designed to absorb the work of motors on down grades when they are acting as generators. The current is taken by means of trolleys, as it was not possible to use bows, which are preferable in many ways, because of the heavy pressure necessary, especially in winter, which wears out the bows very rapidly.

The single truck cars are of the ordinary tramway type, having enclosed platforms. They contain seating capacity for 18 and standing room for 16 passengers. The electrical equipment is similar to that of the double truck cars and the motors are identical. The single truck cars operate the tram service between Lausanne Chalet and Gobet, and Lausanne and Savigny. The double truck cars run direct from Lausanne to Mondon only.

On the entire main line there is a double overhead trolley wire of about ⅓ in. in diameter. The branch line to Savigny has only a single trolley wire. Most of the poles are of wood and the insulators are of American make. At distances of about 3,000 ft. there are inserted in the overhead wires regulators which remedy the effects of expansion and contraction in the wire due to variations in temperature. Lightning arresters of the Carton type are placed 4,500 ft. apart along the line. At the principal stations arrangements

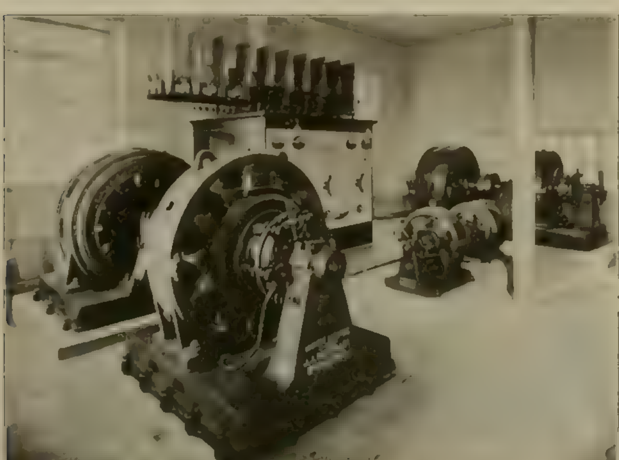
are provided so that different sections of the line can be cut out of the circuit in case it is necessary to make repairs or do other work upon the line. Current is supplied from the central station at Montbovon, in the district of Fribourg.

The current is three phase and of 8,000 volts pressure and is transmitted by a conductor of three wires of ¼ in. in diameter to the main station at Mezieres, 15¾ miles from Montbovon. Provision is made so that in case of a break in the line from Montbovon current can be obtained from the electric station at Hauterive. This station is in fact held as a reserve. From Mezieres, where a transformer station is located, conduits are run to Epalinges, the next transformer station, and also to a number of places

VIEW ON LINE NEAR SYENS

along the railway line to which the railway company furnishes three-phase current for lighting and power at 210 volts pressure. Each of the transformer stations contains two groups of motor generators of 200 h. p. capacity, one of which is held in reserve to supply any extraordinary demand for current. The motors of these sets take current at 8,000 volts.

Each transformer station is provided with an induction motor and a synchronous motor for the reason that the same high tension conductor which feeds the converters also feeds the lighting system by means of transformers. The synchronous motor, during the hours of lighting, which coincide with the hours of railway service, permits of uniform regulation of the pressure of the electric current and consequently assures a good lighting service. On the contrary, the use of the induction motor causes some inevitable



SUB-STATION AT MEZIERES

fluctuations in the voltage of the high-tension conductor. At times when the current is not used for lighting the use of the induction motor offers great advantages. It is much less sensitive to heavy momentary overloads, and when it produces interruptions in the current it does not occasion the interruptions to the service which would be produced in the case of the synchronous motor.

The synchronous motors and the induction motors are both constructed for the use of 8,000 volts and have a capacity of 200 h. p. They run at 500 r. p. m. at 50 periods and have 12 poles. The stator of the synchronous motor has 72 slots, each with 62 conductors of .1 in. in diameter, enclosed in tubes of mica. The poles are wound with rectangular copper wire .2 in. thick. The efficiency of the motor at full load is 93.5 per cent, and the rise of temperature for a short run is not above 35° C. The stator of the induction motor has 108 slots, each with 52 conductors, and the rotor has 108 slots with two conductors. The efficiency at full load is 92.5 per cent and the rise of temperature under continuous operation is not above 40° C. The continuous current generators directly coupled to the motors are shunt machines with armatures 54 in. in diameter. The armature has 220 slots of two conductors and these machines generate at a pressure which may be varied by the regulator between 750 and 900 volts. Their efficiency is 94.5 per cent, making the efficiency of the converter unit 87.5 to 88.5 per cent at full load and 83.5 per cent at half load.

On two opposite walls of the stations between the two groups of converters and entirely separated from each other are the two switchboards, one for the three-phase high tension current and the other for the continuous current at 750 volts. These two switchboards contain the usual apparatus and the high tension conductors are carried to the high tension switchboard in an iron column. Immediately above the board is placed an iron frame carrying the lightning arresters for both the incoming and outgoing conductors. Underneath the high tension switchboard is a small compartment in which the transformers for the lighting are placed.

The Mezieres station contains in addition to the converters a small storage battery of 385 cells with a total capacity of 168 ampere hours, capable of being discharged in an hour. This battery provides a reserve in the case of small interruptions in the current coming from Montbovon. A small converter of 30 h. p. capacity converting from three-phase to continuous current furnishes the auxiliary pressure for charging the battery.

Progress on Joliet, Plainfield & Aurora R. R.

The Fisher Construction Co., of Joliet, Ill., is making rapid progress toward the completion of the Joliet, Plainfield & Aurora Railroad Co's. line from Plainfield to Aurora, and it was expected that the line would be finished as far as Normantown by the middle of May, and to Aurora by the first of July. During the first half of April the track was laid from the center of the village of Plainfield west to the Du Page river, where the track crosses the stream on a 155-ft. steel span bridge which was erected by the American Bridge Co. Track laying for two miles west of the Du Page river has just been completed.

The Joliet, Plainfield & Aurora Railroad Co. has purchased 10 acres of beautiful grove located on both sides of the Du Page river, immediately south of where the road crosses the river, and has fitted it up for picnic purposes. The river has been dammed at this point, affording a two-mile boating course and excellent bathing facilities. A livery of steel row boats and electric launches has been provided.

Lebanon & Columbia (Ky.) Ry.

The Lebanon & Columbia (Ky.) Railway Co., which was recently incorporated with a capital of $1,000,000, proposes to build an electric line between the cities named, a distance of 46 miles. The new road will open up a large section that is now without railroad facilities, and it is stated to be a populous and productive region. It is proposed to do a freight business, as well as a passenger traffic. The route has been located so as to secure easy grades and a good alignment, and it is expected that the cost of construction will be moderate in consequence. Most of the rights of way have been contributed by the land owners and ample easements have been secured. The incorporators of the company are W. K. Azbill, W. W. Bradshaw, G. W. Peterson, L. C. Rawlings, R. N. Wathen, J. M. Knott, J. T. Page, W. R. Myers, C. S. Harris, T. M. Estes, E. C. Lewis, T. A. Peterson, J. H. Young, J. N. Conover, T. R. Stults, John Penn, J. H. Kelley, T. C. Jackson, Wayne Hogan and W. H. Youwell.

The Chicago Union Traction Co. contemplates establishing another loop in the downtown district of Chicago, encircling Harrison, Dearborn and Van Buren Sts. and Fifth Ave.

Trinidad Electric Railroad Co.

Description of the Plant, Roadbed and Rolling Stock of the New Urban and Interurban Lines Recently Put Into Operation in Trinidad, Colorado.

April 28th the newly completed lines of the Trinidad Electric Railway Co. were put into operation, the occasion being a memorable one in the history of the city and the day being given over to a general celebration by the inhabitants of this and the surrounding towns. The road comprises five miles of city track and nine miles of interurban track, all of which is single track. The line passes through a mountainous country necessitating a considerable number of curves and grades, the maximum grade being 7 per cent for a length of 1,500 ft. All of the rolling stock of the company [illegible] in service on the opening day and it is estimated that [illegible] to 7,000 people were carried over the road during the [illegible]. The ceremonies concluded with a banquet at which 150 guests of the railroad company were present.

Mr. [illegible] Read, president of the company, initiated the movement which resulted in the building of the road. After looking over the situation last June Mr. Read made an arrangement with the Chamber of Commerce of Trinidad whereby he would build an electric railroad and an electric lighting plant within 18 months under the following conditions: The Chamber of Commerce was to secure the passage by the city council of a 50-year franchise for the electric railroad and also a 25-year franchise for an electric lighting and power plant; to carry the election necessary under the law for the lighting plant and get for the company a five-year contract for street lighting at $5,000 a year; to secure the right of way through the city and the consent of the property owners to lay the railroad track on the city streets, to provide free of cost to the company the necessary right of way between Trinidad, Sopris and Starkville. These terms were accepted by the Chamber of Commerce and about $10,500 subscribed by the citizens of

HORSE-SHOE CURVE ON TRINIDAD ELECTRIC RAILROAD.

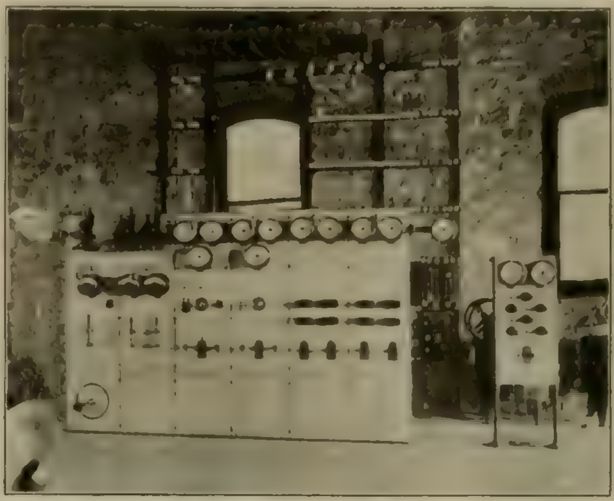
VIEW OF LINE NEAR STARKVILLE

POWER HOUSE TRINIDAD ELECTRIC RAILROAD

Trinidad for the purchase of the right of way for the interurban line. Associated with Mr. Read were Messrs. B. F. and P. M. John-

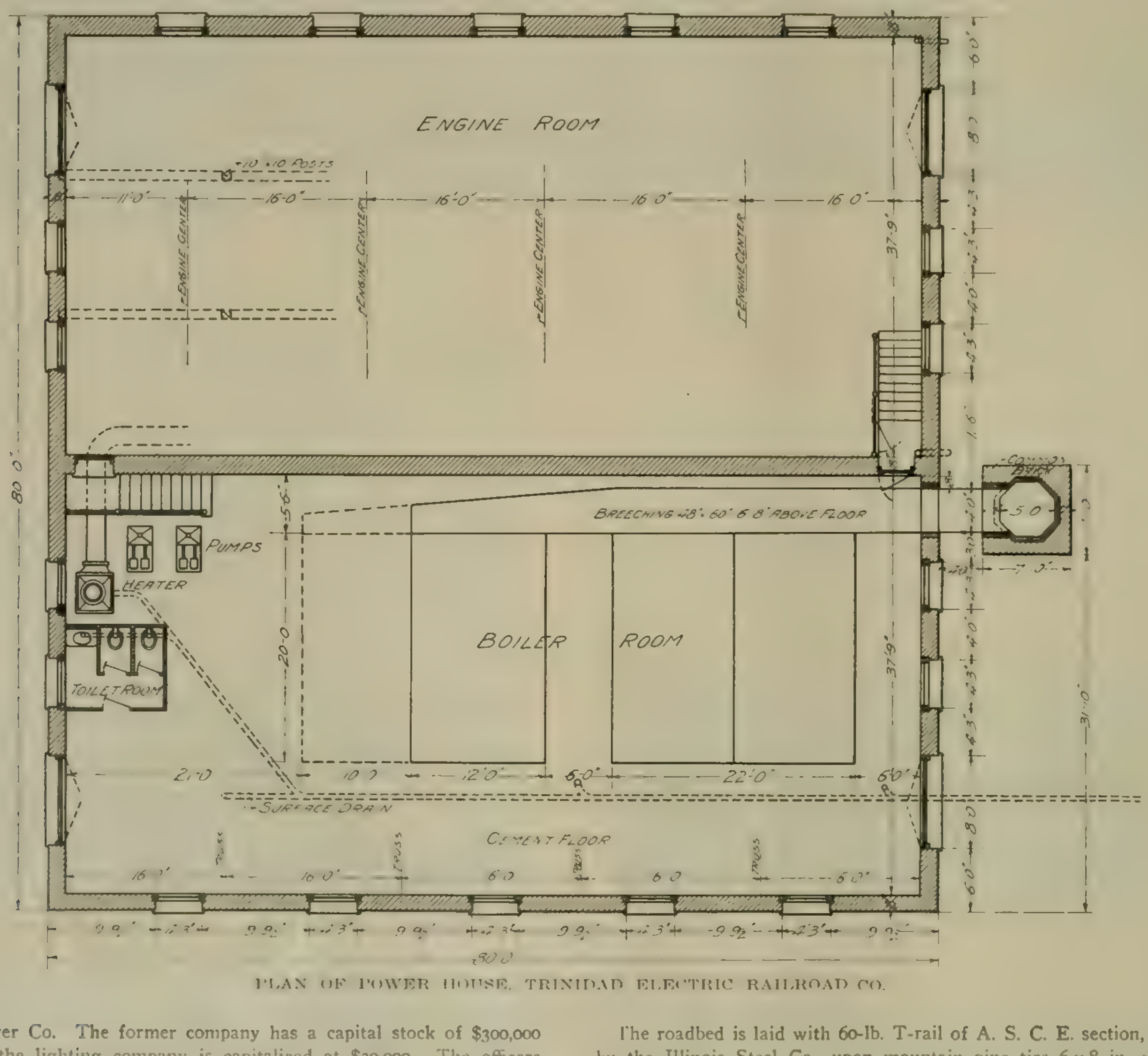
BOILER ROOM, TRINIDAD ELECTRIC RAILROAD CO.

ston, and these gentlemen own the entire capital stock and bonds of both the Trinidad Electric Railroad Co. and the Trinidad Light & Power Co. The former company has a capital stock of $300,000 while the lighting company is capitalized at $30,000. The officers of the two companies are the same: Frank P. Read, president; E. H. Day, vice-president; G. G. Turner, secretary; G. W. Harlan, treasurer and auditor; Dennis Aper, superintendent. The Electrical



SWITCHBOARD, TRINIDAD ELECTRIC RAILROAD CO.

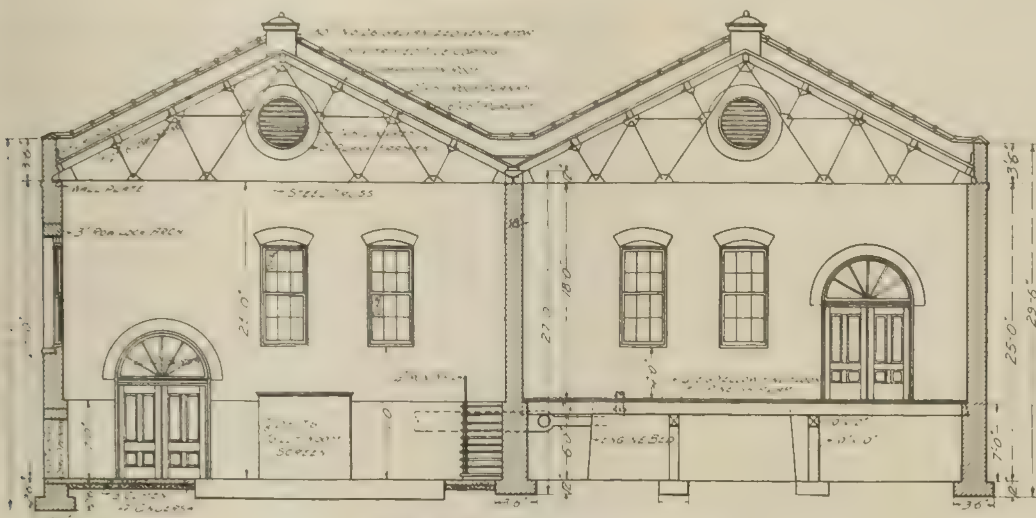
Installation Co., of Chicago, is the general contractor and electrical engineer for the railway and lighting systems.



PLAN OF POWER HOUSE, TRINIDAD ELECTRIC RAILROAD CO.

The roadbed is laid with 60-lb. T-rail of A. S. C. E. section, made by the Illinois Steel Co., upon mountain pine ties 6 x 8 in. x 8 ft. long, spaced 2 ft. between centers. The rails are joined by standard

four-bolt, 24 in. fish plates and are bonded with No. 0000 10-in. Atkinson protected rail bonds. The overhead construction comprises a No. 00 round trolley wire supplied by the W. A. Clark Wire

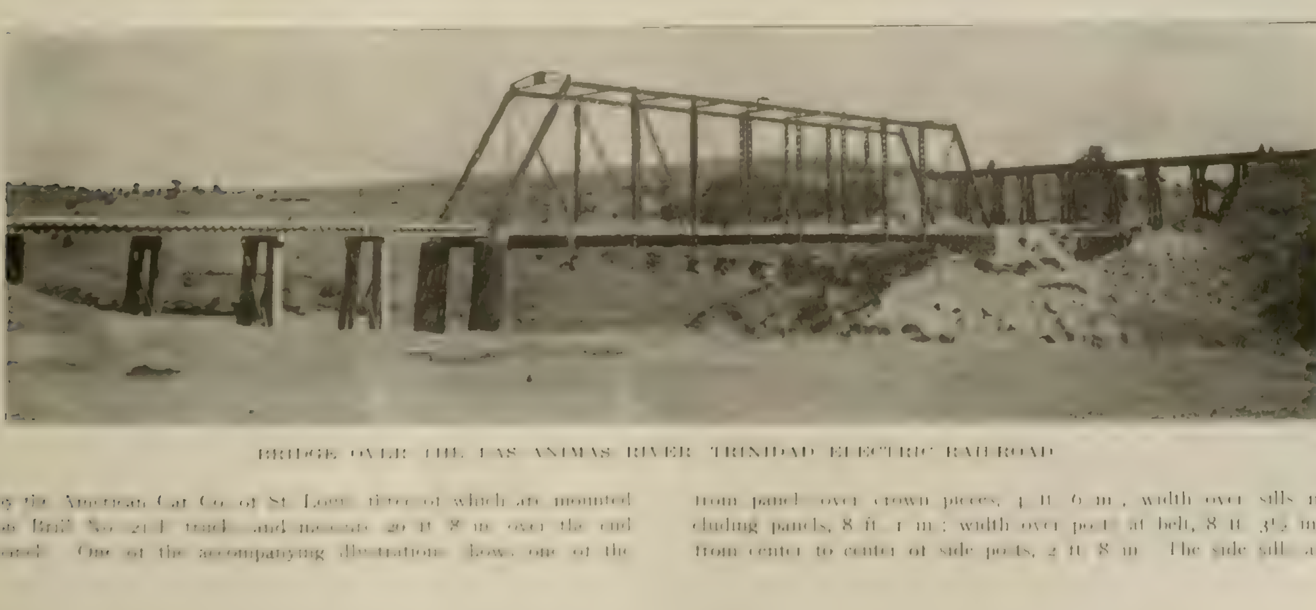


CROSS SECTION OF POWER HOUSE.

Co. and one 300,000 c.m. feeder six miles in length. The insulators and other overhead material were furnished by the Electric Railway Equipment Co. and the pole line is built with Idaho cedar poles.

The rolling stock consists of five Brill semi-convertible cars built by the American Car Co. of St. Louis, three of which are mounted on Brill No. 21-E trucks and measure 20 ft. 8 in. over the end panels. One of the accompanying illustrations shows one of the cars intended for the interurban line which measures 34 ft. over the body and is mounted on American Car Co. M. C. B. trucks, No. 14-B-1. The larger cars have baggage compartments which, except for the sliding doors and window bars, have the appearance of smoking compartments. When these are not used for baggage the folding seats which they contain are used to accommodate smokers. The dimensions of the city cars are as follows: Length over end panels, 20 ft. 8 in. and over crown pieces 29 ft. 8 in.; from panel over crown pieces, 4 ft. 6 in.; width over sills including panels, 8 ft. 1 in.; width over posts at belt, 8 ft. 3½ in.; from center to center of side posts, 2 ft. 8 in. The side sills are

INTERURBAN CAR, TRINIDAD ELECTRIC RAILROAD


BRIDGE OVER THE LAS ANIMAS RIVER, TRINIDAD ELECTRIC RAILROAD

4 x 6¾ in. with 12 x ⅜ in. plates on the insides. The size of the end sills is 5¼ x 6¾ in. and the width of aisles 23 in. The distance from the rail head to the platform step tread is 14½ in. and from the step to the platform 12¾ in. The seats are 36 in. long and accommodate 28 passengers. The wheel base of the trucks is 76 in.

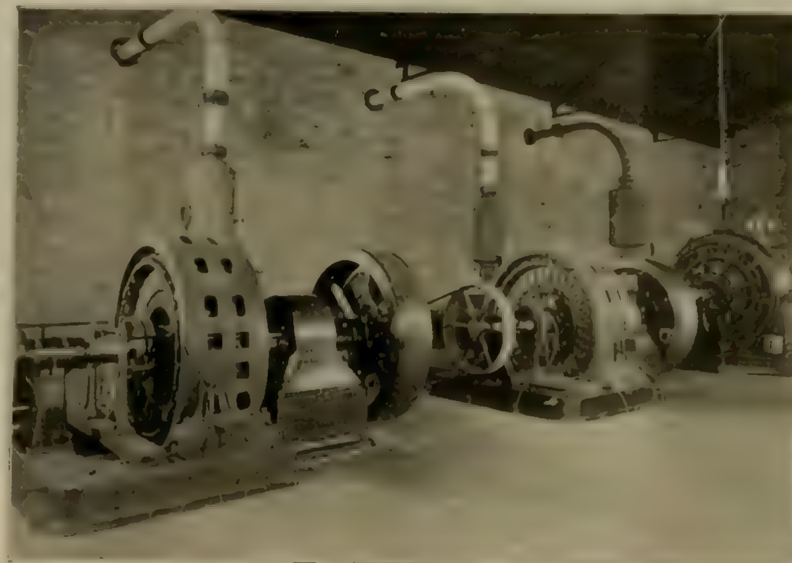
The combination passenger and baggage cars are 34 ft. over end panels and 43 ft. over crown pieces. From the end panels over the crown pieces is 4 ft. 6 in. and the width over the sills including sheathing is 8 ft. 4 in. Other dimensions are as follows: Distance between side posts, 2 ft. 8 in.; size of side sills, 4½ x 7¾ in.; size of end sills, 5¼ x 7¾ in.; sill plates on inside of side sills, 12 x ⅜ in.; side posts 3¼ in. thick and corner posts 3¾ in. The seats in this car, which are 36 in. long, leave the aisle 23½ in. wide and provide seating capacity for 36 passengers. The illustration gives an idea of the open appearance of these cars when the windows are raised into the roof pockets. The trucks have a wheel base of 6 ft. All of the cars are handsomely finished in cherry with birch ceilings and they are equipped with angle iron bumpers, Dedenda gongs and Brill radial draws bars. These cars are also equipped with Westinghouse No. 68-C motors, International registers, electric heaters, made by the Consolidated Car Heating Co. and Nichols-Lintern sand boxes. All the wheels were made by the St. Louis Car Wheel Co. and weigh 550 lb. They are 33 in. in diameter with 3-in. tread, 1-in. flanges and are mounted on 5-in. axles. These cars are provided with Christensen air brakes made by the National Electric Co., and electric brakes are provided on the single truck cars.

CAR BARN AND SHOPS

The power house for both the railway and lighting plant, as well as the car barn, is located just outside of the city of Trinidad, near Day's Lake, this being at about the center of distribution of the system. The building has a double gabled roof and is constructed of Colorado white sandstone. It covers an area of 80 x 80 ft. and the walls extend 25 ft. above the floor line and average 20 in. in thickness. The building was erected at a cost of $10,000. A longitudinal wall divides the building into two rooms of equal size, the one on the east side of the building being used as a boiler room and the opposite room for the engines and generators.

The engines and boilers are set in two parallel rows on either side of the partition wall, thus permitting future extensions.

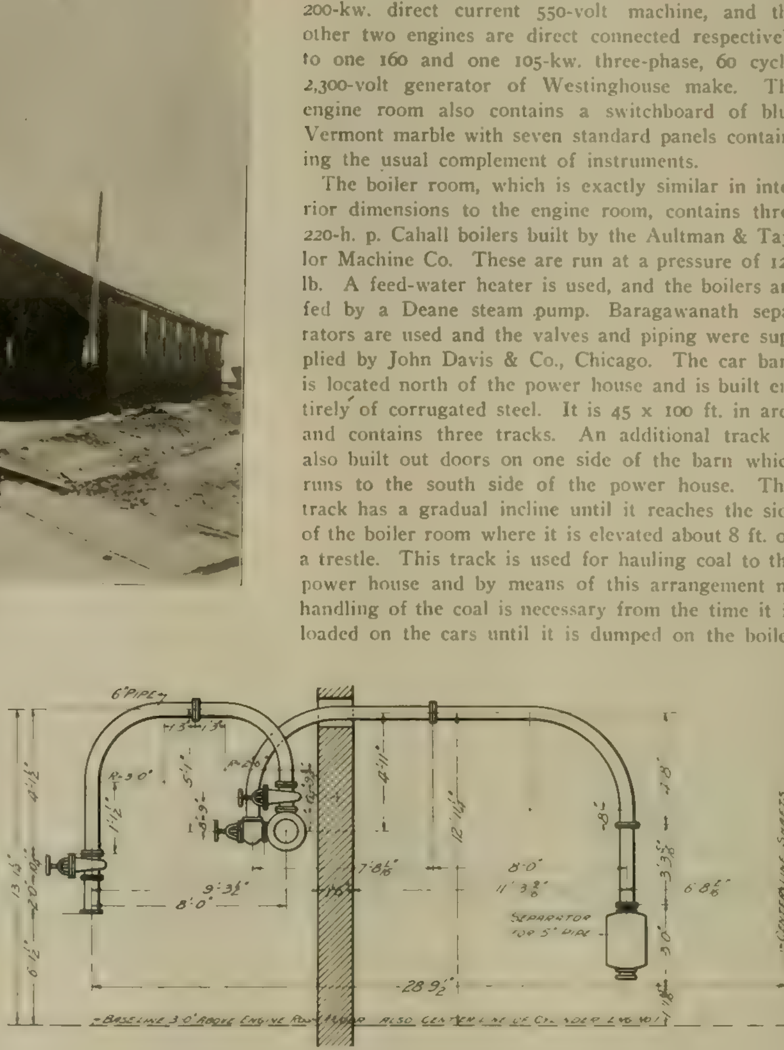
The engine room measures 39 ft. 9 in. x 77 ft. and contains three



INTERIOR OF POWER HOUSE

engines built by the Watertown Engine Co. One of these is of 300 h. p., one is 225 h. p. and one is 150 h. p. The largest engine is direct connected to a 200-kw. direct current 550-volt machine, and the other two engines are direct connected respectively to one 160 and one 105-kw. three-phase, 60 cycle, 2,300-volt generator of Westinghouse make. The engine room also contains a switchboard of blue Vermont marble with seven standard panels containing the usual complement of instruments.

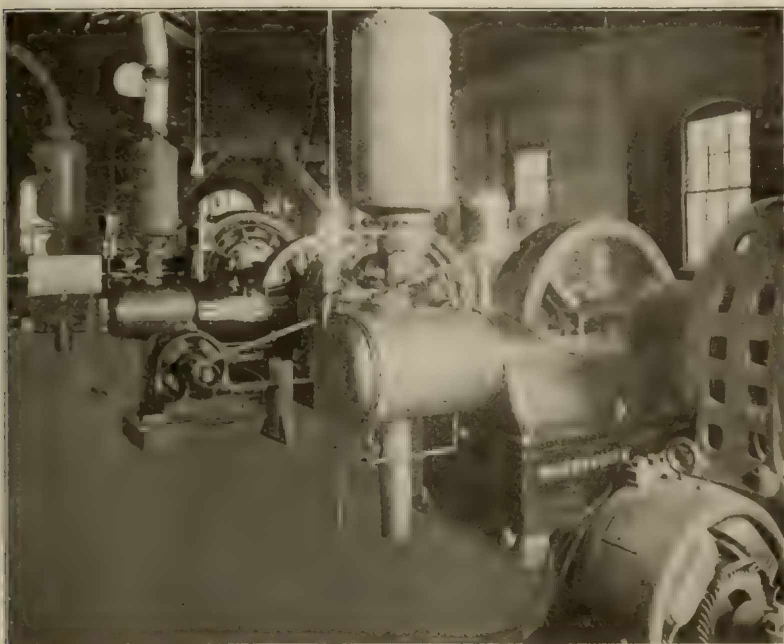
The boiler room, which is exactly similar in interior dimensions to the engine room, contains three 220-h. p. Cahall boilers built by the Aultman & Taylor Machine Co. These are run at a pressure of 125 lb. A feed-water heater is used, and the boilers are fed by a Deane steam pump. Baragawanath separators are used and the valves and piping were supplied by John Davis & Co., Chicago. The car barn is located north of the power house and is built entirely of corrugated steel. It is 45 x 100 ft. in area and contains three tracks. An additional track is also built out doors on one side of the barn which runs to the south side of the power house. This track has a gradual incline until it reaches the side of the boiler room where it is elevated about 8 ft. on a trestle. This track is used for hauling coal to the power house and by means of this arrangement no handling of the coal is necessary from the time it is loaded on the cars until it is dumped on the boiler



CROSS SECTION OF POWER HOUSE PIPING

room floor. A spur track one mile long has been built for the purpose of bringing the coal direct from the mines to the company's power house.

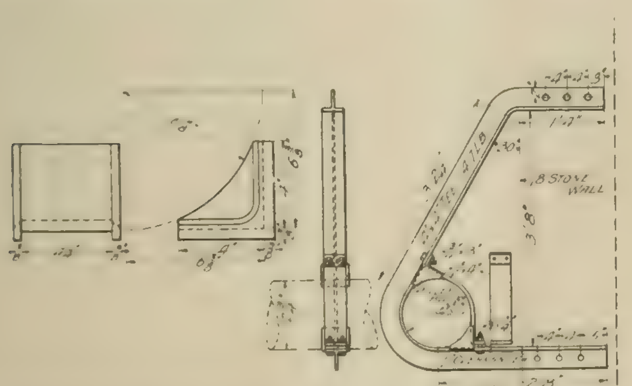
At the present writing no regular schedule has yet been adopted, but it is expected to operate the interurban cars at a schedule speed



VIEW IN ENGINE ROOM

of 25 miles an hour. The fare within the city limits is five cents and from Trinidad to Starkville and Sopris is fifteen cents.

The lighting plant has already been taxed to its utmost capacity, as lighting contracts aggregating $35,000 per annum have been closed, including the contract for city lighting. The company has



DETAILS OF BRACKET FOR SUPPORTING STEAM HEADER

already ordered additional boilers and another 600 kw. alternating current generating unit for the combined service.

The entire plant was designed by the Electrical Installation Co., the general contractor.

The Decatur (Ill.) Traction & Electric Co. has adopted the profit sharing plan and on May 1 each employe was paid a sum equal to 5 per cent of his wages during the year.

"Trolley Rides in City and Country" is the title of an illustrated folder issued annually by the Detroit United Ry. and treating of the attractive rides in and around Detroit. One side of the folder contains a topographical map showing the Detroit United Ry's. interurban lines; there is also a map of the city system. A table shows rates of fare, distances, etc. At this season this folder is in great demand by the patrons of the road.

Southwestern Electrical & Gas Association.

The Southwestern Electrical Association and the Southwestern Gas, Electric & Street Railway Association held a three-days' joint convention at Dallas, Tex., April 25-27th, at which it was voted to merge the two associations, whose territories were similar, under the name of the Southwestern Electrical & Gas Association. Each of the old associations met on the morning of the first day and transacted routine business, after which each appointed a committee to confer relative to consolidation. The opening joint session was held at 2 p. m. April 25th, and A. E. Judge was chosen chairman. There were addresses of welcome by the mayor of Dallas, Hon. Bryan T. Barry, and the president of the Commercial Club, Capt. D. E. Grove.

Papers were read and discussed as follows: "Meters and Methods of Selection," by H. H. Scott, of the San Antonio Gas & Electric Co.; "Economies of the Meter," by J. R. Cox, superintendent of the Brush Electric Light & Power Co., Galveston, Tex.; "Motor Service and Sale of Power by Street Railways," by L. M. Levison, superintendent of the Shreveport (La.) Traction Co.; "Operation of Single-Phase Motors from the Central Station Standpoint," by J. R. Cullinane, secretary of the Denison Light & Power Co. At the conclusion of the paper by Mr. Levison, who detailed the development of motor service in connection with street railway work, that gentlemen offered to send, upon request, to those interested, his schedule of rates, sizes of motors in operation, kinds of motors and fans used, blank contracts and other information.

The program of the second day's session included the following papers: "Advantages of Combination of Gas and Electric Plants," by R. R. Stitchter, superintendent of construction, Cleburne (Tex.) Gas & Electric Co.; "Combination of Public Utilities in Small Cities," by E. L. Wells, jr., manager Arkansas and Texas Ice & Coal Co., Marshall; "Benefits and Evils of Telephone Competition," by J. E. Farnsworth, general manager Southwestern Telegraph & Telephone Co., Dallas, Tex.

The morning session of the third day was also devoted to the consideration of papers, which included the following: "Central Station and Telephone Acounting," by Mr. Shaw, president of the Shaw Water Co., Muskegon, Mich.; "Accidents and the Damage Suit Industry," by H. F. MacGregor, vice-president of the Houston Electric Co. Mr. MacGregor's paper dealt with the element of uncertainty and loss to corporate investments in Texas arising from accidents and damage suits and pointed out how many of the accidents could be prevented by care. His remarks were addressed mainly to the people of Texas, which state suffers because of a lack of confidence in the safety of corporate investments there. He urged continuous effort on the part of the members of the association in giving publicity to existing conditions and to ask the representatives in the legislature to provide adequate penalties for fraudulent accident claims and thus make investments secure and attractive in Texas.

The officers chosen for the new association are: President, J. F. Strickland, Waxahachie; treasurer, A. E. Judge, Tyler; secretary, F. E. Scovill, Austin. Denison, Tex., was named as the next meeting place.

During the convention there were trolley rides, smokers and a vaudeville entertainment at Hadley Park. On the second evening a diversion was furnished by the initiation of 40 members into the order of the "Sons of Jove," which is composed of persons over 21 years of age who are engaged in some branch of electrical work, or allied industries, or who may be engaged in the study or teaching of the science.

The Chicago General Railway Co. has placed slot machines for the automatic vending of chewing gum, candy, etc., in all of its single truck cars. In side-door cars the machines are placed in the corner nearest the door and in double-door cars are placed between the door and the right-hand window. The machines are manufactured by the National Penny Sales Co., of Chicago.

Electric Railway Tests at World's Fair.

The meeting of the executive committee having in charge the matter of electric railway tests to be made during the Louisiana Purchase Exposition was held at St. Louis on May 6th and 7th, and after considering the reports of the engineering committees and the suggestions of the advisory committee it was decided to undertake the following series of tests:

A. Tests on the Service Capacities of Electric Railway Motors.

Equipments will be operated upon the special tracks at different rates and durations of acceleration, coasting and braking, with different lengths of stops, in order to determine the heating of the motors under conditions approaching as nearly as possible those of commercial practice. The motors will also be tested separately for heating and for the determination of their torque curves and accelerating power. This will render possible the comparison of the performance of the same equipment upon the track and upon the test stand.

B. Acceleration Tests.

Acceleration tests upon single cars and upon multiple equipped trains will be made to determine the ability of the equipment to bring the cars to speed quickly and economically.

C. Braking Tests.

Braking tests upon single cars and multiple equipped trains will be conducted in order to determine the quickness of action, the shapes of the braking curves, the relation between the braking forces and the applied pressures and the best methods of application of the braking forces.

D. Tests Upon Train Resistance.

Determination of the resistances due to the rails, to the journals and gearing and to the air will be made by systematic and complete series of runs. The effect of the shape of the car body will be carefully investigated. The methods to be used in measuring train resistance comprise the use of calibrated motors as the sources of power, the hauling of the car under test by calibrated dynamometers, and by noting the falling off in speed while the cars are coasting. The pressure of the air upon different parts of the car will be recorded by means of self-registering pressure gages.

In addition to this definite series, a number of other tests will be conducted upon various exhibits in the Palace of Electricity in order to determine their efficiency and reliability.

The tests A, B and C will be carried on upon the tracks which have been built for the purpose by the Exposition. These are of substantial construction, conveniently located, and of a total length of about 4,500 ft. For the test described under section D the Indiana Union Traction Co. has provided a stretch of eight miles of straight and heavily ballasted track. The resistance tests will be made after the completion of the St. Louis program.

In all of these, graphical records of the measurements will be obtained by the use of autographic instruments which will be built for the purpose or supplied through the cooperation of the manufacturing and operating companies and the technical colleges. The National Bureau of Standards will materially aid in this work by providing facilities for the calibration of all of the instruments.

For the purpose of comparison, the various railway equipments will be divided into several classes, including car weights up to 45 tons, as follows:

a. Light city service equipments,
b. Heavy city service equipments,
c. Light interurban service equipments,
d. Heavy interurban service equipments

The actual work of observation and calculation will be carried on under the personal supervision of the superintendents by a corps of young men carefully selected from among the graduates of leading technical schools, the total number of observers being between thirty and forty. The Exposition management is cooperating enthusiastically with the Railway Test Commission in providing ample facilities for the tests and substantial results of permanent value to the profession are confidently expected.

At the present time a large part of the equipment is already at St. Louis, the organization, and the ranks of the testing corps have been filled with earnest young men who mean business and who are already fitting themselves especially for the tasks before them.

The executive committee consists of: Prof. W. E. Goldsborough, Chief of Department of Electricity; Prof. H. H. Norris, Cornell University, superintendent of electric railway tests; Prof. D. V. Swenson, University of Wisconsin, and H. T. Plumb, Purdue University, assistant superintendents of electric railway tests.

Report on Manhattan Elevated Accident.

The New York Board of Railroad Commissioners has investigated the accident which occurred May 9th on the Manhattan Railway division of the Interborough Rapid Transit Co's. line. The facts are briefly as follows:

At 4:50 p. m. a south bound Third Ave. train, consisting of four motor cars and two trailers, ran into the rear of another south bound train, consisting of four motor and two trailer cars. The accident occurred at 56th St., between the 59th and 53d St. stations. At this point the track is on a tangent and there is a grade of 1½ per cent down from the 59th St. station to the point of collision, 520 ft. The first car of the second train telescoped the last car of the first train.

Both trains were equipped with multiple unit train control and with automatic quick action air brakes coupled up so as to be under the control of the motorman. The investigation brought out the fact that the first train had been stopped at the point of collision by the red flag of the track repair gang working at that point and had been standing for about a minute when struck. The second train left the 59th St. station while the first train was stopped and ran 520 ft. before striking it. The weather was clear and the rail dry.

After a careful consideration of the evidence submitted and as a result of the examination made, the board is of the opinion that the accident was caused by the motorman of the second train misjudging the distance in which he could stop his train, the fact that he was running on a down grade at the time probably having some effect upon the error in judgment made by him. The evidence of the rear guard of the first train was to the effect that the motorman was making every effort to stop his train 30 ft. from the point of the collision, but he no doubt did not commence the application of the brakes in time to prevent the accident.

The equipment of the second train, including controllers and brakes, was tested by the motorman before leaving 106th street and no report of any defects in them was made by him to the conductor of the train, as is customary when any are discovered. The station stops between 106th street and 59th street were made in the usual manner, establishing the fact that up to the time of leaving the 59th street station no defects existed in either system. An examination of the controller after the accident showed that it was in perfect working order. The brake equipment could not be tested after the collision because it was wrecked in the accident.

It is possible to arrange the controllers in such a manner that if the button in the controller handle is released by the motorman, when it resumes its normal position it will not only shut off the current, but also apply the brakes. Safety of operation would be increased if cars were equipped in this manner. For this reason the board makes the following recommendation:

"That all of the motor cars operated by the Interborough Rapid Transit Co. on its Manhattan Railway division be equipped in such a manner that, when the current to the motors is cut off by the action of the automatic cutout device now employed on the controllers, it also will operate the air brake system so as to cause an emergency application of the brakes on the train. Recognizing that the exigencies of the situation will not permit these improvements being put in operation at once, we urge that the work be commenced at the earliest possible moment and pressed to a speedy conclusion and that the board be advised from time to time of the progress made."

A train dispatcher employed by the Oneonta, Cooperstown & Richfield Springs Railway Co. recently prevented a collision by ordering the power shut off at the power house. A car crew had disobeyed orders and two cars were rapidly approaching each other on the same track.

Accountants' Association.

The meeting of the Executive Committee of the Street Railway Accountants' Association was held in Chicago Saturday, April 30th, at the office of the president, Mr. F. E. Smith, auditor of the Chicago Union Traction Co. There were present six members of the committee besides Mr. Smith: W. B. Brockway, secretary, Yonkers, N. Y.; C. O. Simpson, Birmingham, Ala.; J. J. Magilton, Schenectady, N. Y.; H. J. Davies, Cleveland; S. C. Rogers, Youngstown, O.; H. M. Pease, Buffalo. After passing upon the minutes of the last meeting the executive committee acted favorably upon 13 applications for membership. These companies were: Youngstown & Southern Ry., Youngstown, O.; Cleveland, Painesville & Eastern R. R., Willoughby, O.; Cincinnati, Lawrenceburg & Aurora Electric Street R. R., Cincinnati, O.; Northern Texas Traction Co., Ft. Worth, Tex.; Cleveland, Painesville & Ashtabula R. R., Cleveland, O.; Pennsylvania & Mahoning Valley Ry., New Castle, Pa.; Boise Traction Co., Boise, Idaho; Lima Electric Railway & Light Co., Lima, O.; Indiana Northern Traction Co., Marion, Ind.; Knoxville Traction Co., Knoxville, Tenn.; Niagara, St. Catherines & Toronto Ry., St. Catherines, Ont.; New Jersey & Hudson River Railway & Ferry Co., Edgewater, N. J.; Norfolk Railway & Light Co., Norfolk, Va. The total membership of the association is now 145.

It was decided to hold the eighth annual convention of the association at St. Louis on Thursday, Friday and Saturday, October 13th, 14th and 15th. Headquarters will be at the Inside Inn on the Fair Grounds. The meeting on Thursday is intended for the discussion of routine business so that on the two days following the entire time of the association may be given to the reading and discussion of papers and reports. On Friday there will be presented a report on car house and car shop reports and accounts to be submitted by the joint committee consisting of H. M. Pease, of the International Railway Co., Buffalo, and W. G. McDole, of the Cleveland Electric Railway Co., on behalf of the Accountants' Association, and H. H. Adams, United Railways & Electric Co., Baltimore, and H. E. Farrington, Boston & Northern Street Railway Co., Chelsea, Mass., on behalf of the American Railway Mechanical and Electrical Association.

It was the opinion of those present at this meeting that the association could be made more valuable to the membership if a regular question box were established and members were to be invited to submit questions in writing to the secretary, these to be in turn sent out to the membership for answers and the questions, together with the answers thus received, printed for distribution to the membership before the meeting is held. At the Saratoga convention Mr. Elmer M. White, of Hartford, was appointed a committee on blanks and he will submit his report at St. Louis.

The meeting on Thursday will probably be held at the Inside Inn, and the other meetings in Festival Hall.

A. S. R. A.

The report of the meeting of the executive committee of the A. S. R. A., at which the plans for the convention were decided upon, was published in the "Review" for April.

Hotel rates for rooms with bath have been made as follows, the price being per room per day:

Southern (Headquarters), $10 to $15 American.

Planters, $10 European.

Jefferson, $10 European.

St. [illegible], $7 to $10 European.

Lindell, $5 European.

Rooms can be occupied by three persons at the same price per room. Reservations must be made before June 1st. To receive rooms they must be paid for from October 8th to October 15th, but the hotel will rebate whatever revenue it receives during the 8th and 9th from the rooms reserved.

Mechanical and Electrical Association.

The American Railway Mechanical and Electrical Association will hold its second annual convention in St. Louis the week of Oct. 10, 1904. The meetings of the convention will be held in Festival Hall, the convention building on the World's Fair grounds, on Monday and Tuesday, October 10th and 11th. As noted in connection with the report of the plans for the Accountants' Association a joint meeting will be held on Friday to discuss the report on car house and car shop reports and accounts.

Electrical Engineering Theses.

The subjects of theses chosen for the commencement exercises at the Lehigh University, South Bethlehem, Pa., next June include the following topics to be presented by the candidates for the degree of electrical engineering: An Investigation of Single-Phase Alternating Current Commutator Motors; Tests of Alternating Current Transformers; An Investigation of the Effects of Armature Reactions on the Regulation of Alternators; An Investigation Under Running Conditions of the Philadelphia Division of the Lehigh Valley Traction Co's. Electric Railway System; An Experimental Study of a Two-Phase Alternating Current Induction Motor; An Investigation of a Double-Current Generator with Balancing Coils for Three-Wire Distribution; A Study of Apparatus for Measuring the Frequency of Alternating Currents; An Experimental Study of the Effects of Armature Reactions on the Performance of Direct-Current Generators.

Accidents.

About midnight April 20th a car on the Hagerstown (Md.) and Williamsport line was struck by cars that had broken loose from Western Maryland R. R. freight train, resulting in serious injury to the motorman.

April 25th two persons were killed and one badly injured as the result of a collision between an Atchison, Topeka & Santa Fe switch engine and an El Paso (Tex.) Electric Railway Co. car which was returning from Juarez.

April 26th a Broad St. car of the Public Service Corporation of New Jersey collided in Elizabeth, N. J., with a Plainfield car which was standing on a switch, neither crew being aware that the switch had been left open. One of the motormen was injured so badly that he died.

April 26th a car of the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Co. jumped the track at Kingdom bridge about two miles east of Waterloo, N. Y., and went over an embankment. Ten persons were injured, but none fatally.

April 28th a Pittsburg Railway Co. car on the McKees Rocks and Neville Island division was struck by a Pittsburg, Chartiers & Youghiogheny Ry. engine and five persons were injured, one probably fatally.

May 1st an Ironville car of the Toledo Railways & Light Co. was struck by an engine of the Toledo Railway & Terminal Co. and overturned. Two women were seriously injured.

Two elevated trains collided at 57th St. and Third Ave., New York, May 9th, and a motorman was killed and three passengers injured. One train had stopped because of repairs being made to a rail and the other ran into it.

Two Independence cars of the Kansas City (Mo.) Street Railway Co. collided on a single stretch of track at Sheffield, May 8th, and 20 or more passengers were injured, two seriously.

Middleboro, Wareham & Buzzard's Bay.

The cars of the Middleboro, Wareham & Buzzard's Bay Street Ry., which were compelled to stop running in the latter part of February because of power supply being cut off, are not yet in operation, although negotiations between the receivers and the power company are in progress. This company got its power from the New Bedford & Onset Street Railway and at the time the supply was cut off the latter claimed there was owing it $10,000 for power furnished. The Bedford & Onset company refused to furnish any more current until the old claim had been secured in a satisfactory manner. It is understood that the Massachusetts Railroad Commissioners have taken the matter into consideration. The cars of the Middleboro, Wareham & Buzzard's Bay company are being repaired and put in order for operation as soon as a satisfactory settlement of the power situation is effected.

CHICAGO THE LONDON

STREET RAILWAY REVIEW

AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED ON THE 20TH OF EACH MONTH.

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SUMMARY OF CONTENTS.

TRAMWAYS AND DENSITY OF POPULATION.

Those interested in bettering the conditions in the tenement districts of European cities are unanimous in naming the lack of adequate urban transportation facilities as the principal cause of overcrowded tenements, and in looking to tramways to render the suburbs accessible to poorer inhabitants. Ten years ago, when electricity as a motive power had not been extensively applied on European tramways, it was generally believed that the adoption of electricity and the expected development of tramways would greatly improve conditions and reduce the density of population.

The last census of Glasgow, 1901, shows that there were 91,200 persons, or 12 per cent of the total population, living 3 to 12 in one room, and 194,800 persons, or 25 per cent, living 3 to 12 in two rooms. This is a condition that is sufficiently bad, but it is a great improvement within the decade, as will be seen from the following data compiled from an article by Mr. P. F. Sullivan, comparing street railway conditions in Europe and America, published in the "Review" for 1897:.

Year.	Miles of Tramways.	Living in one room.	Living in two rooms.
1871	None	30.4%	.....
1881	40	24.7%	44.7%
1891	57	18.0%	47.5%
1901	130	12.0%	25.5%

This result is undoubtedly in a large measure due to the better tramway service now available, and it is interesting to speculate how much greater improvement would be shown were the tramway mileage equal to that of an American city of the same size, say 400 miles, and a uniform fare instead of the zone system were adopted.

CAR HOUSE AND SHOP ACCOUNTS.

The announcement that during convention week there will be a joint meeting of the Street Railway Acountants' Association and the American Railway Mechanical and Electrical Association for the purpose of discussing the report on the car house and car shop reports and accounts is very gratifying and it gives promise of a satisfactory settlement of a somewhat troublesome subject and one that is growing in importance with the consolidation of small companies and the building of large shops that are necessary to care for the more extensive equipment. Those systems which by consolidation or natural extension have outgrown primitive methods of accounting that formerly served the needs of the mechanical and auditing departments know by experience the desirability of systematizing their forms and methods; and smaller or newer companies will all appreciate directions that will enable them to start right in opening their accounts or in reforming old methods.

It is an especially good thing that this subject is to be taken up by the representatives of the two departments most interested. The accountant naturally considers shop accounting from his standpoint rather than from that of the master mechanic, and the same thing is true of the latter. Each has objects which he wishes to accomplish, and to do this may easily choose a method that will make useless work for the other without securing correspondingly valuable results for himself. When both parties interested can discuss the matter together the result can scarcely fail to be more satisfactory than were either to attempt it alone, and also by the joint action results can be reached at one meeting that otherwise might drag out for two or three years were each association to take action and then submit its report to the other for criticism.

The first work of the Accountants' Association was the standard classification of expense accounts, a subject that affected particularly the accounting offices. At Kansas City in 1900, Mr. C. N. Duffy, then president of the association, recommended that a committee be appointed, charged with the work of preparing model blanks and forms, general in their adaptability and use, with such explanations as may be necessary or desirable, to cover the accounting work of every department. At that time it was considered that this was too elaborate a scheme for the association to undertake with the promise of bringing it to a quick and successful conclusion. A first step was made in the matter of materials and supplies and at the New York meeting in 1901 a report on materials and supplies accounting, submitted by the committee of which Mr. F. E. Smith was chairman, was adopted by the association. The

report now in hand on car houses and car shops will cover another department.

The general scheme would include besides the storehouse, car house and shop, the power house, the maintenance of way department, the transportation department, the claim department and perhaps others, the grouping into departments being, of course, a subject that is of itself worthy of discussion.

VACATION TRAFFIC.

The perusal of the advertising pages of current periodicals is all that is necessary to convince the reader that the annual vacation season is rapidly approaching. The passenger agents of steam roads have long since sharpened their pencils and wet their brushes in the effort to convince vacation tourists that their respective roads are the most delightful in the country and plans are already being made by thousands of people for the annual fortnight vacation. And it is certainly time for the progressive electric railway manager to make his plans for securing some of this extra business.

It is now possible to take some very inexpensive yet quite extended and very delightful trolley trips in this country, particularly in the east and middle west, and this can be done with very little help from the steam railroads. The tourist can now strike far inland from the Atlantic coast or the Great Lakes region and cover many hundreds of miles in electric cars, passing through sections whose adaptability for vacation purposes cannot be easily surpassed. Many of the electric railroads pass through regions quite remote from the beaten paths of steam railroad travel, bringing the tourist within easy access of previously unavailable tracts of forest, meadow and stream. There is, therefore, strong reason why the electric railway manager should begin a peaceful campaign in favor of the scenic and other attractions of his own local territory.

In advancing plans for securing this extra traffic consideration must be taken of both the local and through business. To some extent each will be benefited by the other. Considering first the question of local traffic, there is a wide field for the exercise of ingenuity and originality in developing amusement and recreation resorts, in discovering for the public the attractive spots in the country surrounding populous sections, in the efficient advertising of the pleasures of trolley travel and emphasizing its comparative cheapness. It is indeed a barren part of the country which is devoid of some attractive piece of woodland, boating place or ball ground, within easy reach of a large town. The ignorance of people generally in regard to the natural and historical resources of the country immediately surrounding them is so proverbial that it has ceased to be surprising. Many a Bostonian has never climbed Bunker Hill Monument, and many a New Yorker has yet to visit the Statue of Liberty, while thousands of residents of other places are equally unfamiliar with the prominent features of their localities, which others travel thousands of miles to see.

Generally speaking, the methods found most successful in developing park traffic will be best adapted to, and prove most successful in obtaining local vacation business. In considering through traffic it is evident at once that an electric railway system must not overlook its neighboring systems if the fares of the long distance traveler are to fall into its strong box. A few of the interurban and city lines are known by reputation outside of the states in which they operate, but these are exceptions. Most electric roads have but a local reputation, and while it is important to advertise the system, the majority of interurban railways cannot afford to spend large amounts of money in this way. The very best advertisement which a road can have is a record of good service, and the one thing which specially makes good service is punctuality. A close adherence to published schedules is worth more to the through traveler than almost anything else which can be named. Of almost equal importance is an arrangement between connecting roads which avoids long delays at the connecting points. Facilities for handling ordinary baggage, knowledge of steam railroad schedules on the part of the conductors, through tickets and comfortable waiting rooms all come into play in securing the traffic of the vacation tourist.

If the scenic attractions of the road are specially noteworthy it will usually pay the company to publish a small pamphlet describing them, with a few typical illustrations included. Such a publication should always include a map or at least a rough sketch of the lines described, complete time-table of all through and local cars, and should give the connections with other systems, as well as a table of fares and distances, and in most cases it would be a good plan to compare the fares by trolley between through points with the steam railroad tariffs, especially in cases where the systems parallel each other. Usually the fares on the electric lines will nearly cut the steam rates in half.

Effective advertising may be done in the cars themselves and the regular card racks afford means for attractively calling attention to the pleasures of traveling without the drawbacks of cinders, smoke and dirt. The temperature records of the pine woods along the lake shore and the advantages of the cool air and comfort which a nickel or a dime will purchase may also be briefly hinted at.

In connection with the subject of publishing advertising literature by the street railway companies there is generally a noticeable lack of information in regard to the connections for through trolley routes. In New England this lack has been supplied by the publication of guides to through trolley trips giving time-tables of the various routes and connections between distant points, but with the exception of this territory, such information is hard to obtain. While the connections between two adjacent systems are generally known, it is usually difficult or impossible to obtain information in regard to connections between comparatively distant points where perhaps three or four different roads may be used.

A compilation showing the different connections and time-tables and all the connecting roads covering a large territory would go far towards securing not only considerable vacation traffic, but would be a great aid to commercial travelers as well.

Lastly, the rolling stock and roadbed should be in good order in anticipation of both through and local traffic. Not until this condition has been met is it safe for the road to advertise its attractions and its service. Due attention to the safety, reliability and excellence of equipment and service, coupled with judicious advertising of the natural and artificial attractions of the road, and the economy of this method of traveling will materially increase the revenue of the road and will go far towards securing a large proportion of the coming vacation traffic.

GRAPHICAL MATHEMATICS.

On another page of this issue will be found part three of an interesting series of articles on "Graphical Mathematics" by Mr. A. G. Holman. Graphical methods are coming more and more into use, and the aim of the author is to begin at the fundamental operations of addition, subtraction, multiplication and division and to lead up by successive steps to the more complex problems which may be solved graphically. A thorough understanding of the principles involved will often furnish short cuts and simple methods by means of which much valuable time may be saved and the drudgery of numerous calculations avoided.

Graphical methods may be employed in a large number of operations, many of which are commonly used by engineers. The graphical division of a steam engine indicator card into ten equal spaces for the purpose of computing the mean effective pressure, and the addition of ten lengths so divided, are illustrations of graphical methods which are familiar to every engineering student. Some of the more complex operations explained in these articles are the calculation of the areas of triangles and irregular surfaces, percentages, the construction of railway time schedules and the laying out of charts and special diagrams for various classes of problems.

ELECTRICITY ON TRUNK LINES.

The introduction of electric traction on two English steam roads, the Lancashire & Yorkshire and the North Eastern railways, marks a new era in British railway practice. A brief description of the Liverpool & Southport branch of the former system is given in this issue, and the opening of this line, which is 18½ miles long, was almost simultaneous with the opening of the Newcastle-on-Tyne and Tynemouth section of the North Eastern Ry. These two installations differ considerably, however, in details of both roadway construction and method of train control. The Liverpool & Southport is equipped with a fourth rail, which is used for a return circuit instead of the track rails, and although the latter are bonded to the fourth rail, no bonds are used at the joints of the running rails. This construction was adopted with a view to avoiding the difficulty of maintaining the bonds in good contact at the joints of

[illegible] the renewal of rails with less trouble. [illegible] increase the conductivity of the return circuit, as the running rails carry a considerable part of the current.

The method of train control on this line is also a departure from common practice. The direct multiple control, as this system is called, is distinguished from the multiple unit system in that the whole current for the train is carried by the controllers instead of by different sets of contractors, as in the multiple unit system. The direct system is limited to the use of trains carrying only two motor cars, and the controllers contain two barrels, one for each car, each controlling one-half of the train. For trains of limited size this offers the same advantage as the multiple unit system, with the additional advantage of less complication in the wiring. It, however, lacks the flexibility of the multiple unit system, which permits an unlimited number of motor cars to be operated together in a train. The installation of the North Eastern Ry. has been along conventional lines, the third rail and multiple unit systems having been adopted, and a comparison of the results of operation of the two lines will be awaited with interest.

The electrification of these English lines marks the early steps in the inevitable supersedure of the steam locomotive by electricity, if not on trunk lines generally, at least on their suburban divisions. In the cases just cited electricity was chosen in order to facilitate the handling of heavy traffic, while in this country it has been adopted by several steam roads for branches where the traffic was too small to be profitably handled by steam locomotives, which facts taken together constitute an argument in favor of the use of electricity under the most widely divergent conditions.

Ohio Interurban Railway Association.

The Ohio Interurban Railway Association held its second regular meeting at the Hollenden Hotel, Cleveland, April 28th. The transportation committee of the association, which has the interchangeable mileage matter in hand, reported that it had decided not to take final action as authorized, but to submit a plan to the association. Mr. H. C. Lang, of the Western Ohio Railway Co., also submitted a plan for interchangeable mileage patterned after that of the Central Traffic Association. The association decided to submit both plans to the individual member companies and take a letter ballot. The general scheme of the committee was given in our last issue; that of Mr. Lang contemplates the formation of a permanent bureau composed of representatives of all roads that are parties to the agreement which would be conducted by an executive committee of three persons, the decisions of this committee to be final on all questions arising between parties to the agreement.

Another matter which was the subject of interesting discussion was rates for interurban cars operating over other interurban lines. Mr. F. J. J. Slote, manager of the Cincinnati, Dayton & Toledo Traction Co., presented a table of figures based upon current consumption for different motor capacities and gear ratio.

Mr. Walter H. Abbott, of the Roberts-Abbott Co., delivered the lecture on steam turbines which was scheduled for the preceding meeting.

In the evening a party of delegates was taken over the Cleveland & Southwestern to Elyria, returning via Lorain.

Correspondence.

MATERIAL AND SUPPLIES ACCOUNTING.

Editor "Review":

Referring to Mr. Dimmock's article in the December "Review," on the above subject, and contributing to a discussion thereof, the writer would preface his remarks by referring to the fact that he was a member of the Committee of the Street Railway Accountants' Association which submitted reports on this subject to the Conventions of 1901 and 1902; and believes that those reports provide for a system of stores accounting which is both comprehensive enough for the largest road, and flexible enough to permit of its adaptation to the needs of the smallest.

Undoubtedly the question of stores accounting is one of the most important that presents itself to the attention of the average road; but it is also one which if carried to its fullest logical conclusion would involve considerable expense for its proper handling, and the management too often looks upon the cost of keeping track of stores as out of proportion to the results obtained.

It must be borne in mind that every road has its own peculiarities of internal organization or physical location which may require the modification of any suggested system of blanks and forms in order to meet the local conditions; and also in order to meet the views of an economical management the system should be so devised as to keep the clerical work at a minimum, consistent with accurate results. These facts were borne in mind by the above-mentioned Committee, and in their report in 1901 no blanks were submitted, but in place thereof under each heading was outlined a statement of the information which should be conveyed by the blanks requisite to carry out the suggestions given under that heading, leaving the arrangement of the blanks to the individual accountant.

It was also stated that the report in its entirety devised what the Committee believed to be the ideal system of stores accounting, but that each member of the Association must judge for himself as to what portions of it could be safely eliminated upon his own system.

The writer believes that the blanks suggested in the Committee's report for 1902 contained the foundation for a full and complete system subject to certain modifications which might be necessary to meet the local conditions.

In the blanks as submitted by Mr. Dimmock, Form No. 1 contains a number of sub-divisions of general heads which, while they would furnish some interesting information, could probably be dispensed with by the average road, and thereby some clerical work could be saved.

Form No. 11 of the Accountants' report covers the same ground with less labor.

The same remarks would apply to Form No. 2, preference being given to the Committee's Form No. 1.

Form No. 3 in Mr. Dimmock's paper, or Form No. 2 in the Committee's report, both cover the ground, although neither of them meets the writer's requirements, which are governed by local conditions. In this connection it is desirable that both requisitions and purchasing orders should be prepared in some good loose-leaf system, so that the copies retained in the various departments may be filed in an indexed binder, thereby not only preserving the document from becoming soiled by handling, but also facilitating reference thereto. The writer's practice is to keep two sets of binders: One for requisitions, for which orders have been placed in their entirety; and one for those which have been only partially filled: one for purchasing orders which have been filled and which are filed numerically, and one for orders which have not been filled and which are filed alphabetically.

Forms Nos. 4 and 4½ are practically identical with the Committee's Forms Nos. 3 and 4. In the judgment of the writer, however, most small roads will find the clerical labor in keeping up a lot number record involves more expense than the results obtained will justify, for the reason that the amount of stores which they carry, or should carry, is sufficiently small for the storekeeper to be thoroughly familiar with his stock without the necessity for reference to such record.

Forms Nos. 5 to 12, inclusive, seem to be well adapted to their respective uses.

Form No. 13—a rubber stamp—is objectionable. The writer will not permit the use of rubber stamps upon invoices, and in all cases insists upon the use of invoice blanks furnished by the company, upon which spaces are provided for all the necessary notations, checks and approvals. Invoices rendered on shippers' blanks are frequently so filled up that there is no blank space on the face upon which to place the rubber stamp thus compelling each one who handles the invoices to turn it over, in the aggregate a considerable amount of unnecessary labor and loss of time. Rubber stamps will blur, especially in damp weather, rendering the invoice illegible. Rubber stamp impressions can be erased. The approving officer does not know where to look for the stamp; whereas, with a company's printed form of invoice, all notations, checks and approvals are always on the face, always in the same place, do not in any way render the face of the invoice illegible, and cannot be erased, effecting a great saving in labor and time.

Philadelphia. C. L. S. TINGLEY,
Secretary, American Railways Co.

The Street Railway and Ferry Systems of Oakland, Cal.

The Oakland Transit Consolidated controls all the electric lines in Alameda County in addition to a ferry connecting Oakland with San Francisco. The city of Oakland has about 100,000 inhabitants, and the electric railway connects it with Berkeley, Leandro, San Pablo, and other suburbs. About 75 per cent of the residents of these places do business in San Francisco, which provides not only a large patronage for the railway system, but which also makes an efficient ferry service necessary. The length of the ferry is two and three-quarter miles and this distance is covered by the ferry boats in 15 minutes. From the pier, which is illustrated [illegible] the distance to Berkeley is 6.84 miles, to San Pablo, 3.84 miles. There are two ferry boats in regular operation and the ferry cars are operated in five-car trains. The "Key Route," or ferry system, and the ferry were built during the past year, and were first opened to traffic in the latter part of September, 1903.

VIEW OF PIER, OAKLAND TRANSIT CONSOLIDATED.

The pier, of which the ferry building is the "Key Route" terminal, is nearly 17,000 ft. long. The building itself has three tracks 20 ft. apart, each track capable of holding eight 55-ft. cars. In addition there is ample room for offices, waiting rooms, etc. At the shore end of the pier is a subway 1,300 ft. long, 30 ft. wide, and 25 ft. deep, through which the road passes under the tracks of the Southern Pacific Railroad. The subway is constructed of piles and cement.

The general view of the trolley used on the trains operating on the pier and through the subways is shown upon the forward car of the train in the accompanying illustration. This trolley has been examined by a number of prominent electrical engineers, all of whom have pronounced it one of the best that has ever been put into practical operation. The master mechanic of the Oakland Transit Consolidated, Mr. St. Pere, states that the trolley is very

FOUR-CAR TRAIN, OAKLAND TRANSIT CONSOLIDATED.

cheap to build and from the time it was put into operation last September has as yet required practically no repairs.

The track construction of the railway systems is of the best. The rails are a 70-lb. A. S. C. E. section and are laid on redwood ties 6 x 8 in. x 8 ft. and spaced two feet apart. The rails are double bonded at each joint with Edison-Brown No. 0000 bonds. The entire line is heavily ballasted with crushed rock, ten to twelve inches of which is placed under the ties. The plan of what is known as the University Ave. crossing, which is shown herewith, illustrates the substantial character of the track construction. An elevation of this construction is also shown from which it will be seen that the bearing rail is laid with its head touching that of the main or track rail. The function of the former rail is to carry the false or outer flanges of bad or grooved wheels, as it prevents the battering which such wheels cause on the rails at the gaps or flangeways for the wheels on the crossing tracks.

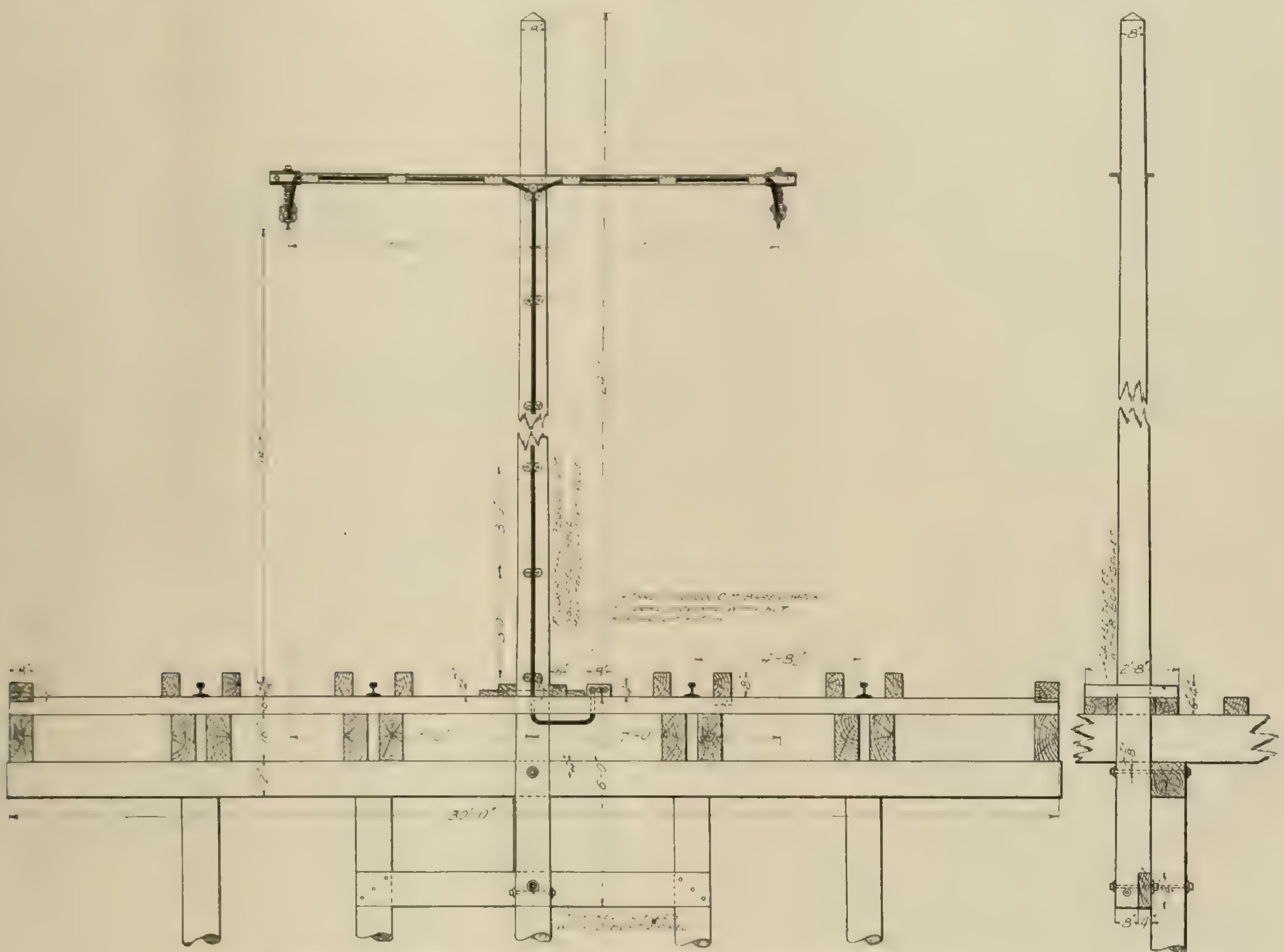
After the roadbed had thoroughly settled it was re-surfaced and oiled, crude oil being used direct without heating. A diagram of the track-oiling attachment for the tank car is shown herewith. The flow of oil is controlled both by a valve on the tank car and also by a quick-acting gate valve just below the 4-in. union. About two miles of single track can be oiled with a 6,500-gallon tank car. One of the illustrations shows the arrangement of tracks and pole line on the pier. The overhead work is double bracket, center pole construction, and the ferry system tracks are 14 ft. from center to center.

SHORE END OF PIER, OAKLAND TRANSIT CONSOLIDATED.

VIEWS OF CAR GATE AND BUFFER, OAKLAND TRANSIT CONSOLIDATED.

The power plant of the San Francisco, Oakland & San Jose Railway is equipped with eight 500-h. p. boilers fitted with oil burners.

These boilers consume 2,500 gallons of oil each twenty-four hours. The generating room contains two direct-connected G. E. generators. The large unit consists of a 2,000-h. p. corliss compound engine, direct connected to an 850-kw. generator, running at a speed of 80 r. p. m. The small machine is a 1,000-h. p. corliss compound engine direct-connected to a 650-kw. generator, running at 100 r. p. m.

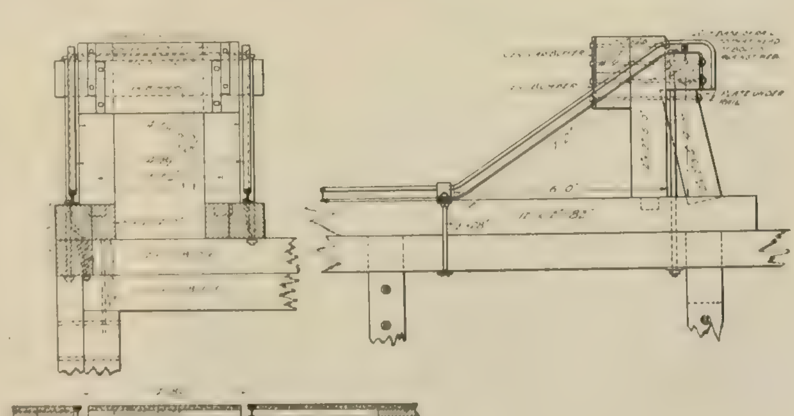


ROADBED AND BRACKET CONSTRUCTION ON PIER, OAKLAND.

The day load is carried by the small generator alone, the large one being used only when extra power is required during the morning and evening hours of heavy traffic. A storage battery plant of 264 cells, having a capacity of 1,000 ampere hours, is used in connection with the generators to take care of any sharp peaks in the load. The different lines of the two systems use approximately 8,000 kw. per 24 hours.

The present plans of the company call for a large amount of construction work during the coming summer. About 100 miles of the track are to be built at least, and more than this if it can be accomplished. The heavy rains of the past winter have not affected in the least the ferry system, as all of the trains have been on time and in no case have the ferry boats been obliged to delay their trips. During last month a shipment of 1,000 tons of 70-lb. rail was received by the company, which, however, is only a small proportion of the amount which is expected to be laid before winter.

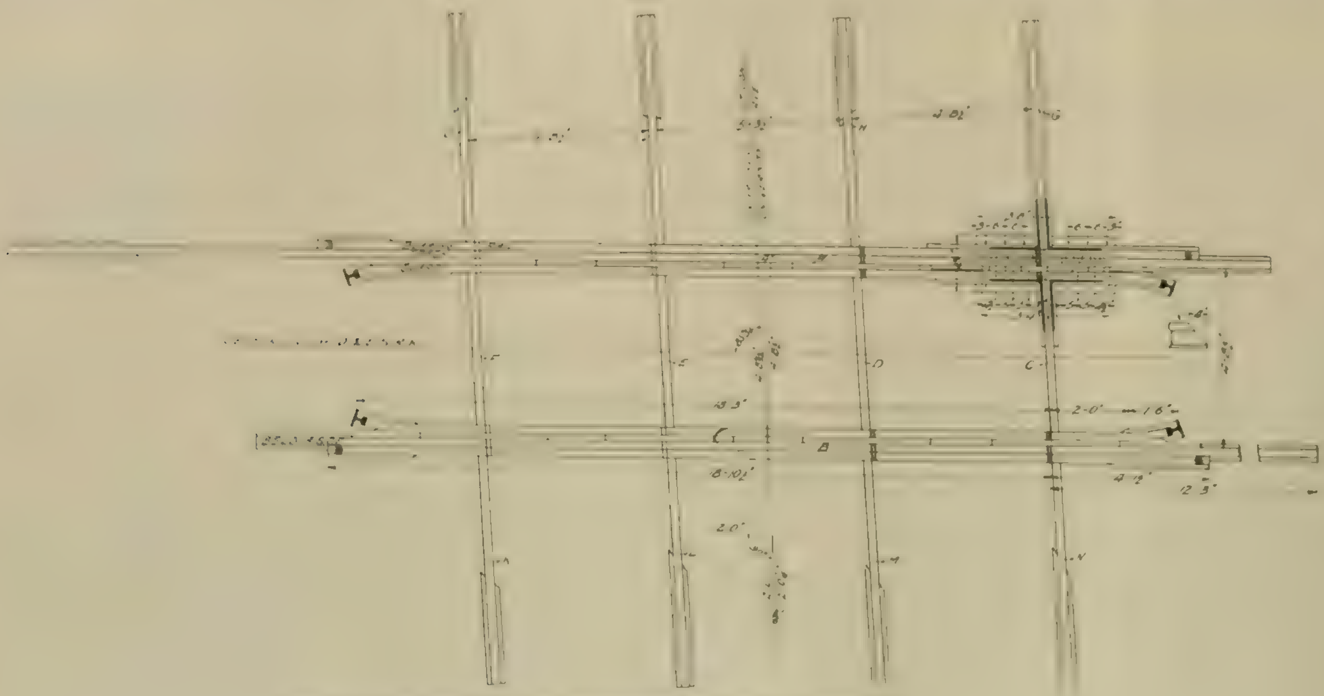
The San Francisco, Oakland & San Jose Ry. is now doing about 75 per cent of the ferry business between Oakland and San Francisco, and in order to care for its rapidly growing patronage 20 new cars have been ordered for the ferry service alone. There have also been ordered more cars for the East Oakland service, and all of these new cars are of the same type, speed, capacity, and horse power as those illustrated herewith. In addition to these cars, which were ordered from the St. Louis Car Co., the railway company is constantly building new cars for its local traffic, turning out a new forty-foot city car with a capacity for 100 to 150 people, at the rate of one every five or six days. All of the shops of the company are now running both day and night and are about a month behind hand on rush orders.



DETAILS OF BUMPER ON PIER, OAKLAND.

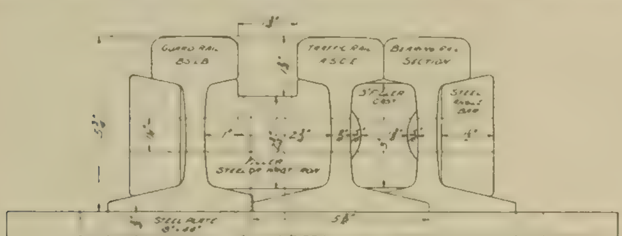
The growth of the ferry business has made additional boats necessary, and plans have recently been received and accepted for three more boats for the "Key Route." The new boats are to be

considerably faster and of much larger carrying capacity than those at present in operation.



DETAILS OF STEAM AND ELECTRIC RAILWAY CROSSING

The cars of this company previously mentioned include some novel features not usually found in interurban cars. As will be seen in one of the illustrations showing end view, partial side



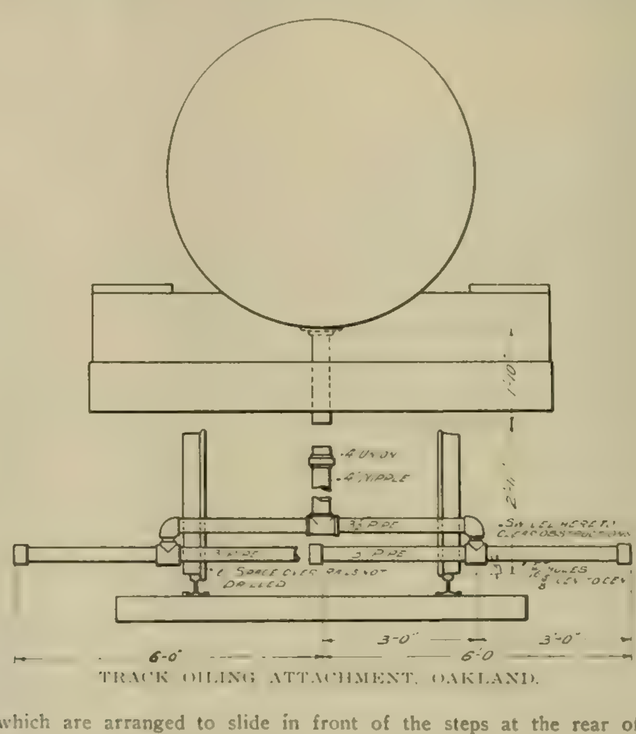
CROSS SECTION OF TRACK AT CROSSING

view and section at vestibule, these cars are equipped with pilots, similar to those of the steam locomotive, which are placed entirely underneath the vestibule and which do not project up as far as the

FERRY BOAT ENTERING SLIP, OAKLAND

bumpers. This location of the pilots makes it possible to couple cars together into a train so that the Gould continuous buffers, with which the cars are equipped, come close together.

The arrangement of the vestibule is also somewhat unusual. In addition to the side doors, which swing in, there is a center door which swings in and folds back against one side of the vestibule in order to provide a continuous passage between the cars of the train. The motorman's cab is placed in front of the vestibule at the right-hand side of the car and is partitioned off from the rest of the vestibule, as shown in the illustration, so as not to interfere with the operation of any of the doors. Another feature of interest in connection with these cars is the wire gates



TRACK OILING ATTACHMENT, OAKLAND.

which are arranged to slide in front of the steps at the rear of the car and which effectually prevent ingress and egress until the car is stopped and the gate opened. The attachment for the gate includes a frame which is shown in the illustration, fastened to the outside of the car. The roofs of these cars are of the steam road pattern and an arc headlight is mounted on the front door of the forward car of each train.

Some Experiences With High-Tension Transmission Lines.

BY H. C. REAGAN, E. E.

Upon the many high-tension systems now in operation throughout the United States there are many and varied experiences by those having charge of such systems. High-tension transmission

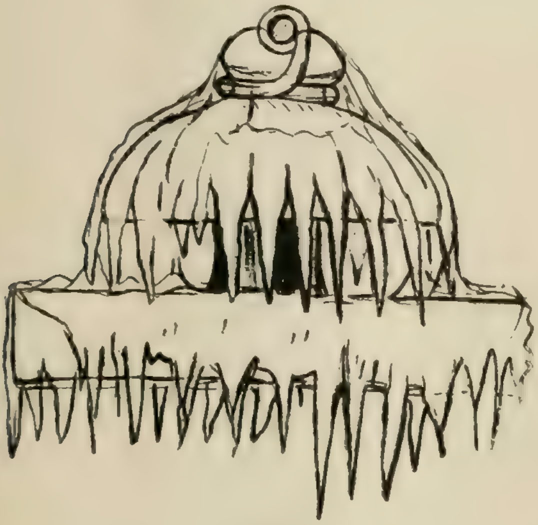


FIG. 1.

is ideal, and has so demonstrated itself in practice, but the one great question in the construction of such lines is that of insulation, as a very small leak will cause trouble and increase until a short circuit is established. These troubles with high voltages are more apparent where only a single transmission line is used, as in this case such troubles are apt to tie up a whole railway system using rotary transformer sub-stations. Various conditions affect the insulation of a line, such as climate, quality of insulators, workmanship and location. The following experiences which have come under the observation of the writer will undoubtedly be of interest to other workers in the same field.

Fig. 1 shows the condition of the insulators on a transmission system due to weather conditions. This system carried 26,000 volts for 50 miles, and at this time a heavy rain occurred which gradually ceased, and was followed by a dense fog, with lower temperature. After this it again began to rain and freeze until the insulators were in the condition shown in the illustration. They

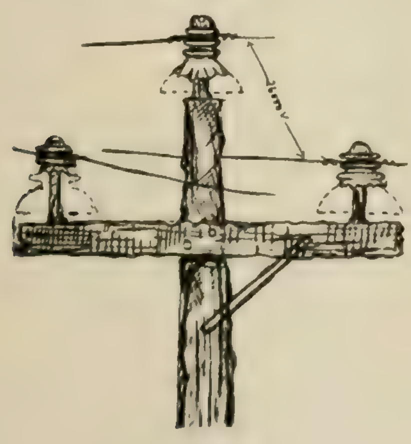


FIG. 2

were coated with ice and icicles formed between them and the cross arms. The current was on the line and the system was in operation continuously during this storm. The weather continued cold during the day as the ice did not melt until after the shutting down of the system at night, when it rained again, thus melting the ice and clearing the line. This demonstrates the high degree of insulation of ice in a dry condition.

An opposite condition to that just described, one of extreme heat, is illustrated in Fig. 2, which shows what very unfavorable conditions a transmission line may meet without failing. This line was carying 26,000 volts, and was supported by Hemingray glass insulators. The pole shown herewith stood close to a switch tower at the crossing of a steam and an electric road. While the signal man was out putting up signal lamps, the switch tower caught fire and quickly blazed up, due to the oil stored in the basement. The flames mounted to the roof of the tower, and set fire to the pole, with the result that the pole, cross arms and pins were charred and quite deeply burned. During this time the current was on, notwithstanding the heat became so great that the petticoats of the insulators all dropped, leaving only the knobs in position. Although new insulators could not be supplied for two days, the knobs which held the line proved sufficient, and no trouble with insulation was experienced.

Fig. 3 shows a condition that could exist only under peculiar circumstances, and is no doubt a rare occurrence. In this case a current of 26,000 volts was carried on a bare cross arm. The line inspector reported that an insulator was missing from a cross arm at a point 30 miles from the power station, and he wanted to know if there had been any trouble indicated at the station. The

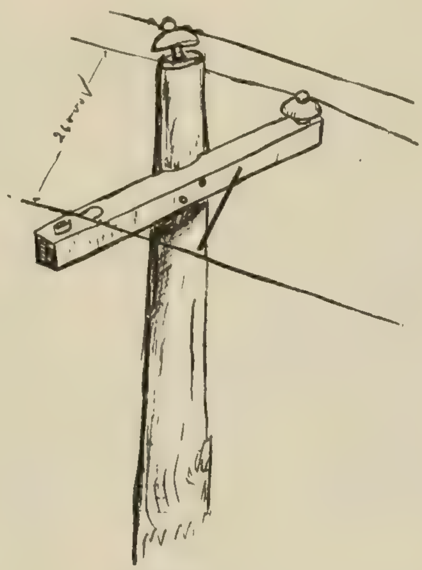


FIG. 3.

writer had not seen any indications of trouble, as the system was in full operation, and the report was attributed to an oversight. The same conditions continued for about five days, when it was again reported that an insulator was missing at the same point and that one phase of the line was lying down on the cross arm. The writer visited the pole reported and found the report correct. The pin was charred at the top and the insulator had burst and fallen entirely out of the tie wire. The line wire had fallen toward the pole with the tie wire in the position shown, but there was no sign of burning at that point. The probable reason for this not forming a short circuit is due to it being summer time, and as there had been a scarcity of rain everything was extremely dry. The paint at this point also had a hard varnish-like surface, and these two conditions made such a condition possible where a little moisture would have caused a short circuit.

One day in the fall a condition occurred which is illustrated in Fig. 4. There was a short circuit on the line which pulled every circuit breaker out. After waiting some little time for developments, it was concluded to throw the current on, to see if the short circuit had burned off. The sub-stations cut the line out in sections, and all the sub-stations started except the last one, which again threw out the system. After awhile another effort was made to start, and everything went smoothly. Having thus located the supposed short circuit, the writer patrolled that section of the line with the inspector, desiring to see just what had caused the trouble. The illustration shows what it was. The pin was undoubtedly defective

when put up, and there was an inward strain on the wire due to the pole being somewhat out of line with the others. The pin broke and strangely the insulator just turned over without falling off the cross arm. The tie wire which came in contact with the cross arm caused a short circuit which burned a hollow place in the arm, and the insulator just bridged this hollow place. The second short circuit burned the cross arm so that it cleared the tie wire, after which the current stayed on the line without further trouble.

A heavy short circuit occurred on the line one afternoon, throwing out the whole system. After a short time the sub-stations were notified to prepare for the current, starting with the first station nearest the power house. All went well until the last line switch was thrown in, when a short circuit again occurred, but not so severe as the first time. The second time the current remained on, although when the wind began to blow slightly during the night there were indications of a swinging short circuit at times, but not enough to pull out the oil switches. The next morning the inspector reported a pole burned off completely, as shown in Fig. 5. It appears that an insulator broke, causing the wire to burn off the end of the cross arm. The wind then caused the wire to swing to and fro against the pole, until the pole was completely severed as shown, the other two wires supporting the cross arm and top of the pole.

Fig. 6 shows a very bad break in an insulator, which caused the

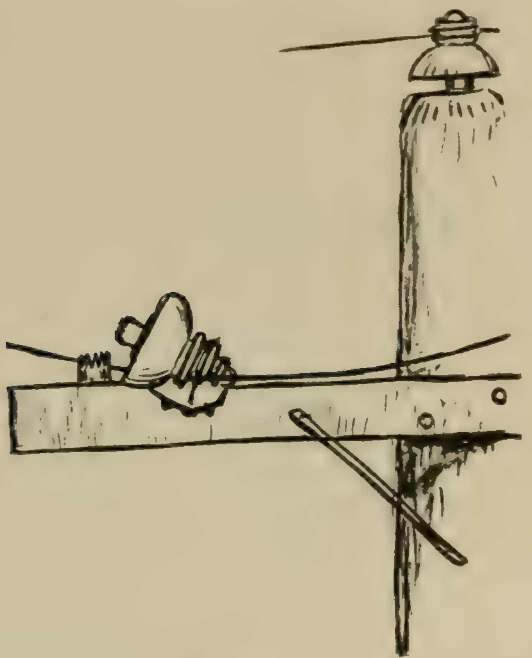


FIG. 4.

death of a man. The writer was seated at his desk in the power house when all the switches on both the a. c. and d. c. switchboards came out. This occurred about 7:30 p. m. When the switches were thrown in there was no further trouble. A report came in that a man had been killed, and on going to the spot it was found that an insulator broke on a corner pole as shown in the illustration. This was the inside wire of the curve, and the strain on the wire broke the knob and a portion of the bell of the insulator. The wire dropped across the corner of a lot and swung about three feet from the ground, and a man crossing the lot after dark walked against the wire, which came across the upper part of his body and death occurred instantly. The main point to be emphasized in this case is the design of the insulator, which is a poor one. It will be seen by the dotted line that the pin did not project up into the knob or beyond the tie wire. This makes a weak construction. All pins should project beyond the point where the wire is tied to the insulator, as this gives a support to the insulator instead of throwing all the strain on the glass alone. The upper piece of the insulator was attached to the wire as shown in the illustration, the remaining portion being on the pin.

Fig. 7 shows a porcelain insulator, which had withstood a high test, but which caused a serious amount of trouble. Insulators of this pattern were installed in the sub-station and the main power station, in the buss bar compartments, and on the outgoing lines. Trouble began when lightning storms occurred. These insulators were mounted on iron pins which were bolted to iron bars or frames, and the iron pins were cemented to the insulators with sulphur. The trouble started with the season of lightning storms,

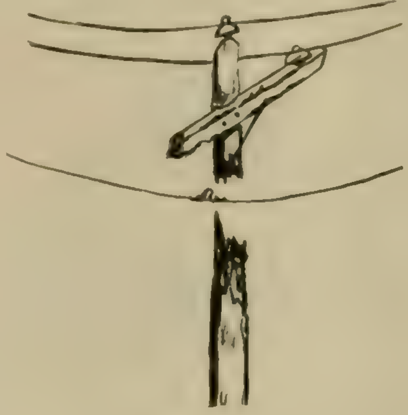


FIG. 5.

and to say that it was a puzzle to find the trouble, would be putting it mildly. The outward appearance of the insulator did not indicate any defect whatever, and the reason for this is plain, as the puncture was in a hard place to find, directly under the wire and over the top of the iron pin. The illustration shows the location of the puncture. The hole was about the size of the lead in an ordinary pencil, being a little wider at the opening near the wire, and tapering at the lower end near the pin. This caused a dead short circuit. The porcelain would be fused as clean as if drilled, and around the hole would be found fused copper run into the glazing. The sulphur was burned black, forming a direct path to the pin. The trouble was at first located by watching the insulators for a flash whenever the current was thrown on, but this was very difficult to detect. It occurred to the writer that the pin sub-

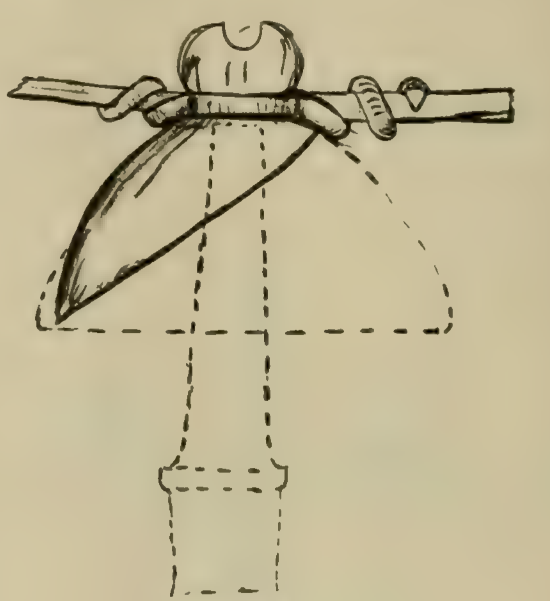


FIG. 6

ject to short circuit must be warm, and this proved correct. After this we felt of the pins to detect any rise in temperature, and never failed to find the punctured one in this way.

A very common and serious mistake in tying high tension lines on the insulators, is shown in Fig. 8. The ends of the tie wires are left so long that they are bent down and touch the insulator near its edge. This has the effect of reducing the striking dis-

tance between the line and the ground by virtually bringing the line to the edge of the insulator. This is bad practice, and should be avoided in high tension installations.

Fig. 9 illustrates a peculiar phenomenon which was observed by the writer while connected with a system on which some new insulators were installed. These insulators cost a little less than some of the standard makes, and there was about 50 miles of them in use. It was found, however, that these insulators would frequently burst with a loud report and in consequence the 50 miles of line had to be rebuilt with another make of insulators.

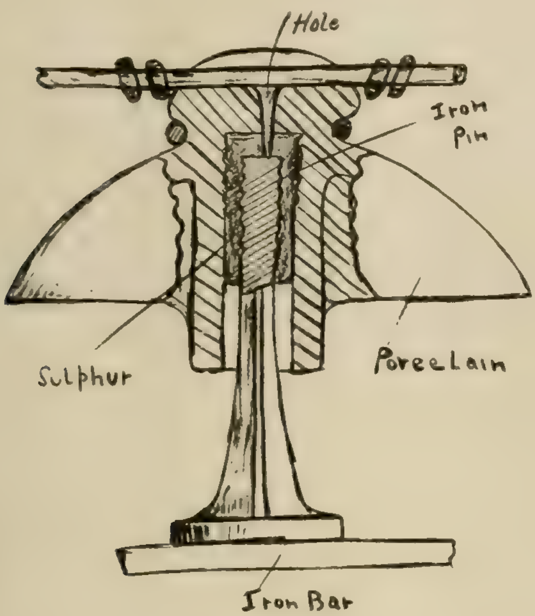


FIG. 7.

The cause of the trouble was that the insulators were not properly annealed during manufacture.

A peculiar short circuit which occurred on a 26,000 volt line was observed by the writer during the summer season in a western state. The peculiarity of the short circuit was that it would come on the line about 4:30 p. m. every day. It was at first thought

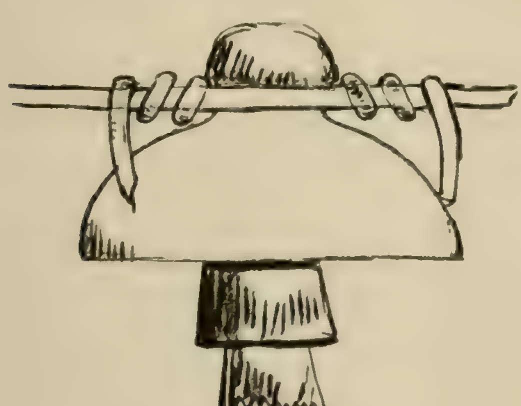


FIG. 8.

that the line came in contact with trees on which moisture had collected, but on inspection no such condition was found. When the short circuit again occurred it remained until after the sun came up the next morning. The line was again carefully inspected, but no trouble could be found. When the writer was about ready to give up the search and wait for results, being about 15 miles from the power station and at a junction of two divisions of a high tension system, a small boy in passing said "Say, mister, you ought to see the fireworks up there last night." That was the information desired, and the diagram, Fig. 10, shows what the trouble was. Where one division of the line left the other, the wires crossed at an angle of about 45 degrees. This caused the two outside phases to cross each other at the point marked +, one wire being about 18 in. above the other in the middle of the day.

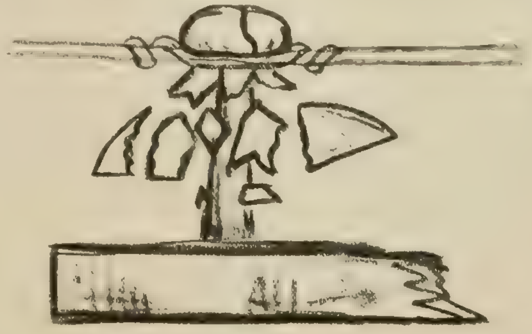


FIG. 9.

When the sun shone on the wires the expansion caused them to sag considerably, but as the afternoon grew cooler, the wires would contract until the two lines came into contact, or so near it that they touched when swayed by the wind. The wire C was dropped

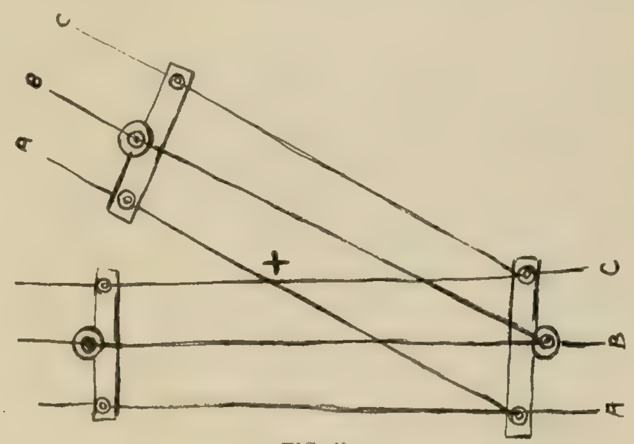


FIG. 10.

lower down and there was no more trouble. This short circuit was difficult to detect, from the fact that there was very little burning owing to the perfect contact.

The New East Side Subway in New York.

The committee on plans of the New York Rapid Transit Commission recently submitted a report to the commission recommending in detail the route of the new East Side subway. The route recommended is from the present subway station at 149th St. and Third Ave., down Lexington Ave. and Irving Place to 15th St., thence west to Union Square, and down Broadway, circling through Chambers St. to William St., and swinging westerly across Broad St. and Battery Park to Greenwich St., and then uptown by way of West Broadway and Washington Square, to Greenwich Ave., to Seventh Ave., to 34th St., thence down 34th St., connecting with the proposed East Side line at Lexington Ave., meeting the present subway again.

In addition to this route the committee recommends: A short line to connect the Lexington Ave. line with the present subway near 40th St. and Park Ave.; a line up Seventh Ave. from 34th St., to connect with the present subway at 43rd St.; a line from Fort Hamilton, Brooklyn, under Fourth Ave. and Flatbush Ave., and over the Manhattan Bridge to Canal St., near Center St. The committee also recommends securing methods for the protection of traffic and property and also to secure the necessary legislation to carry out the plans.

The Bay City (Mich.) Traction & Electric Co. has adopted new signs for its cars. The signs are of wood with the letters cut out and backed by muslin which has been treated with paraffine

Advertising.

Extract from a paper read before the Convention of Branch Managers, Department Managers and Salesmen of the H. W. Johns-Manville Co., by Henry W. Hart, Manager Advertising Department.

Advertising is not an expense but a profitable investment.

The three departments vital to the development of any business of today are the manufacturing, the publicity department and the sales department—all of practically equal importance to the business—each indispensable to the other. The publicity or advertising department is perhaps most closely allied with the sales department. These two work together for the common end—the selling of goods, the advertising preparing the way—sowing the seed, as it were—for the sales department.

Methods of advertising can be broadly divided into three general classes—trade paper advertising, printed matter and circularizing.

Trade Paper Advertising.

"Constant dropping will wear away even stone." Constant advertising is not less potent to make its impression even on the hardened mind of the purchasing agent. The single drop has no effect beyond a temporary dampness. The single ad. is not even damp.

It is the cumulative force of advertising that pays.

At a conservative estimate, there are 100,000 concerns and individuals in this country that should be buying some of our goods. There are the architects, the builders, the contractors, the railroads and manufacturing plants of all kinds classed as steam users, the engineers, hardware dealers, general stores, automobile manufacturers and owners, electrical power plants, electrical railways, to mention only a few of the classifications.

Each one of these trades, professions and great enterprises has innumerable journals devoted to its own particular interests. And these journals are subscribed to, paid for, and read by the men in these lines. And the advertising pages are read no less thoroughly and interestedly than the others.

The men that read these papers are the men we want to buy our goods. One of the cheapest and best ways of keeping these men posted in regard to what we have to sell is by printing the facts in good, big type where they cannot help but see them—and that is in the trade papers that they read. Where there is a babel of tongues, we must speak loud to be heard, and speak often to be understood.

This is not doing the work of the salesman.

It is doing the work the salesman should not have to do. It is clearing the way for the salesman, so that he can do more of the work that shows on the books—the actual selling of goods—and less of the missionary or educative work which is more cheaply and more thoroughly done by proper advertising. If the salesman has to spend a part of his valuable time doing this missionary work, he frequently cannot clinch the order on the spot. But the competitor who follows finds things in nice shape to make a sale.

In other words, if our salesmen had to spend all their time explaining why covering pipes and boilers saves coal, they would have no time to actually sell some of our coverings made for the purpose. The next salesman that obtained an audience, however, would find the prospective customer already convinced of the advantage of insulation and ready to hear about the special covering that would meet his requirements.

We must, therefore, by advertising, prepare the way for our salesmen to do business, and not leave them merely to prepare the way for our competitors' salesmen.

Besides this, the largest selling force could actually see and interview only a small percentage of the 100,000 possible customers. But constant advertising can and does see and interview them all. It is the man known to be interested in our goods that we want the salesman to interview. Advertising can create this interest and can ferret out the interested man.

Of the thousands of trade papers published, 50 of the very best will usually cover adequately all the various interests that one concern wishes to reach. And in these 50 should be used not spaces 2 in. or 3 in. square (the size of a couple of special delivery stamps), not one-eighth pages, the size of a postal card—but quarters, halves, and a few whole pages that will really advertise.

It is sometimes questioned whether advertising in trade papers pays. If a man should ask—does twice two make one and a half? you would wonder whether it would be possible for you to explain to that man just what the answer was, and why.

No business could be done without advertising. The printing of the firm's name and a list of the goods on a letter head, the hanging of a sign over the door, is advertising, and is the result of the instinctive conviction that advertising is a necessity. If this much advertising is good, more is better.

It is impossible and unnecessary to attempt always to trace direct results from periodical advertising, unless one is doing a strictly mail-order business. But I venture to say that if we stopped advertising altogether, in all trade papers, and sent out no more printed matter, business would fall off fully one-half.

The right kind of advertising costs money, but it is not expensive, because the returns in actual business are manyfold.

In order to secure the maximum benefit from advertising space, the advertising "copy" must be, first of all, of such a nature that it will be immediately noticeable among the hundreds of other ads. that surround it. This is perhaps best accomplished by means of some striking design incorporating an original idea, which arrests the reader's attention. Having thus button-holed the audience, your story can be told. And this story should be such as to hold the attention aroused by the striking idea—it should tell something definite about the goods advertised; tell why they are better than all the other goods of the same kind, and this, either because they are cheaper or higher grade, or possess some individual advantage peculiar to these goods alone.

The object is not to print your entire catalog in a quarter-page ad., but to arouse the reader's interest sufficiently to insure a certain familiarity with the name and qualities of the goods advertised, or even to induce him to write for further information.

* * *

This then is the object and the value of trade paper advertising—to go where as many prospective customers as possible can be reached and their attention drawn to something we wish to sell them. It is a field, fruitful in the past, but open to infinitely greater development, and one that cannot well be disregarded.

The printed matter of a house issued to influence trade, should be attractive, definite, conclusive and by no means cheap looking. The first impression of a house is often obtained from its printed matter—its catalog most likely. First impressions are lasting, and it is therefore well to make them as favorable as possible. A salesman would not be allowed to represent the house in shabby and cheap looking clothing. Neither should printed matter be allowed to go out poorly dressed. It is human nature to judge first, superficially—by externals.

In addition to catalogs, a liberal use of envelope enclosures, folders, etc., is of the greatest advantage. Every customer as well as every prospective customer, should have dropped on his desk, every month at least, and possibly every two weeks in the season, some attractive, convincing printed matter, keeping our name favorably and pleasantly before him at all times.

It is always profitable to co-operate with the retail dealer and the supply houses, in articles for which a demand can be created in part by the display of attractive and striking window cards, hangers, etc.

I have had the pleasure of submitting to your individual consideration the annual report of the advertising department, including the factory printing plant and circularizing division for 1903, and it will therefore be unnecessary to enter into detail regarding the development of this department during the last year and a half. A mention of the leading features, however, may not be without interest:

In 1902 the advertising department numbered six members, today it numbers 16.

In 1902 our printing plant occupied a space of approximately 10 x 15 ft., and executed 15 per cent of our printing orders, printing sample jobs, such as labels and factory forms. Today it occupies a space 25 x 100 ft. and executes 100 per cent of our printing orders, which include catalogs, fine color work, account books, etc. With our new cylinder press in operation, in conjunction with two small jobbers, the factory printing plant has a capacity of over 1,500,000 pieces of printed matter a month.

The South Bend (Ind.) & Southern Michigan Traction Co. has raised the round-trip rate between Niles, Mich., and South Bend from 25 to 30 cents and has increased its other fares proportionately.

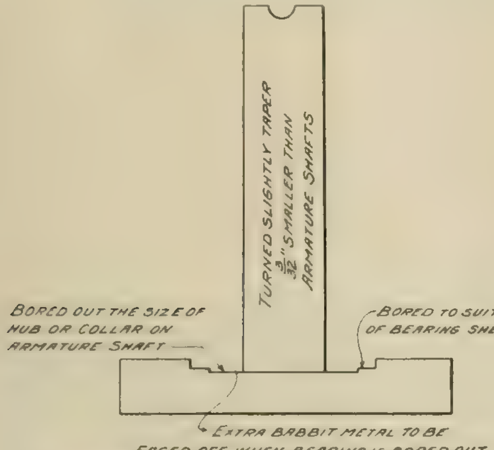
Boring Armature Bearings.

BY S. P. BAIRD, ASSO. MEM. A. S. C. E., GENERAL MANAGER OF THE PORTSMOUTH (O.) STREET RAILROAD & LIGHT CO.

I have read with considerable interest several articles in the "Review" concerning the methods used in various street railroad shops to bore out armature bearings and should like to describe the method which we have had in use in our shops for several years, and which we think superior to any that has been described. The accompanying illustrations show the special chuck and special babbitting mandrel used for this work.

We are now using Westinghouse 12A and 12C 30-h. p. motors, which were equipped with brass bearing shells babbitted, the pinion end being split and the commutator end being solid. After using the split bearings on the gear end for some time, we tried solid bearings in their stead and found that solid bearings gave enough better mileage to more than pay for taking off a pinion every time a bearing was changed. We have also experimented with armature bearings bored out of center, or so that the armature is slightly nearer the upper pole pieces than the lower. We found that the bearings so bored lasted 50 per cent longer than the old style.

Our object in boring out bearings in this manner was to get more metal under the shaft where most of the wear takes place,



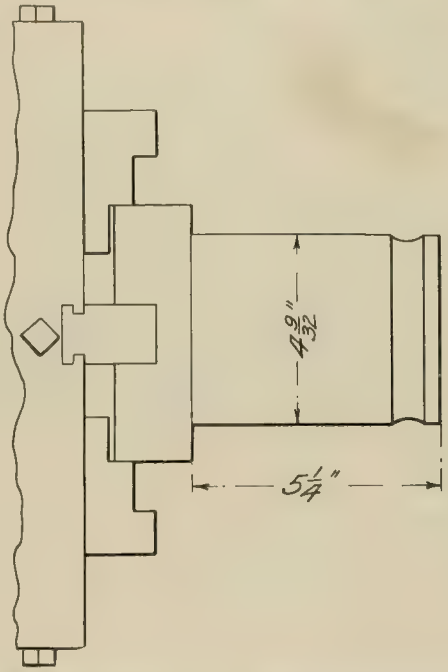
MANDREL FOR BABBITTING SHELLS.

and we found that the bearings wore less per mile run than when bored out centrally, with the same conditions of lubrication. It has been suggested that the armature being closer to the upper poles is magnetically suspended in part whenever the motors are using current.

After deciding to use solid bearing shells on both ends, and to bore all bearings out of center, we prepared our shop to do the work quickly, cheaply and well. We first made a pattern for a new bearing shell to be made of iron; the salvage from the old brass shells more than paid for the new. The reason for making new shells was to make the hub on the bearing shell eccentric to the barrel of the bearing to the same extent that it was decided to have the shafts out of center, which was 3-64 in.

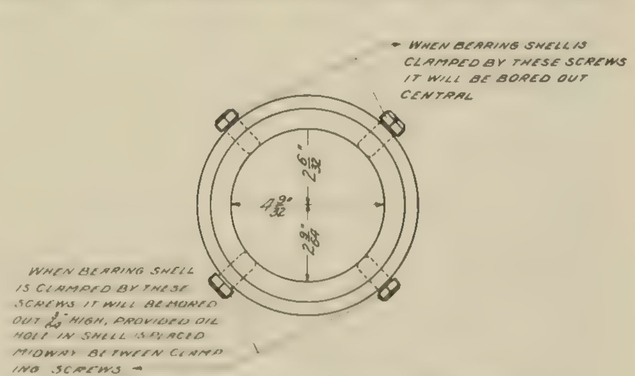
We next made a mandrel for babbitting the shells; an examination of the drawings will show the plan followed. The mandrel is made of cast iron, has a flange on one end, and it is slightly tapered so the bearings will come off easily. The flange is counterbored at the same time the mandrel is turned up, thus making all the surfaces concentric. The outer counterbore is just the size of the hub of the bearing shells, thus forming a joint tight enough so that hot babbitt will not run through when casting. The inner counterbore is the size of the collar on the armature shaft and about 1-16 in. deep, and this gives a little metal to face off when the bearing is bored out.

The construction of the special chuck for finishing the bearing shells and boring out when babbitted required more thought. We had the casting made and chucked in an ordinary four-jaw chuck, the outer surface turned off, the end faced and the threads cut



BEARING SHELL IN A FOUR-JAW CHUCK.
First Operation, Finish Except Outside of Hub.

to fit the spindle of the lathe. The special chuck was then screwed on the lathe and the outer surface finished as shown in the drawings. The inside was bored out to fit the standard bearing shell. The special chuck was then taken off the lathe and the four-jaw put on; the special chuck was clamped with the threaded end next to the four-jaw chuck in such a way that the outer surface kicked 3-32 in. The inner surface was then rebored, the tool cutting on



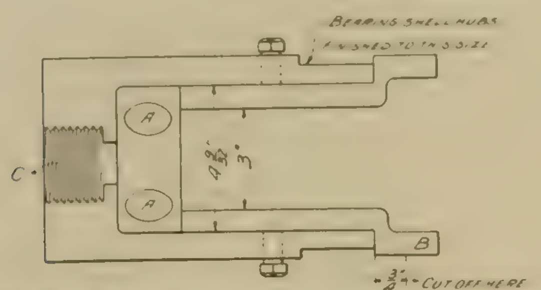
END ELEVATION OF SPECIAL CHUCK

one side only, until the diameter of the deepest cutting was 3-64 in. greater than across the opposite way.

The point on the special chuck which showed the greatest kick was carefully marked and the set screws put in on each side of this mark 45° and 135°, respectively. The holes for the escape of the babbitt metal borings were then drilled and also the holes for a spanner wrench to take the chuck off the lathe. We were then

ready to finish our bearing shells. The shells were put in the special chuck at random and clamped by the screws which forced the shell out into the eccentric side of the chuck. The hub of the bearing shell was then turned off to size.

The result of this operation was that when the bearing shells were placed on the babbitting mandrel and babbitted the hole left by the mandrel was eccentric to the body of the shell to the same extent that the finished bearing would be. This gave a uniform



SECTION OF CHUCK AND BEARING SHELL READY FOR CUTTING OFF AND TURNING HUB

A Hole to Allow Babbitt Metal Borings to Fall Out
B Bearing Shells Cast This End Up and Cut Off as Shown.
C Threads to Fit Lathe

depth of cut when boring out the babbitt to fit the armature shafts. The grease hole was then drilled midway between the marks left by the set screws, the dowel pin hole was drilled and the shell was ready to bore out to suit the size of the shaft it was to be used on.

We have a number of extra bearing shells already babbitted and when a bearing is to be renewed the shaft is "calipered" on the commutator end, and while the bearing is being bored out the pinion is removed and the bearing taken off. By the time the pinion is off the bearing is finished in the lathe and put on the shaft on the pinion end. While the helper is putting the pinion on again the machinist is boring out a bearing for the commutator end. Both ends of the shaft are the same diameter when new, and we keep them so by returning the shafts every two years.

The ease with which a bearing can be chucked in the special chuck permits a bearing to be tried on the shaft, and if found to be a close fit it can be rechucked in an instant and another cut taken. The bearing shells all have a mark which corresponds with one on the chuck. Our record is two bearings bored out and fitted in 20 minutes on one lathe. The amount of metal bored out is about 1-16 in. at the deepest cut; this is caused by the tapered mandrel. With our experience, were we to make another chuck we would bore it out eccentric only. We run our cars one way only and it was our idea that the bearings would wear differently in the front and back motors, but we find that they wear alike.

Summer Courses at Armour Institute.

The Armour Institute of Technology, Chicago, Ill., has issued its prospectus of summer courses in mechanical engineering, electrical engineering, civil engineering, telephone engineering, chemistry, drawing, shop work, mathematics, physics, French and German. The school will open Monday, June 27th, and will close August 5th. Full information will be forwarded upon application to Howard M. Raymond, dean of engineering studies.

Keeping Equipment Records.

The St. Louis Transit Co. uses the card system for keeping records of its cars. Two cards are used; the one for the original record,

Car #

Location	Date Changed	Reason	Location	Date Changed	Reason

CAR SERVICE RECORD.

which is 8 in. x 5 in. in size, is filled out for each car and shows the original equipment and has space for three changes. For a record of the service in which the cars are used a card 5 in. x 3 in. in size is found more convenient. On this are shown the location, date of change and reason, there being room on the card for 18 changes.

EQUIPMENT RECORD — ST. LOUIS TRANSIT CO., ST. LOUIS, MO. — CAR No.

TYPE	BUILT BY	WHEN BUILT	SEATING CAPACITY	ARRANGEMENT OF SEATS	MAKE OF SEAT

	ORIGINAL RECORD (DATE)	CHANGES (DATE)	CHANGES (DATE)	CHANGES (DATE)		ORIGINAL RECORD (DATE)	CHANGES (DATE)	CHANGES (DATE)	CHANGES (DATE)
SINGLE OR DOUBLE TRUCK					SIGNS				
TRUCKS					FENDER				
BRAKES					STYLE VESTIBULE				
MOTORS					[illegible]				
GEARING					WEIGHT EQUIPPED				
CONTROLLERS					LENGTH OF BODY				
CIRCUIT BREAKER					LENGTH OVER ALL				
FUSE					HEIGHT OVER TROLLEY BOARD				
LIGHTNING ARRESTER					HEIGHT OF BODY				
RESISTANCE					WIDTH OVER [illegible]				
NO. LAMPS					WIDTH OVER GUARD RAIL				
HEADLIGHT					WIDTH BETWEEN [illegible]				
TROLLEY STAND					DISTANCE BETWEEN PIVOTAL POINTS				
SANDER					TOTAL WHEEL BASE				
					HEIGHT DRAW HEAD				
REMARKS									

CAR EQUIPMENT RECORD.

East St. Louis & Suburban Railway.

Describing the New Power Plant Recently Completed to Replace Several Smaller Plants of the Consolidated Companies.

The opening of the great Louisiana Purchase Exposition has focused the attention of the world on St. Louis and its immediate surroundings, and East St. Louis, with its fifty thousand inhabitants, lying at the eastern end of the Eads bridge, is so intimately connected with the manufacturing and commercial interests of the World's Fair city that it must receive its share of attention.

An important factor in the wonderful growth of East St. Louis has been the electric railway system which had its beginning in 1890, and has extended steadily, not only to all parts of the city, but also to the surrounding towns. The East St. Louis & Suburban Railway Co. now controls and operates the following lines, which were formerly independent:

1. The East St. Louis Electric Railway Co., which began operating its cars in East St. Louis in 1890, with current furnished from its own power station.

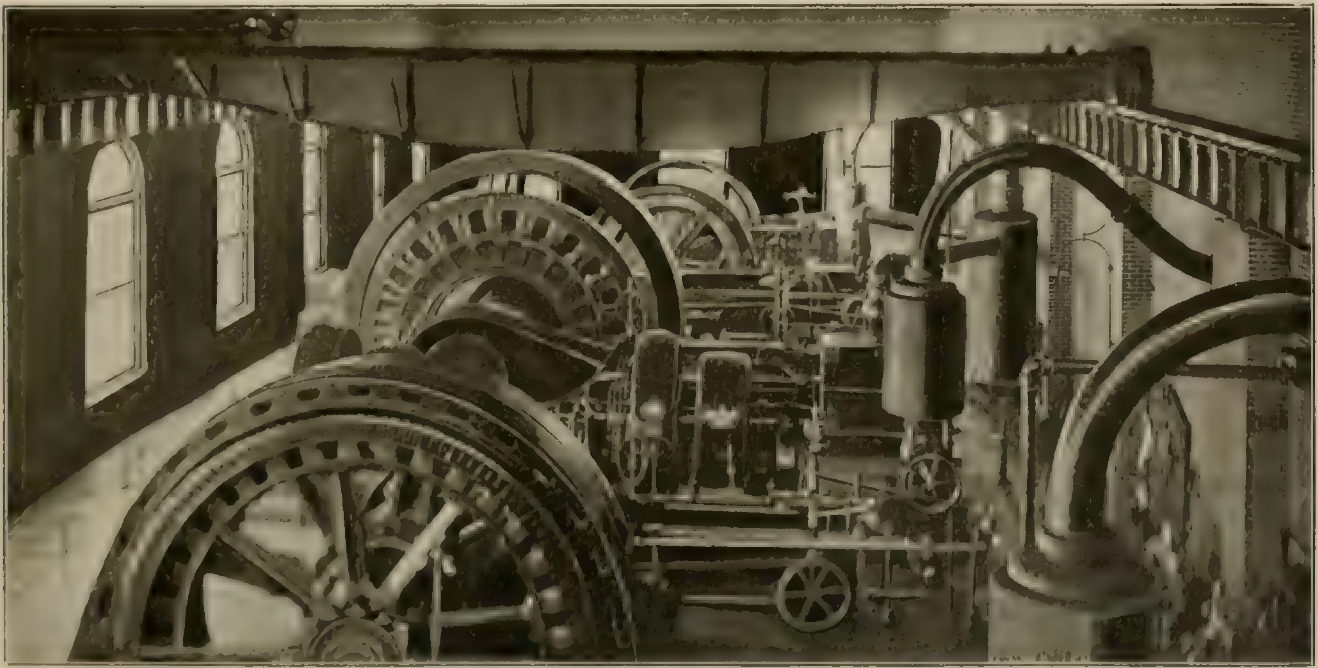
2. The St. Louis & East St. Louis Electric Railway Co., which began operating across the Eads bridge in 1890. This company had its own power station at the east pier of the bridge.

3. The St. Louis & Belleville Electric Railway Co., built in 1896 and 1897. This company operates over a private right of way between East St. Louis and Belleville. It also owned the lines in Belleville. Its power station was located on the bluffs, one mile east of Edgemont. This line is now being operated as a coal road with electric locomotives.

4. The East St. Louis & Suburban Railway Co., which in 1897 constructed its double track road between East St. Louis and Belleville along the Belleville Turnpike. Its power station was situated at Edgemont.

5. The Collinsville, Caseyville & East St. Louis Electric Railway Co., which built its line in 1899, between Collinsville and Edge-

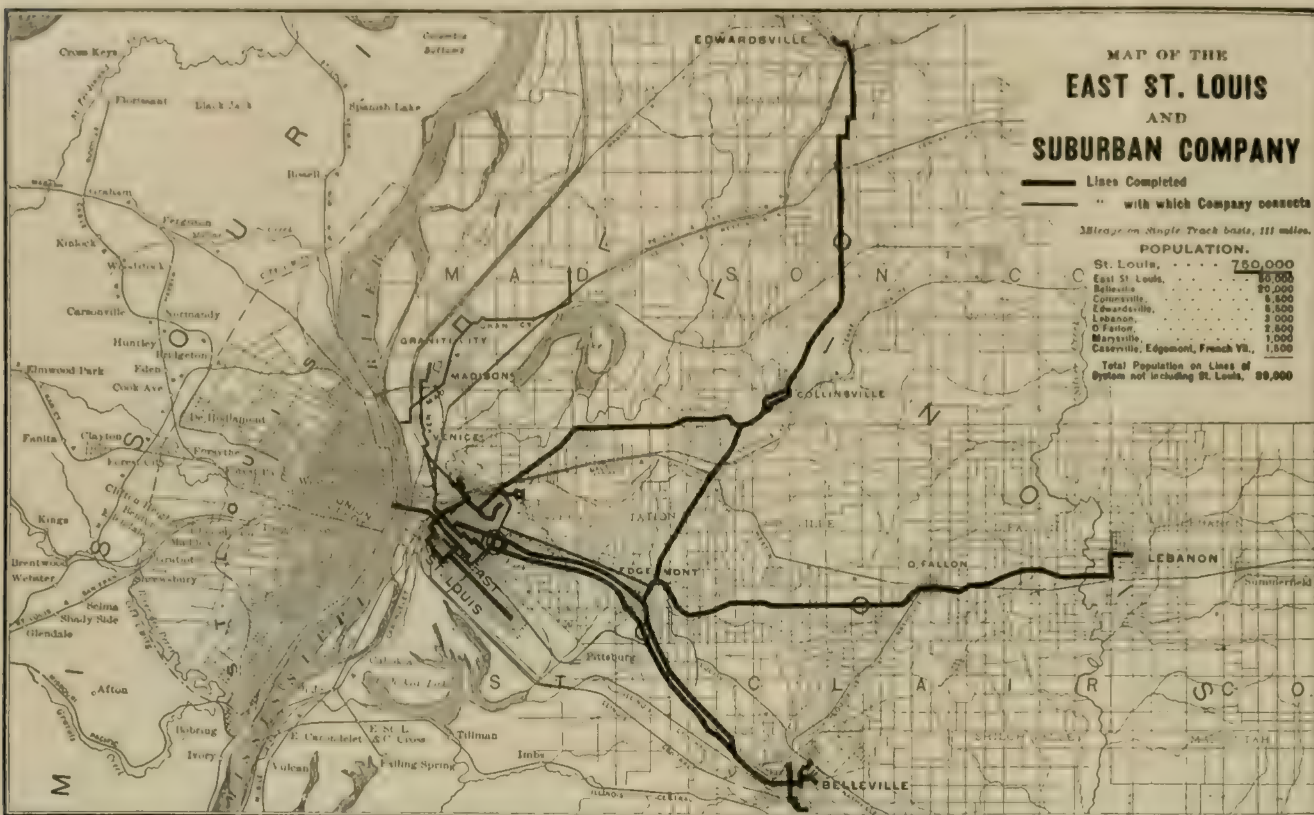
POWER STATION AND HIGH TENSION LINE



ENGINE AND GENERATOR ROOM, EAST ST. LOUIS & SUBURBAN RY.

mont. This line was supplied with power by the St. Louis & Belleville Electric Railway Co.

6. The Mississippi Valley Traction Co., which built a line from



O Sub-Station ◎ Power-Station

MAP OF THE EAST ST. LOUIS & SUBURBAN RY. SYSTEM.

East St. Louis to Collinsville in 1901; this was later extended from Collinsville to Edwardsville. Its power station was located one mile west of Collinsville.

7. The St. Louis, O'Fallon & Lebanon Electric Railroad Co., which in 1903 built a line from Edgemont to O'Fallon and Lebanon.

IN THE BLUFFS BETWEEN EDGEMONT AND O'FALLON.

It is supplied with power from a sub-station. Its roadbed, trestles and bridges were constructed with a view of supporting heavy freight traffic. The maximum grade is 1½ per cent compensated for curvature. The maximum curvature is 10°. The bridge over Silver Creek is a deck plate girder, and that over the Baltimore & Ohio South Western Railroad, near O'Fallon, is a through plate girder bridge.

Subsequently, the property of the Citizens Electric Light & Power Co., including power house, was acquired.

At the present time the entire system of the East St. Louis & Suburban Railway Co. includes 111 miles of track. One branch of the suburban line extends east from East St. Louis to Edgemont, another branch runs northeast to Collinsville, while a north and south line between Edgemont and Collinsville completes a triangular loop. From Edgemont a branch extends southeast to Belleville, another branch runs from French Village, just north of

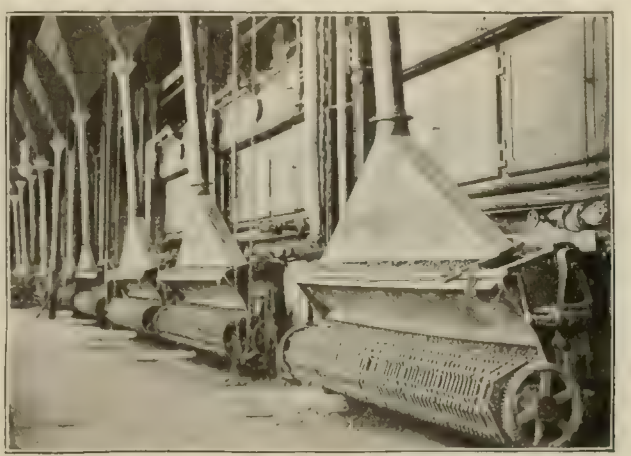
Edgemont, east to Lebanon and a third branch extends from Collinsville north to Edwardsville.

Belleville contains about 20,000 people and is the manufacturing center of a fine coal and agricultural region. Its manufactures now cover a wide range of products which contribute largely to the business of the railway. This city has been the county seat of St. Clair County since 1814 and was the home of three of the governors of the state of Illinois. Belleville was visited by Charles Dickens in 1842, at which time it was a small collection of wooden houses huddled together in the heart of a swamp and his experiences in traveling through what was then a wilderness are humorously told in his "American Notes."

OVERHEAD CROSSING OF B. & O. S. W. R. R. NEAR O'FALLON

Collinsville is a progressive city of about 7,000 population and is growing rapidly. It lies in the center of a large coal mining district and contains numerous manufacturing industries. O'Fallon is now a thriving town and illustrates the value of an electric railway to a small community, as since the advent of electric cars the growth in population and the amount of buildings has been marked. The coal mines at this place constitute one of its leading industries. Lebanon is the seat of McKendree College, said to be the oldest institution of its kind in the state. Its educational facilities make it one of the most desirable residence suburbs of East St. Louis.

Edwardsville is the northern terminus of the line and is a city of rapidly growing importance. It is a place of much historical interest, being the home of Governor Edwards, the first territorial governor of Illinois, for whom the city was named. One of the chief objects of interest to tourists is the Edwardsville Hotel, which was built in 1804 and which has been visited by many noted guests, including Daniel Boone, Governor Edwards, General LaFayette, Abraham Lincoln and Stephen Douglas.



BOILER ROOM, EAST ST. LOUIS & SUBURBAN RAILWAY CO.

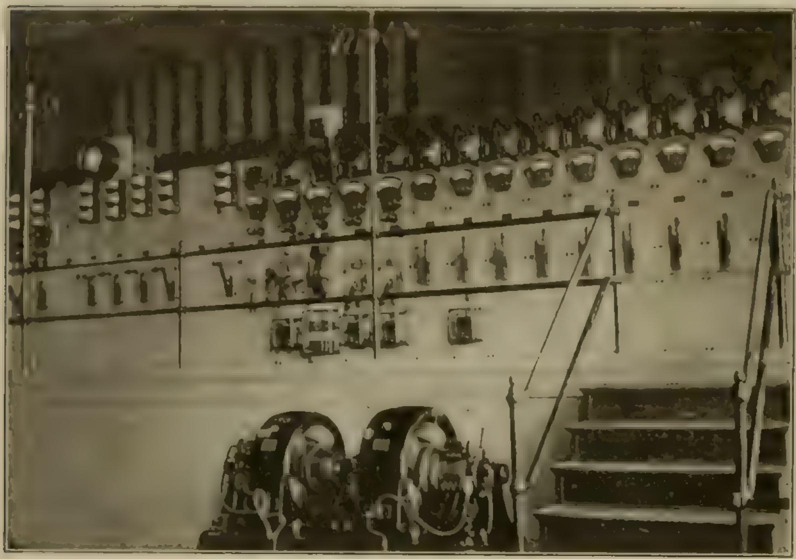
In order to generate power for the various properties to the best advantage, a power station was erected in East St. Louis, with sub-stations properly distributed, and the five smaller stations were abandoned. The new power station is located between the two belt railroads, and on the electric lines to Belleville, receiving its fuel over the company's coal road, which is here connected with both belt railroads, which in turn connect with all steam roads entering East St. Louis.

CROSSING OVER ILLINOIS CENTRAL RAILROAD NEAR EDWARDSVILLE

The dimensions of the power station, which is a brick structure, are shown on the accompanying plan. The foundation walls are of concrete, resting on piles. All engine and boiler foundations, built also of concrete, are on piles. Steel roof trusses carry the gravel roof and the coal bunkers above the boilers. The greater portion of the current generated at this station is used in the city

railway service of East St. Louis, with a center of distribution a little more than [illegible] miles distant.

The very low cost of coal and the absence of a cheap water supply made the use of simple non-condensing engines necessary. The coal used is nut, pea and slack, which is handled from the mines in the company's bottom-dump cars, built by the American Car & Foundry Co. These discharge their contents into a steel hopper over the conveyor. This conveyor is of the McCaslin type, made by John A. Mead & Co., and is of the overlapping bucket type, with 18 x 24 in. buckets, delivering the coal to steel bunkers



LOWER SWITCHBOARD, MAIN STATION

holding two car-loads each, over the boilers. The ash is taken from the pits beneath the boilers by the same conveyor, and emptied into a hopper overhead, from which it is discharged into the coal cars by gravity.

The boiler room contains five 1,000-h. p. batteries of Heine water-tube boilers. In order to obtain enough grate surface, owing to the grade of coal used, it was necessary to set two 250-h. p. boilers side by side to form each half of the battery, instead of using the single 500-h. p. units. Demand for large grate surface prompted the Green Engineering Co. to build for this plant the first traveling link grates 12 ft. in width ever constructed.

The engine room, which is served by a 35-ton crane built by the Cleveland Crane & Car Co., contains five engines direct connected to their generators, three motor generator sets, one rotary converter, besides two steam driven and one motor driven exciters. The direct current at 550 volts, supplying the city trolley lines, is furnished by a 1,600-kw. generator, driven by a Fulton Iron Works twin corliss engine, having cylinders 34 in. indiameter by 60-in. stroke, and by two 425-kw. generators, each direct connected to a 22 x 42-in. St. Louis corliss engine. The 300-kw. rotary also stands ready to convert the alternating into 550-volt direct current, on demand. The St. Louis corliss engines were built by the St. Louis Iron & Machine Works.

The current for the suburban lines is generated at 13,200 volts having 25 cycles. Two 750-kw., three-phase revolving field alternators supply this current. Each alternator is keyed to the shaft of a St. Louis corliss engine, running at 94 r. p. m. The alternators are operated in parallel without the least difficulty.

The blue Vermont marble switchboards occupy the south end of the engine room. The lower board is used for the 550-volt direct railway current and for the control of the 13,200-volt, 25-cycle alternating current. The alternating current is distributed to the three sub-stations now in operation through oil switches. The upper switchboard is set on a gallery supported by a 36-in. plate girder. It is used for the control of the 2,300-volt lighting current; the arc circuits and 550-volt direct current power circuits.

The sub-stations are located as shown on the accompanying map. Those near Maryville and O'Fallon each contain two 200-kw. rotary converters, and seven 75-kw. oil cooled transformers, with reserve space for another set. The sub-station on the bluffs east of Edgemont contains at present two 300-kw. rotaries with 125-kw. oil cooled transformers. It also has reserve space. As the load on this sub-station is very fluctuating and increasing rapidly, a storage battery will probably soon be installed in it.

The arc and incandescent lighting for the city of East St. Louis is done from the main power station by means of motor generator sets. As this lighting load is comparatively small it is taken care of by taking 550-volt current from the railway bus bars and changing it to 2,300 volt, 60-cycle alternating current, by means of motor generator sets. There are two of these sets, governed by a Tyrrill regulator in the station, each being of 420 kw. capacity. The 550-volt power circuit is changed from grounded to metallic circuit in the same way, through the medium of a 300-kw. set. The arc lighting is done through three 100-light constant current transformers. All the electrical apparatus, including the switchboards, was supplied by the General Electric Co.

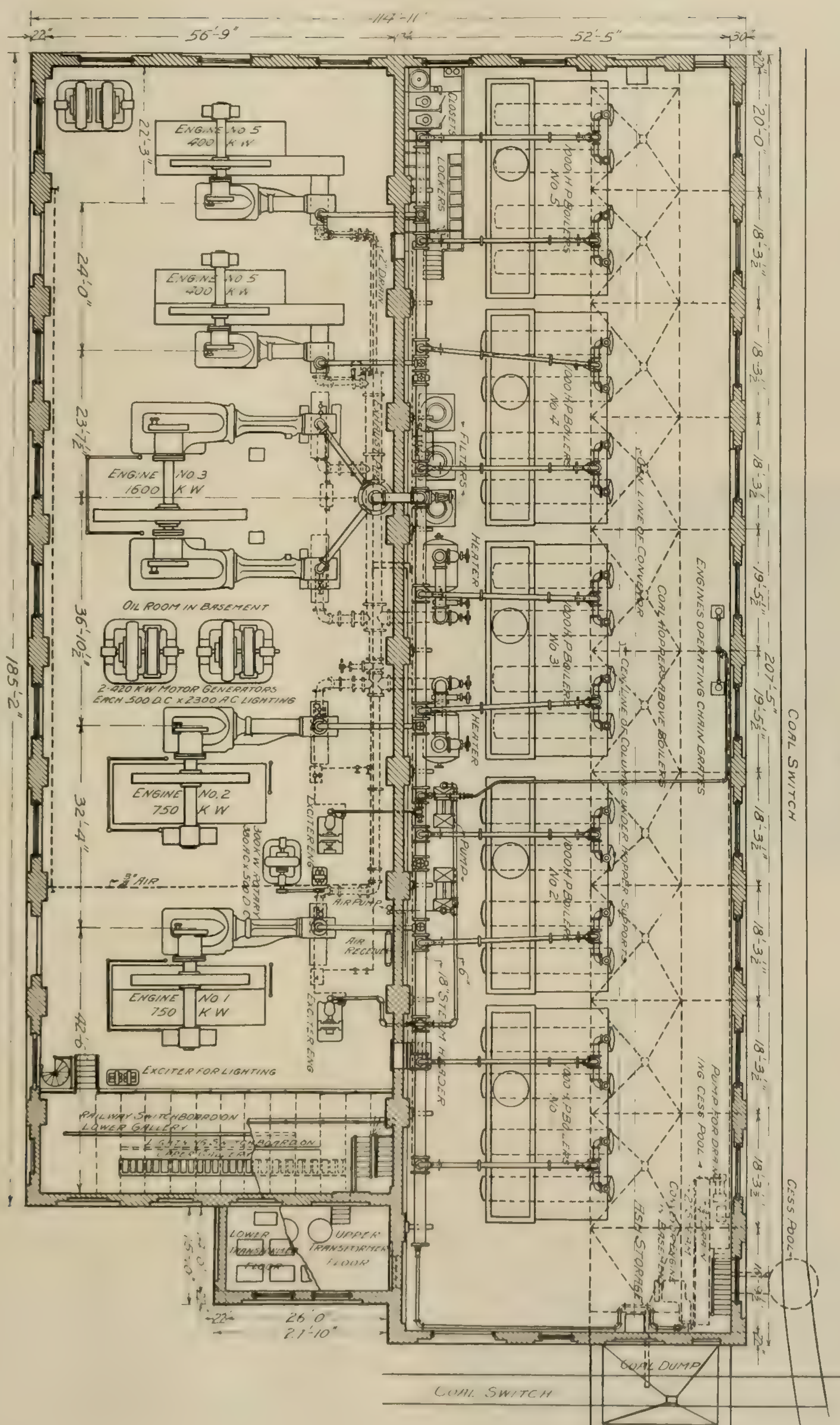
The high tension lines and suburban feed wires were supplied by the Pittsburg Reduction Co., and are of aluminum on Knowles glass insulators. White cedar poles are used throughout. The trolley wire is mainly of the No. 00 figure 8 type, hung from brackets.

A feature of interest in connection with the system of the East St. Louis & Suburban Railway Co. is its telephone system which covers the whole of the city and suburban lines. Arrangements are made for attaching portable telephones to the poles at about every 1,600 ft. Each suburban car carries its own portable telephone as well as a pole list, so that in case of accident communication can be quickly had with shops or the superintendent. The telephone list contains the names and numbers for both the private line, the Bell telephones and the Kinlock telephones of the various offices and stations on the road and of the company's physicians which are to be called in case of accident. The poles on all the suburban divisions are consecutively numbered and on the back of the tele-

INTERURBAN CAR, EAST ST. LOUIS & SUBURBAN RAILWAY CO.

phone list is given the number of each pole to which telephones may be attached. By means of this system a car on any part of the lines can immediately communicate with all of the shops, stations and offices of the company.

The cars in the city service seat 36 passengers. They are of the closed type, with 26-ft. bodies, each having two G. E. No. 67



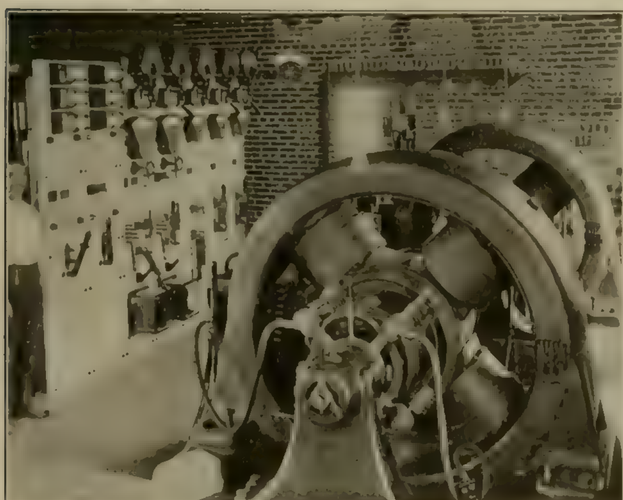
PLAN OF POWER HOUSE AND MACHINERY OF THE EAST ST. LOUIS & SUBURBAN RAILWAY CO.

motors on Brill trucks. Twelve bench open cars are in service during the summer.

The suburban cars are supplied with four G. E. No. 57 motors, and are equipped with air brakes. They have a seating capacity for 60 people. The bodies are 40 ft. long and platforms are 5 ft. wide. These are mounted on St. Louis Car Co's. No. 23 B trucks.

The freight traffic on the line between East St. Louis and Belleville is handled by two fifty-ton General Electric Co's. electric locomotives. Each of these is equipped with four 100-h. p. motors and Westinghouse air brakes.

There are a number of points of attraction situated along the company's lines which give rise to a large amount of pleasure traffic especially during the summer season. Lansdowne Grove is a popular resort at the northern city limits of East St. Louis which is an ideal spot for picnic parties in the summer time and which affords an attractive skating resort during the winter season. The grove contains three lagoons which are crossed by bridges. A livery of row boats is kept for hire at this place and the bathing facilities are one of its greatest attractions. There are a number of fishing resorts on the Monk's Mound division, scattered along for several miles beyond the northern city limits. Some of these are considered the best fishing grounds in the Mississippi Valley



INTERIOR OF O'FALLON SUB-STATION.

and are visited annually by thousands of people during the fishing season.

Monk's Mound, on the line of this company, is the highest artificial mound in the world and is the center of a group of about 100 smaller mounds. It is supposed to be the remains of a prehistoric mound builders' city. Monk's Mound derives its name from a monastery of Trappist monks that once crowned its summit. Traces of this monastery still remain and the spot has been visited by scientists from all parts of the world. On the Belleville division an attractive resort known as Priester's Park has been laid out, with an artificial lake, groves, dancing pavilion, bowling alleys and other attractions. A well equipped restaurant is also maintained at this park.

The offices of the East St. Louis & Suburban Railway Co. are located in East St. Louis. The operation of the road is in the hands of L. C. Haynes, vice president, and J. M. Bramlette, general superintendent. The design and construction of the new power station, sub-stations, track and line work on the suburban extensions is the work of Messrs. Lichter & Jens, consulting engineers, of St. Louis, who have had entire charge of the engineering work of this property.

The officers of the company are: C. M. Clark, Philadelphia, president; L. C. Haynes, East St. Louis, vice-president; G. L. Estabrook, Philadelphia, secretary and treasurer; T. W. Gregory, East St. Louis, assistant secretary and treasurer; J. M. Bramlette, East St. Louis, general superintendent; F. H. Thomas, passenger and excursion agent.

Iowa Street & Interurban Ry. Association.

April 21st the Iowa Street & Interurban Railway Association was organized at Des Moines, Ia., by gentlemen who are actively engaged in electric railway work in that state, the object being to further the interchange of helpful ideas bearing upon the construction, maintenance and operation of street and interurban railways. Several of the members of the new association are affiliated with the Iowa Electrical Association and fraternal relations will exist between the two associations, although they are distinct organizations. It was voted to admit both companies and individuals to membership in the new association, the admission fee being $10.00. Annual dues are placed at the same sum.

The officers of the new association are: President, G. B. Hippee, general manager of the Des Moines City Railway Co.; vice-president, J. F. Lardner, secretary, treasurer and general manager of the Tri-City Railway Co., Davenport; secretary and treasurer, L. D. Mathes, general manager of the Union Electric Co., Dubuque.

After the meeting the officers of the Des Moines City Railway Co. and the Des Moines-Colfax Interurban Ry. entertained the members at lunch, which was followed by a trip over the interurban line to Colfax.

The next meeting will be held at Dubuque in April, 1905.

Private Car for President Bancroft.

A very handsome private car has just been built for General Bancroft, president of the Boston Elevated Railway Co., by the Kuhlman Car Co., Collinwood, O. This car is 37 ft. 6 in. long over all and 8 ft. 4 in. wide over the eaves. It has a standard steam car roof with full empire deck and large vestibules which will be used as smoking rooms. The vestibules are lighted by five lamps held by specially designed brackets. There is a sliding door in the ceiling to permit storing camp chairs, etc., in the upper deck. The vestibules are entered through a sliding door which runs into a pocket in the side of the car and on the bottom of this door is fastened a board which moves with the door and covers the opening in the platform made by the steps, thus keeping out the cold and dirt. The vestibule has three large windows, two in front having curved glass, and one side window, and there is a specially large glass in the sliding door.

The main body of the car has six windows on each side and stationary elliptical shaped windows above them. The latter are embossed with a neat, artistic design.

The interior of the main compartment is lighted with 30 incandescent lamps. Three groups of four each are located upon the ceiling and are covered with globes of special design. The remainder of the lamps are located at the sides of the car over the windows and are also equipped with specially designed globes and fixtures. The wide window posts, of which there are six on each side, are fitted with bevel edge mirrors, and the interior finish is of inlaid mahogany. The car contains a buffet and Nickolean water cooler and the chairs will be specially designed so as to harmonize with the interior. The windows are all made to drop and are provided with silk draperies and curtains which pull down; also other curtains which pull up.

The electrical equipment of the car will be furnished by the General Electric Co., and the air brakes are of the Christensen type. The motors are designed to run the car at a speed of 60 miles an hour. The body is mounted on two Brill solid forged No. 27-E trucks having a 6-ft. wheel base. The trucks are made extra strong and the wheels are steel tired and have steel centers. These are made by Krupp, of Germany. The outside painting of the car and the decorations of the ceiling, as well as the draperies, curtains, chairs and carpets, will be installed at the car works of the Boston Elevated Railway Co.

Hans Dahl, a painter living near Berlin, Germany, has invented an automatic speed indicator for motor cars. The device is attached in proximity to the wheels, the velocity of motion being transferred to the indicator by means of a belt or chain. Varying rates of speed are shown by means of colored disks which are operated by electrical contact made by the elongation of spiral springs attached to a vertical axis which is set revolving by the motion of the wheels.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

WHEN RULE OF COMPANY COMPETENT EVIDENCE.

Frizzell vs. Omaha Street Railway Co. (U. S. C. C. A.), 124 Fed. Rep. 176. July 27, 1903.

On the trial of a charge of negligence in the operation of a street car, the United States circuit court of appeals, eighth circuit, holds that a rule of the company which directs the method of operation in respect of which complaint is made is competent evidence.

STARTING WHILE PASSENGER IS PASSING FROM PLATFORM INTO CAR.

Sharp vs. New Orleans City Railroad Co. (La.), 35 So. Rep. 614. June 22, 1903. Rehearing denied Jan. 18, 1904.

It is not negligence, the supreme court of Louisiana holds, for a street car to start while a passenger is in the act of passing from the platform into the car.

DUTY TO SECURE SAFETY OF GENERAL PUBLIC—LIABILITY FOR INJURIES FROM WRONGFUL OR NEGLIGENT OPERATION OF CARS BY LESSEE.

Muntz vs. Algiers & Gretna Railway Co. (La.), 35 So. Rep. 624. Nov. 30, 1903. Rehearing denied Jan. 18, 1904.

A railroad corporation, by its very incorporation under the laws of the state, the supreme court of Louisiana holds, assumes as one of its primary obligations that it shall operate the road under such conditions as to properly secure the safety of the general public. It is liable for injuries to persons caused by the wrongful or negligent operation of the cars upon the road, whether operated by itself or by another corporation to which it had leased it.

SUFFICIENT DESIGNATION OF DESTINATION OF CAR.

City of New York vs. New York & Queens County Railway Co. (N. Y. Sup.), 85 N. Y. Supp. 857. Dec. 30, 1903.

"Flushing, via Jackson Avenue," the second appellate division of the supreme court of New York holds to be a sufficient and substantial compliance with an ordinance requiring the destination of a car to be designated thereon to enable proposed passengers to board the car which will carry them to the place they seek, Flushing once having been the name of a village and town now merged in the city of New York, and still presumably a popular description of the territory formerly within that village or town, as so used, indicating a particular part of that city—the car starting in the territory of one former city and village, and traveling to another.

FOOTBOARD OF PASSING CAR STRIKING PERSON WAITING ON PLATFORM.

State, to Use of Egner et al., vs. United Railways & Electric Co. of Baltimore (Md.), 56 At. Rep. 789. Jan. 13, 1904.

A man standing on a raised platform which had been used for years, and who was waiting for a car, after two had passed without stopping, was struck by the footboard of the third car, which was moving rapidly, perhaps at the rate of 30 or 35 miles an hour, its footboard extending over the platform about eighteen [illegible] passengers to stand on while waiting for a car. There was no evidence whatever that the motorman in charge of the car acted in a negligent or unlawful manner when passing the platform, or that the car differed in construction from the other cars that had passed. The court of appeals of Maryland holds that there was no such evidence of negligence on the part of the company as entitled the plaintiffs to recover.

AMOUNT BID FOR FRANCHISE TO BE CREDITED UPON TAX BEING ITSELF IN THE NATURE OF A TAX.

Heerwagen vs. Crosstown Street Railway Co. (N. Y. Sup.), 86 N. Y. Supp. 218. Jan. 5, 1904.

Is a street surface railroad corporation, organized under the laws of the state of New York, entitled to be credited upon the tax assessed against it in any year under the franchise tax law with the amount which it may have paid the previous year to the municipality in which its road is located, under and by virtue of the bid which it made or the agreement which it entered into as a condition of obtaining its franchise from such municipality? The majority of the fourth appellate division of the supreme court of New York, according to McLennan, P. J. (who with Hiscock, J., dissents), are of the opinion that the amount thus paid by the corporation should be so credited, because such "payment was in the nature of a tax," within the meaning of section 46 of the franchise tax law.

NO LIABILITY FOR INJURY FROM FALLING ON SIDEWALK OF PASSENGER CARRIED BY STREET AND WALKING BACK.

Haley vs. St. Louis Transit Co. (Mo.), 77 S. W. Rep. 731. Dec. 23, 1903.

The negligence of the defendant, consisting simply in a failure to stop the car, in obedience to the plaintiff's signal, at the crossing nearest to her residence, in consequence of which she was carried to the next crossing, one block further west, where, of her own volition, she left the car in safety, the supreme court of Missouri, division No. 1, holds, was not the proximate cause of her injury, where, after safely alighting at the crossing, in returning to the crossing at which she intended to alight, she fell on the sidewalk leading from the one to the other, sustaining injury. And it holds that the fact that by reason of climatic conditions, or other natural causes, the sidewalk may have been in less safe condition than usual, in no way changed the relative rights, duties or obligations of the parties.

INJURY TO CONDUCTOR FROM PULLING OUT OF TROLLEY POLE USED WITHOUT WHEEL.

Lynch vs. Brooklyn Heights Railroad Co. (N. Y. Sup.), 85 N. Y. Supp. 805. Dec. 30, 1903.

After the wheel had fallen out of the socket at the top of the trolley pole, a conductor was told by a transfer agent and starter to proceed to a certain place, being careful, in going over crossings or around curves, that he did not pull the wires down. While proceeding in this way upon a straight piece of track where there was no crossing, the pole got entangled with a supporting wire, and was pulled from its socket on the top of the car, falling upon the conductor, injuring him. He had been in the employment of the company only three months, and testified that he did not know that the trolley pole was bolted onto the top of the car loosely, so that, if it caught in the wire, the pole would pull out, rather than pull out the wire. The second appellate division of the supreme court of New York, in affirming a judgment for $4,200 damages in his favor, says that, if it appeared without contradiction that the servant knew the character of the appliances, and the dangers to be incurred, and the method of operating them in their incomplete or defective condition, it would have to be held as matter of law that he assumed the risk of exposing himself to

and danger. Upon the proof in the present case, however, it made the question whether the plaintiff assumed the risk of and so [illegible] proximately occasioned could not be determined as matter of law, and was properly submitted to the jury.

CONDUCTOR PUTTING HEAD OUT OF WINDOW AND BEING STRUCK BY POST.

Govan vs. New Orleans & Carrollton Railroad Co. (La.), 35 So. Rep. [illegible]. June 22, 1903. Rehearing denied Jan. 6, 1904.

Well aware of the situation of iron posts located near the electric car track, and to which were attached the wires supporting the trolley, and required to keep, and keeping, notice posted in his car giving warning to keep heads, arms and body inside the car, and otherwise warned by his employers of the danger incident to his employment, and no duty being required of him calling for such act on his part, a conductor, nevertheless, thrust his head and neck out of one of the windows of the car and was struck by one of the posts distant eleven inches from the outside of the window of the passing car. The car tracks and posts had been located pursuant to directions of the city engineer who had authority in the matter. The supreme court of Louisiana holds no recovery for damages legally possible.

MEASURE OF DAMAGES FOR LAND TAKEN BY CONDEMNATION.

Chicago & Milwaukee Electric Railroad Co. vs. Mawman (Ill.), 69 N. E. Rep. 66. Dec. 16, 1903.

This was an action to condemn a right of way across certain lots. The supreme court of Illinois holds that the measure of the landowner's compensation was the fair cash market value of the land proposed to be actually taken, having proper regard to the location and advantages as to situation and the purposes for which it was designed and used, and the amount, if any, which their lands not taken would be depreciated in their fair cash market value by the construction and operation of the proposed road. Damages resulting from danger to the person of the owner of the land from the construction and operation of the road. it holds, are too remote, uncertain, and speculative to be considered by the jury in fixing the amount of the owner's compensation for lands taken and for the depreciation in the value of lands which will be damaged, but not actually taken, by the construction and operation of the proposed road.

FRIGHTENING HORSE WITH ADVERTISING BANNER ON CAR.

Indianapolis & Greenfield Rapid Transit Co. vs. Haines (Ind. App.), 69 N. E. Rep. 187. Dec. 10, 1903.

The theory of the complaint in this case was that the injury complained of was caused by reason of the plaintiff's horse becoming frightened at a sign or banner on the car which he met while driving along the highway, and that the sign or banner was not necessary to the operation of the car. It was averred that the banner, together with the speed and motion of the car, which agitated the banner, made it dangerous, and calculated to attract the notice of and frighten horses unaccustomed thereto, passing along the highway; that the banner was not necessary in the proper management and running of the car, or in any manner required in in the operation of the road, but was purely a method negligently and carelessly adopted and being used by the company of advertising a street carnival along its route. The appellate court of Indiana, division No. 1, holds that the complaint sufficiently showed the company's negligence, and stated a cause of action.

LIABILITY FOR INJURY FROM CONDUCTOR TRYING TO PUSH OFF STANDING CAR PERSON ATTEMPTING TO BOARD SAME AFTER SIGNAL TO START.

Ferris vs. Interurban Street Railway Co. (N. Y. Sup.), 85 N. Y. Supp. 866. Dec. 30, 1903.

According to the plaintiff's story, as she stood on the lower step of a car in the process of entering the car, the conductor commanded her to take another car, and at the same time shoved her so that she fell against the dashboard, and was injured. The car was standing still, but the conductor testified that he had given the signal to start, to which, for some reason, the motorman had not responded. The court was requested to charge the jury "that, if they find that she tried to board the car after the conductor had given the signal, and just before the car started in response to that signal, why then the defendant is not liable, and their verdict must be for the defendant." The second appellate division of the supreme court of New York says that the request does not embody any recognized rule of law, and was properly refused. It takes no note of the question of the plaintiff's knowledge, or means of knowledge, of the fact that a signal had been given to start the car, nor does it include any suggestion bearing even remotely upon the consideration of the plaintiff's possible negligence. As an abstract proposition of law it asserts that there can be no liability for assault upon the person of a passenger, or for any other act of negligence, if the passenger boards the car while apparently invited to do so, but after a signal had in fact been given to start the car, but given without his knowledge and without effect. In other words, freedom from liability is predicated absolutely upon the fact of the signal, and wholly independent of all the surrounding facts and circumstances. A statement of the alleged proposition of law included in the request seems a sufficient refutation of its accuracy and soundness. The judgment for the plaintiff should be affirmed.

INJUNCTION AGAINST ABUTTER INTERFERING WITH USE OF CONSENTS REFUSED—NATURE OF CONSENTS.

Paterson & State Line Traction Co. vs. Wostbrock et al. (N. J. Ch.), 56 Atl. Rep. 698. Dec. 31, 1903.

The company, the court of chancery of New Jersey says, sought to enjoin certain abutters interfering by word, deed, or writing, with its use of their consents, and to compel the withdrawal by one of them of a paper filed by him with the borough council, or the execution of some document to be filed with the council nullifying or canceling his consent. Subsequent to the filing of the bill of complaint, however, a resolution denying the application of the complainant to construct its road was passed by the council, so that there was at the time the court decided this case no application pending relative to which the consents in question could be held to apply. The only basis, therefore, upon which the complainant's bill could then be rested, was that the consents gave to it such rights against the persons who had given them as to entitle it to a declaration or decree preventing threatened interference with the right conferred by the consents. The complainant claimed that, the consents having been granted upon consideration, they were in the nature of property rights or easements. But the court dismissed its bill, saying that the manifest object of the provision of the statute allowing consents was not to give to every abutting owner, as such, a right to consent for all future owners of the land to any future application, but to require the consent of those who were owners of the land at the time of the application to be acted upon. Any other view of the nature of the consent would, under color of this statutory consent, confer upon an abutting owner a transferable property right in the street, which has always been denied to them. There is not, therefore, and there cannot be, any right to consent, which is a general property right or easement attached to the ownership of the property, and the only right which complainant can enforce under such consents must be the statutory right which arises only in connection with some application or proposed application to the council for constructing its road.

TRANSFERS REQUIRED AFTER EXTENSION OF CITY LIMITS.

Indiana Railway Co. vs. Hoffman (Ind.), 69 N. E. Rep. 399. Jan. 6, 1904.

A company which has acquired the right to operate a line of street railway within the limits of a city and to operate an interurban line connecting therewith at the city limits on which there is the right to charge a separate fare, and which thereafter contracts with the city to issue transfer tickets free of charge to all passengers requesting the same who may board the cars at any point

upon any of its lines within the limits of the city, whose destination may be to any point upon any other line of the company's road within said limits, the supreme court of Indiana holds is bound to give a transfer to a point on said interurban line brought within the limits of the city by a subsequent annexation of territory. It says that whatever rights the company in this case had in such territory under its grant from the board of commissioners were not impaired or destroyed by the extension of the city boundary, but were changed by its agreement with the city to issue transfer tickets over its line therein to all points within the city limits. This agreement could not be held to apply only to passengers who were transported on the company's cars within the old limits of the city, but must be held to apply to and include any and all passengers whose destination was within the limits of the city as they were extended by the annexation of territory. This extension by the municipal authorities was the exercise of governmental powers. In a legal sense the city is a unit, although its boundaries may be changed from time to time by extension, and all persons within the limits thereof as extended become bound by, and must yield obedience to, its ordinances. It certainly in reason cannot be asserted that an ordinance adopted by a city must, in its operation, forever be confined to the limits of the municipality as they were at the time it was passed, and cannot become operative in territory thereafter annexed, and made a part of the corporation. And with no more force and reason could it be said in this case, under the circumstances, that the agreement of the company in regard to issuing transfer tickets was not operative within the limits of the city as thereafter extended.

DEPARTURE IN DETAILS FROM APPROVED PLANS OF CONSTRUCTION DOES NOT MAKE A PUBLIC NUISANCE — USE OF TIES OF DIFFERENT WOOD OR RAILS OF DIFFERENT WEIGHT—RATIFICATION BY CITY OF VARIATIONS—CONSTRUCTION OF CROSS-OVER SWITCH 500 FEET FROM DESIGNATED POINT —ABUTTER NOT ENTITLED TO MANDAMUS.

State, ex rel. Howard vs. Hartford Street Railway Co. (Conn.), 56 Atl. Rep. 506. Dec. 18, 1903.

A cross-over switch connecting the two tracks of a double-track electric railway was constructed in front of the relator's residence, at a point 500 feet distant from that indicated on the plan. The supreme court of errors of Connecticut says that it may be that a railroad structure of this kind, placed in the highway, is an unlawful obstruction, unless its location and mode of construction are submitted to and approved by the council; and it may be that after such approval a road can be located and constructed in such utter disregard of the plan approved as to be, in effect, a road built without submission or approval. But it cannot be that a railroad authorized by the legislature, approved in its location and mode of construction by the council, and built in substantial accord with that approval, is a public nuisance, merely because in some detail of construction there is a departure from the plan approved. And it cannot be that a particular part of the structure so built, which differs in detail from the mode of construction indicated by the plan, is, for that reason only, a public nuisance, although the difference may be sufficient to justify the council in ordering the part to be removed, and the construction to conform to the plan. For instance, in the plan before the court the railroad ties are required to be of oak or chestnut wood, and the steel rails to be of a specific weight. Can it be that any tie of a different wood, or any rail of a different weight, is, for that reason only, an unlawful obstruction on a highway, and so for that reason a public nuisance? Such effect cannot reasonably be given to the legislation regulating the novel and peculiar situation arising from the relation of the defendant corporation and the city to each other and the highways. That legislation recognizes a railroad structure as a part of the highway, furthering the identical public use of common travel for which the highway was established, unless authorized for a different purpose, or constructed and operated so as to be perverted to a different [illegible] property, [illegible] without compensation.

In making the discretion of the railroad subject to that of the city, and providing efficient means whereby the latter can enforce obedience, the law makes full provision for any departure from the plan, in detail of construction by the railroad without the assent of the city, but does not directly or indirectly declare that by the mere fact of such departure the tramway, or any part of it, ceases to be a constituent part of the highway, facilitating its use for public travel, and becomes a mere lawless obstruction to that travel. If the railroad company, in some detail of construction, departs from the plan adopted, the city has the power to compel conformity, but is not necessarily bound to do so. It is within its discretion to ratify the variation by a formal change of the plan in the manner provided, if not by formal acquiescence; and, even when the council has issued an order of conformity, the city is not necessarily bound to enforce that order, either by writ of mandamus as authorized by the statute, or by itself doing the work at the expense of the company. It is still within its discretion to ratify the change. It may be doubtful whether the duty resting on the railroad company of exact conformity with the plan in detail of construction is a corporate duty that can be enforced by mandamus, except at the instance of the city, as specially authorized by statute.

With reference to the aggravation of noise and vibration when the public travel passes over a cross-over switch, the court says that the defendant is not liable for an annoyance of this kind, because such annoyance is an incident to the use of the highway for public travel, and is not made liable because, through its disobedience of the council's orders, it happens to fall with greater stress upon the relator than upon his neighbors. It is the nature of the annoyance, as a necessary incident to the public use of the street, and not the defendant's disobedience to the council's order, which determines its liability to those who happen to suffer most by the annoyance.

But the relator apparently claimed that the annoyance suffered by him was not merely an ordinary incident to the use by the public of a highway constructed with a double-track tramway and a cross-over switch, but that, owing to physical or other conditions existing at this particular place, it was peculiar and exceptional, and so injurious to his right to the quiet enjoyment of his home that the legislature, in authorizing a street railway, could not be held to have authorized its construction in such manner at this place, or that the legislature itself could not authorize such an invasion of his rights of property without compensation. If this claim is well founded, the court says, the relator has a grievance against the defendant, and is entitled to legal redress, but such right does not entitle him to a writ of mandamus commanding the railroad to obey the order of the city council. His private right cannot be enforced without establishing the absolute illegality of such construction of the highway at this point, whether built with or without the joint action of the defendant and the city council. This question is not involved in an application for the writ. An ordinary action in equity will furnish a complete remedy for testing the existence of such a wrong to the relator, and giving the relator full and adequate redress. This of itself is a conclusive answer to any application for the extraordinary remedy by writ of mandamus.

WARNING OF RAILROAD COMMISSIONERS COMPETENT EVIDENCE IN PERSONAL INJURY CASE.

Baruth vs. Poughkeepsie City & Wappinger's Falls Electric Railway Co. (N. Y. Sup.), 85 N. Y. Supp. 822. Dec. 30, 1903.

The New York railroad law provides: "No examination, request or advice of the board [state board of railroad commissioners], or any investigation or report made by it, shall have the effect to impair in any manner or degree the legal rights, duties or obligations of any railroad corporation, or its legal liabilities for the consequence of its acts, or of the neglect or mismanagement of any of its agents or employes." The second appellate division of the supreme court of New York says in this personal injury case that it can see nothing in this provision which makes the fact incompetent as evidence that prior to an accident the attention of a railroad corporation was called to a dangerous condition of its road, which dangerous condition subsequently caused the accident complained of. Notice to the company of the defect from which injury has resulted is always deemed competent and cogent evidence in cases of this character, irrespective of the source from which the notice may have emanated. Again, the court says, that the section referred to relates only to the legal effect upon the rights, duties, obligations, and liabilities to be given to the recommendations and actions of the board. Such action cannot change these rights and liabilities as a matter of law. The language is quite appropriate to the idea

[illegible] hold that such advice or report cannot be taken into consideration by a jury in determining the question of neglect or mismanagement as one of fact. It is true that the legal rights of the company are not to be impaired by the action of the board, nor would they be impaired by the admission of proof of such action. The liability would still rest upon the fact of negligence, notwithstanding the company had the legal right to maintain its road in the condition that it did, in so far as concerns the action of the state board of railroad commissioners. But on that question of fact it would seem that an official notification to the company from a competent and qualified source, made more than a year before the accident, calling attention to existing conditions as dangerous, and suggesting an easy and appropriate remedy, which notification was wholly neglected and disregarded, must be legitimate evidence in an action between the railroad and a person injured by the alleged neglect, in the absence of a clear legislative prohibition of the use of such notification as evidence.

CARE REQUIRED TO AVOID INJURY TO PERSONS USING HIGHWAY AND AT CURVES WHERE RUNNING BOARD OVERLAPS SIDEWALK—DUTY TO REDUCE SPEED AND SOUND GONG—DUTY OF MOTORMAN—USE OF LONG CARS NOT NEGLIGENCE—DUTY OF PERSONS ON SIDEWALK OR IN STREET.

Hayden vs. Fairhaven & Westville Railroad Co. (Conn.), 56 Atl. Rep. 613. Jan. 6, 1904.

The plaintiff, standing in conversation on a street corner about twelve inches from the edge of the sidewalk, was struck by the running board of a long double-truck car which at one point at such corner projected over the curbstone and over the sidewalk for a distance of twenty-five inches in rounding a curve opposite such corner in turning from one of the intersecting streets to the other. As to the degree of care required of the defendant, the court charged in substance as follows: It was the duty of the defendant, in running its cars on the highway, to use reasonable care to avoid injury to persons using the highway; and what is reasonable care depends upon the circumstances of the case; and, as the danger of accident increases, the degree of care should also increase. It was the duty of the defendant to the plaintiff to exercise such care as would be exercised by a reasonably prudent man under all the circumstances. At places where there is more danger the speed must be greatly reduced, and the gong should be sounded to give warning; and if the defendant company was operating a car, the running board of which, at curves, extended over a part of the sidewalk, it was its duty to use reasonable care and diligence to prevent injury thereby to any person standing on the sidewalk at such place; "and it is the duty of the motorman operating such car to use reasonable care to avoid injury to persons on the sidewalk at places where there is such overlapping of the running board; and reasonable care may mean great care, depending upon the circumstances, and, the greater the overlapping, the greater the degree of care must be exercisd. It is his duty to avoid injury to persons lawfully using the public street, whether crossing it or whether on the sidewalk." The supreme court of errors of Connecticut thinks this was a fair statement of the law relating to the duty of the defendant and its servants towards the plaintiff in this case, and that it was well adapted for the guidance of the jury.

The court further charged, in substance, that if the car that struck the plaintiff was of the kind in general and ordinary use by other companies engaged in the same business as the defendant, "the mere use thereof as a street car at such curves as the one in question, in a manner in all other respects careful and proper," would not of itself constitute negligence. The plaintiff complained of this, but, the supreme court of errors thinks, without reason.

Nor does the latter court think there was any error in a failure to charge, as requested, that, because the plaintiff was on the sidewalk, he was under no duty to exercise reasonable care with reference to the approach of a car around the curve in question. It says that, standing where the plaintiff did, so near the edge of the sidewalk, it was, it thinks, his duty to exercise some degree of care with reference to the street traffic. He was not, standing there, as free from all duty with regard to that traffic as he would have been in bed; yet that was substantially the import of this request. Standing in the street, it would have been his duty to exercise a higher degree of care, perhaps, than would be required of him on the sidewalk; but even on the sidewalk he was not entirely free from the duty to exercise some care with reference to street traffic. Whether on street or sidewalk, he was bound to exercise some care; the degree of care varying with the circumstances. In short, he was bound, standing where he did, to exercise such care as would be exercised by a reasonably prudent man in like circumstances.

CRIMINAL RESPONSIBILITY OF OFFICERS OR AGENTS—CONSTRUCTION AND MAINTENANCE OF AUTHORIZED DANGEROUS GRADE CROSSING—NOT PUTTING IN DERAILING SWITCH.

State vs. Young (N. J. Sup.), 56 Atl. Rep. 471. Sep. 3, 1903.

This was a prosecution for manslaughter against the president, vice-president, executive committee, general superintendent, superintendent and assistant superintendent for Essex county, and the roadmaster of the North Jersey Street Railway Company. They were indicted as the result of a grade-crossing accident. That this crossing was a place of especial danger, the supreme court of New Jersey says, could not be controverted. That human ingenuity could not render it absolutely safe was manifest. But notwithstanding that fact, neither the corporation, whose agents these defendants were, nor the defendants themselves, were guilty of any criminal act, or even civilly responsible for the construction of their railroad at this place, for the reason that the legislature had authorized the company, or its predecessor, to construct and operate a trolley road along the surface of that avenue, down that incline, and across the tracks of the steam railroad company at grade. And being authorized by the legislature, the act was a legal one. No responsibility, either criminal or civil, rests upon a man who does a legal act, unless he does it in a negligent way.

The state very properly conceded, as the court understands it, it goes on to say, that the only responsibility which could attach was such as arose from a negligent performance of duty, either in the method of construction of that road in that dangerous locality, on the grade of the street, or in the system of its operation. The question of the criminal responsibility of the individual officers or agents of the company was a much narrower one than that of the civil responsibility of the corporation. It must appear that each of these directors or officers, to be responsible criminally, had been guilty of gross negligence, either in the doing of, or in the omission to do, some specific act, which was rendered necessary in the performance of his duty to those who rode on that car.

The undisputed facts, as submitted by the state, showed that at the crossing of trolley roads by steam railroads it is not the universal practice to put in derailing switches, and that, so far as the case disclosed, not more than perhaps 10 per cent. of all the crossings in this country are so protected. That suggested, at least, the court says, the idea that there must be a great difference of opinion among men who operate these trolley roads at such points as to the advisability, the wisdom, of such a method of protection, as to whether or not it really does add to the safety of the crossing, or whether it does not, in fact, make it more, rather than less, dangerous. That raises a question, and, where a question is presented of that kind, there being reasons for and against the adoption of a scheme, it does not follow that, because one method is discarded, rather than adopted, the act is a negligent one. Whether or not a derailing switch is a necessary precaution, the omission of which suggests, or rather demonstrates, gross negligence on the part of those who omit to put it in, cannot be decided without considering also the question of the operation of the road as it is constructed.

And it is said that, taking the system of construction and the system of operation together, if they did not furnish the safest method which could possibly have been devised for the protection of passengers on the trolley cars, they certainly did furnish so safe a method as to justify these directors and officers in supposing that additional precautions were not necessary. It was a question for them to determine whether the putting in of a derailing switch would be an additional safeguard. And, because they reached the conclusion that it was not required, instead of the opposite conclusion, it could not be said that they were guilty of such gross negligence in the performance of duty as to render them criminally responsible.

Financial.

The gross earnings of the Toledo & Western Railway Co. for April amounted to $17,985, against $12,756 for April, 1903, a gain of $5,229.

The postponed annual meeting of the Chicago & Oak Park Elevated Railroad Co., was held May 4th and a further postponement taken to June 7th, owing to the annual report and the reorganization plan not being in readiness.

The Rochester (N. Y.) Railway Co. reported for March as follows: Gross earnings, $117,249, an increase of $16,813; operating expenses, $66,743, an increase of $12,890; net earnings, $50,506, an increase of $3,926; fixed charges, $35,850, an increase of $10,757; net income, $14,656, a decrease of $6,831.

The Hoosac Valley Street Railway Co., of North Adams, Mass., has petitioned the railroad commissioners for authority to issue $100,000 of new stock, making the total $500,000, and also an issue of $300,000 bonds, making the total $400,000.

The Massachusetts railroad commissioners have authorized the Boston & Worcester Street Railway Co. to issue $200,000 4 per cent 20-year bonds and $100,000 additional stock for payment of improvements and extensions. In 1903 the company increased its capital by $500,000. In July last year it was authorized to issue $1,000,000 5 per cent 20-year bonds and in September $250,000 4½ per cent 20-year bonds. The present capital is $1,465,000; bonds outstanding, $1,250,000.

The gross earnings of the St. Louis Transit Co. for April were the largest in the history of the company and amounted to $710,338, as compared with $607,031 in April, 1903, a gain of $103,307. A total of 20,225,000 passengers were carried during the month, as against 17,460,000 in April last year, and it is estimated that 14,206,760 were revenue passengers. The gross earnings for the four months ending April 30th amounted to $2,484,176, a gain of $303,882 over the same period in 1903.

ST. JOSEPH RY., LIGHT, HEAT & POWER CO.

The St. Joseph (Mo.) Railway, Light, Heat & Power Co. reported for March as follows:

	1903	1904	Increase.
Earnings from operation	$42,695	$51,115	$8,420
Operating expenses	25,394	28,887	3,493
Net earnings	17,301	22,228	4,927

TOLEDO RAILWAYS & LIGHT.

The statement of the Toledo (O.) Railways & Light Co. for March compares as follows:

	1903.	1904.	Increase.
Gross earnings	$127,012	$138,665	$11,653
Operating expenses	65,453	77,859	12,406
Net earnings	61,560	60,806	* 754
Deductions for interest	40,716	41,971	1,255
Net income	20,844	18,835	2,009

The earnings for April were $95,495, against $93,714 for April, 1903, a gain of $1,781. The gain would have been greater but for the winter floods. *Decrease.

DETROIT UNITED RY

The Detroit United Ry. reported for March as follows:

		Increase.
Gross earnings	$330,155	$ 2,529
Operating expenses	221,306	29,070
[illegible]	100,810	*25,532
[illegible]	19,495	*33,313

*Decrease.

The passenger earnings for April were $[illegible], against $[illegible] for the same period last year, a gain of $[illegible]. All divisions made gains in April except the Rapid Ry., which earned $[illegible] against $[illegible] in April, 1903, a loss of $1,[illegible].

HAVANA ELECTRIC RY

The Havana (Cuba) Electric Railway Co. reported for the year ending December 31st as follows:

	1902.	1903.	Increase.
Gross earnings	$864,865	$1,061,729	$196,864
Expenses	559,429	641,832	82,403
Net earnings	305,436	419,899	114,461
Other income	7,407	22,779	15,372
Total income	312,843	442,676	129,833
Charges	334,704	412,441	77,737
Surplus	*21,861	30,325	52,066

*Deficit.

CLEVELAND & SOUTHWESTERN.

Following is the comparative statement of the Cleveland & Southwestern Traction Co. for March:

	1903.	1904.	Increase.
Earnings from operation	$31,546	$33,860	$2,314
Operating expenses	18,624	24,471	5,847
Net earnings	12,292	9,389	*2,903
For three months:			
Earnings from operation	$83,730	$89,168	$ 5,438
Operating expenses	55,698	69,527	13,829
Net earnings	28,032	19,641	*8,391

*Decrease.

CHICAGO & MILWAUKEE ELECTRIC.

Following is the earnings statement of the Chicago & Milwaukee Electric Railroad Co. for April:

	1903	1904	Increase
Gross earnings	$15,161	$28,063	$12,902
Operating expenses	6,242	12,188	5,946
Net earnings	8,918	15,875	6,956
For four months:			
Gross earnings	$51,196	$87,936	$36,741
Operating expenses	24,948	43,678	18,730
Net earnings	26,248	44,258	18,010

TWIN CITY RAPID TRANSIT CO.

The Twin City Rapid Transit Co., of Minneapolis, Minn., reported for March as follows:

		Increase.
Earnings from operation	$343,302	$23,746
Operating expenses	164,407	11,103
Net earnings	178,895	12,643
From January 1st:		
Earnings from operation	$988,073	$74,078
Operating expenses	480,661	38,333
Net earnings	507,412	35,745

LAKE SHORE ELECTRIC RY.

The statement of the Lake Shore Electric Railway Co., Cleveland, O., for March is as follows:

	1903.	1904.	Increase.
Gross earnings	$42,309	$41,772	*$ 537
Operating expenses	31,859	35,995	4,136
Net earnings	10,449	5,777	* 4,672
For the quarter:			
Gross earnings	$109,089	$110,902	$ 1,813
Operating expenses	89,265	110,615	21,350
Net earnings	10,825	287	*10,538

*Decrease.

Passenger earnings for April amounted to $45,593, against $44,414 a year ago, a gain of $1,178.

NORTHERN TEXAS TRACTION CO.

Following is the comparative statement of the Northern Texas Traction Co. for April:

	1903	1904	Increase
Gross earnings	$37,381	$41,770	$4,389
Operating expenses	22,222	23,253	1,031
Net earnings	15,159	20,517	5,358
Fixed charges	9,018	9,750	732
Net profit	6,140	10,768	4,628
For four months:			
Gross earnings	$127,772	$160,985	$33,213
Operating expenses	70,154	96,829	26,675
Net earnings	57,618	64,157	6,539
Fixed charges	35,988	38,325	2,337
Net profit	21,629	25,832	4,203

NORTHERN OHIO TRACTION & LIGHT

The comparative statement of the Northern Ohio Traction & Light Co., of Akron, O., for March is as follows:

	1903	1904	Increase
Gross earnings, railway	$52,882	$52,692	*$ 190
Gross earnings, light	8,727	9,417	690
Gross earnings total	61,600	62,109	500
Operating expense, railway	32,096	32,999	903
Operating expense, light	3,265	3,617	352
Operating expense total	35,361	36,616	1,255
Net earnings	26,247	25,492	*755
Fixed charges	21,083	22,466	1,383
Surplus for stock	5,164	3,026	*2,138

*Decrease.

The passenger earnings for April were $52,133, against $51,095 for April, 1903, a gain of $1,037.

PHILADELPHIA CO.

Following is the statement of operating statistics of the Philadelphia Co. and affiliated corporations for the three months ending Mar. 31, 1904:

Earnings from operation	$4,205,505
Expenses and taxes	2,273,782
Net earnings	1,931,723
Miscellaneous income	166,566
Total earnings	2,098,289
Fixed charges	1,030,484
Total income	1,067,805
Accrued div. Phila. pref.	71,805
Net income surplus	996,000
Available for Phila. Co.	994,248

ELGIN, AURORA & SOUTHERN

Following is the statement of the Elgin, Aurora & Southern Traction Co. for March:

	1903.	1904.	Increase.
Earnings from operation	$32,824	$34,544	$1,720
Operating expenses	19,973	23,239	3,266
Net earnings	12,851	11,304	*1,547
Deductions	9,216	9,133	*83
Net income	3,635	2,171	*1,464
For nine months:			
Earnings from operation	$319,978	$344,630	$24,652
Operating expenses	185,903	207,578	21,675
Net earnings	134,076	137,052	2,976
Deductions	81,946	82,641	695
Net income	52,130	54,411	2,272

*Decrease. Operating expenses include an accident appropriation equal to 2 per cent of gross receipts. Bonds of the company purchased and held in sinking fund, $37,000.

CINCINNATI, NEWPORT & COVINGTON

Following is the condensed statement of the Cincinnati, Newport & Covington Light & Traction Co., of Covington, Ky., for March:

	1903.	1904.	Increase
Gross receipts	$94,830	$100,204	$5,374
Operating expenses	39,456	43,725	4,269
Damages, taxes, rents and tolls	16,830	16,906	67
Total expense	56,296	60,631	4,335
Net earnings	38,534	39,573	1,039
Fixed charges	21,433	20,917	*516
Net profit	17,101	18,656	1,555
Operating ratio	.4160	.4363	.0203
Same inc. damages, taxes, etc.	.5936	.6050	.0114
For three months:			
Gross receipts	$275,305	$294,002	$18,697
Operating expenses	115,451	126,501	11,050
Damages, taxes, rents and tolls	50,025	50,390	365
Total expense	165,476	176,892	11,416
Net earnings	109,829	117,110	7,282
Fixed charges	63,415	63,283	*132
Net profit	46,414	53,827	7,413
Operating ratio	.4193	.4302	.0109
Same inc. damages, taxes, etc.	.6010	.6016	.0006

*Decrease.

INTERNATIONAL TRACTION CO.

Following is the comparative statement of the International Traction Co., Buffalo, N. Y., for March:

	1903.	1904.	Increase.
Gross earnings	$295,916	$315,021	$19,105
Operating expenses (ex. taxes)	170,294	215,264	44,970
Net earnings	125,621	99,756	* 25,865
Fixed charges	130,861	137,632	6,771
Net income (deficit)	5,239	37,876	32,636
Net income July 1st to date	135,742	92,741	* 43,000
Operating ratio (ex. taxes)	.584	.691	.107
For the quarter:			
Gross earnings	$859,473	$896,341	$ 36,867
Operating expenses (ex. taxes)	494,908	616,314	121,407
Net earnings	364,565	280,026	*84,539
Fixed charges	378,303	400,828	22,525
Net income (deficit)	13,738	120,801	107,064
Operating ratio	.585	.696	.111
For nine months:			
Gross earnings	$2,783,163	$3,071,106	$287,943
Operating expenses (ex. taxes)	1,494,562	1,781,092	286,529
Net earnings	1,288,601	1,290,014	1,414
Fixed charges	1,152,858	1,197,272	44,414
Net income	135,743	92,742	* 43,000
Operating ratio	.546	.588	.042

*Decrease.

OHIO UNION TRACTION CO.

In the announcement made by A. E. Appleyard & Co., of their plan for taking over the traction roads of central Ohio under the charter of the Ohio Union Traction Co., it was stated that the total bond issue, including the underlying issues, will not exceed $30,000 per mile of single track, and $10,000 additional per mile of double track of main line, exclusive of turnouts and sidings, outside of cities and $60,000 per mile of single track and $40,000 additional per mile of double track of main line within cities, except where those are situated upon unpaved streets the limitation shall be $5,000 per mile. Holders of stock or bonds of the Dayton, Springfield & Urbana line; Columbus, London & Springfield; Columbus, Grove City & Southwestern; Central Market; Urbana, Bellefontaine & Northern; Kenton & Southern, Springfield and Southern were given until May 1st to exchange their 5 per cent bonds in $1,000 blocks for the Ohio Union Traction Co's. first consolidated mortgage fives, based on their respective market values. In all there will be 100 per cent bonus of common stock of the Ohio Union Traction Co. One hundred dollar receipts are issued for parts of the amount, fractions of $1,000 to be paid in cash.

ANNUAL REPORT OF PHILADELPHIA CO.

The 20th annual report of the Philadelphia Co., incorporating also the 2nd annual report of the Pittsburg Railways Co., for the year ending Mar. 31, 1904, has been received. For the Philadelphia Co. the president, Mr. J. H. Reed, reports relative to the gas and oil wells purchased and drilled during the year and the number of miles of mains laid, and states that the company now holds under lease 290,457 acres of gas and oil territory in western Pennsylvania

and West Virginia, and it controls through ownership of the Union Gas Co. and the Equitable Gas Co. 1,500 acres more. The additional receipts from gas sold during the year amounted to $608,236.

The combined income account of the company for the year shows the gross earnings to have been $11,153,953; operating expenses and taxes, $6,505,632; net earnings, $4,648,321; other income, $208,015; total income, $4,856,335; deductions, $2,315,207; fixed charges, including dividend on preferred stock $137,935, $2,011,355; net income, $529,773. There have been declared out of this surplus dividends on the common stock of the affiliated companies to the amount of $110,891, the Philadelphia Co's. proportion being $110,661. The total assets of the company are $57,180,087, including $8,444,102 total property and plant. The total capital is $34,697,842; funded debt, $19,312,850.

In the report of the Pittsburg Railways Co. the president, Mr James D. Callery, states that during the year the Pitcairn & Wilmerding Street Ry. and the Wilkinsburg & Verona Street Ry. were added to the system; the East McKeesport Street Ry. completed a connection in Wilmerding by a viaduct over the Pennsylvania R. R.; the Pittsburg & Charleroi Street Ry. completed connection between Castle Shannon and Monongahela City; through cars are now operated from the head of the Pittsburg Incline to Allenport, 32 miles; the tracks of the McKeesport & Reynoldton Street Ry. have been extended to the southern limits of Glassport; the Howard & East St. Ry. was constructed to the city limits of Allegheny, and the tracks of the Bellevue & Perrysville Street Ry. to West View. The results of the operation of these lines during the summer and fall were satisfactory. The company constructed during the year 34.53 miles of new track, making a total of 445.56 miles. The company purchased 100 closed vestibule motor cars and 100 closed trail cars.

The gross receipts show a satisfactory increase, .0481 per cent. The depression in general business and closing down of many of the mills caused a slight decrease in receipts between Jan. 1, 1904, and Mar. 31, 1904. The extremely cold weather during the winter also affected the receipts and increased the operating expenses. The principal item in the increase of expense is shown in the transportation department and is owing to the increase in wages to all classes of workmen, especially to motormen and conductors, and to the advanced cost of coal, which was about 40 per cent. The president announces, however, that due to competition the company will secure its coal this year at reduced prices.

The total earnings from operation for the year amounted to $8,661,394; operating expenses and taxes, $5,186,882; net earnings, $3,474,513; other income, $137,656; total income, $3,612,169; deductions, $1,293,805; net income, $2,318,364; fixed charges, $2,334,441; deficit for year, $16,076; surplus Mar. 31, 1903, $206,962; bad accounts collected and premium on bonds sold, $8,578; surplus Mar. 31, 1904, $199,463. The gross earnings increased $384,829 over 1903 the preceding year.

The number of passengers carried during the past year were 174,400,055; car mileage, 34,748,836 miles; earnings per car mile, $.2532; expenses per car mile, including taxes, $.1492; net earnings per car mile, $.1040.

HONOLULU RAPID TRANSIT & LAND CO.

The annual report of the Honolulu (H. I.) Rapid Transit & Land Co., for the year ended Dec. 31, 1903, shows the gross earnings to have been $279,873; operating expenses, $152,519; net earnings, $127,354; income from other sources, $4,446; total income, $131,800; charges, $41,607; net income, $90,193; dividends, $30,955; surplus, $59,238; total surplus carried over to 1904, $126,133.

The capital stock is $1,250,000, of which $339,000 preferred and $800,000 common has been issued; of the $1,000,000 6 per cent 15-25 year gold bonds authorized there is outstanding $610,000, making the net capital liabilities per mile of track $81,333.

The total assets amount to $1,999,517, including $300,825 lands, buildings and power plant; $621,072 roadway, track and overhead line; $160,156 rolling stock and motors, and $530,000 franchises and [illegible]

An analysis of the operating expenses shows that $9,269 was ex- [illegible] tures and $10,884 for the maintenance of cars. The cost of fuel [illegible] The wages of conductors amounted to $39,157; motormen, $38,587; salaries of officers, $4,360; of clerks, $4,340. There is charged to damages $943 and to legal expenses on account of damages $1,155.

The report of the manager of the company, Mr. C. G. Ballentyne, shows that the road began the year with 15 cars in regular service and ended it with 24 which were operated over 19.937 miles of track. The total mileage construction completed during the year, including the line of the Waikiki Road, upon which half the work was done in 1902, but no part of which was then complete, was 9.258 miles of track and overhead structure, including turnouts. With the exception of certain connections which will be placed so that cars may be conveniently transferred from one line to another, and possibly some short extensions, the completion of the Beretania St. line will complete the system, and the company will then have 22.016 miles of track in operation, exclusive of turnouts and sidings measuring 1.463 miles, and 28 cars in regular week-day service. The cost of labor and ballast for the mileage completed during the year was $73,524. The line on the Waikiki Road was completed on January 31st at a cost of $20,064, including the cost of three bridges and filling-in.

The report shows that the total mileage for the year was 1,183,080; total number of passengers carried, 5,789,157. The operating ratio was .5364. The company pays its motormen and conductors 30 cents an hour.

The original rolling stock equipment consisted of 35 motor cars and 10 trailers. This was found to be inadequate and the directors ordered 10 new motor cars of the open type, having a seating capacity of 56 persons each, and decided to splice some of the small motor cars and trailers, thus making one motor car of large seating capacity, doing away with trailers during the rush hours.

In May, 1903, the company substituted fuel oil for coal for steam generating purposes, with great success as to economy, efficiency and cleanliness. The saving has been about 15 per cent, resulting in greater evenness in the steam pressure, and the smoke nuisance has also been done away with.

The company's Christmas box to the employes consisted of a club house, fitted up with a billiard table, a pool table and other accessories. The building employed was formerly a kindergarten building on Beretania St. The management believes that it will be demonstrated that this is a good investment, "as anything tending to improve the moral, physical and intellectual standard of its employes will increase their efficiency and thereby add materially to the value of their service."

The manager's report concludes as follows: "I desire to say that the year's success has not been the result of the efforts of any single individual, but is the result of the united efforts of all the company's employes, each performing his share towards the end in view, regardless of the character of his employment."

The officers of the Honolulu Rapid Transit & Land Co. are: President, L. Tenney Peck; vice-president, L. A. Thurston; secretary, George P. Thielen; treasurer, C. H. Atherton; auditor, F. W. Klebahn; manager, C. G. Ballentyne. These with W. R. Castle and J. B. Castle comprise the board of directors.

Brief Southern Notes.

The surveyors employed by the Jackson-Vicksburg Interurban Electric Ry., which has been projected by the Mississippi Land & Investment Co., have surveyed the route from Jackson to Edwards, where the power house will probably be erected.

The Biloxi (Miss.) Street Railway Co. has elected officers as follows: President, W. K. M. Dukate; first vice-president, E. C. Jouillian; second vice-president, E. Glennan; treasurer, W. H. Buck.

Mr. King Harding Knox has resigned as manager of the Baton Rouge (La.) Electric Light & Street Railway Co's. power plant and has been succeeded by Capt. O. B. Steele, who was for a number of years manager of the plant, but resigned when he became candidate for state treasurer.

There is an annoying delay in the plans for the proposed electric railway between the United States Naval Reservation, opposite New Orleans, and Gretna. The franchise in the city was bought by Leigh Carroll, president of the Algiers Ice & Electric Co., and that at the other end of the line was purchased by A. M. Halliday, president of the Union Ferry Co. The latter holds the old street car line franchise, also.

Personal.

MR. H. CHAPMAN, of the Montreal Street Railway Co., has been appointed superintendent of construction for the company.

MR. W. F. LYMAN, of Kewanee, Ill., has been elected president of the Galesburg & Kewanee Electric Railway Co., vice Mr. H. W. [illegible], resigned.

MR. RICHARD GRIFFIN has been appointed assistant superintendent of the London (Ont.) Street Railway Co., vice Mr Thomas Reycraft.

MR. J. MANNING has been appointed superintendent of the Owosso & Corunna Electric Co., of Owosso, Mich., and has assumed the duties of the position.

MR. JAMES K. SWARTZ, treasurer of the Washington, Alexandria & Mt. Vernon Railway Co., has been elected vice-president of the company, vice Mr. G. E. Abbott, resigned.

MR. CHARLES B. MARTIN presented a paper on "The Power Supply System of the Brooklyn Rapid Transit Co." at the regular meeting of the Brooklyn Engineers' Club, May 12th.

MR. MASON B. STARRING on May 12th was elected general manager of the Chicago City Railway Co., to succeed Capt. Robert McCulloch, resigned, the appointment to take effect at once. Mr. Starring was born in Chicago May 8, 1859, and was educated in Chicago public schools. Subsequent to graduating from the high school, in 1878, he entered the steam railroad business, with which he was connected until 1885, when he removed to Iowa, where he went into business for himself, conducting a banking and general merchandise establishment. In 1888 Mr. Starring entered the office of Mr. C. B. Holmes, president and superintendent of the Chicago City Railway Co., as clerk, which position he filled until Mr. George Henry Wheeler became president three years later.

M. B. STARRING

In 1891 Judge Julian S. Grinnell was made general counsel for the company and Mr. Starring was assigned to the general counsel's office and placed in charge of the claim department. He resumed the study of law at this time, was admitted to practice in Illinois and in February, 1894, was appointed assistant general counsel of the company. He remained with that title, but in full charge of the claim department and trial work of the company after Judge Grinnell's death in 1898, no successor having been appointed to Judge Grinnell. This year Mr. Starring was elected general solicitor of the company. During his 16 years' connection with the company, which embraces the entire period of electrical construction, Mr. Starring has been in close connection with every department as adviser to every operating manager under every administration.

MR. F. R. PHILLIPS has been appointed master mechanic of the South Covington & Cincinnati Street Railway Co. He formerly held a similar position with the Cleveland Electric Railway Co.

THE ENGAGEMENT of Mr. T. E. Mitten, general manager of the International Railway Co., Buffalo, and Miss Ruth Bissell, daughter of Mrs. M. Bissell, of Lockport, N. Y., has been announced.

MR. D. L. BENSON, of the engineering firm of H. M. Byllesby & Co., Chicago, has been appointed supervising engineer in charge of the reconstruction work of the Muscogee (I. T.) Electric & Gas Co.

MR. E. H. RAUPP has been appointed chief train dispatcher of the Detroit, Monroe & Toledo Short Line Co. He previously occupied a similar position with the Rochester & Eastern Rapid Railway Co.

MR. JOHN B. ALLAN, general manager of sales of the Allis-Chalmers Co., last month resigned his position. He expresses his intention of taking a vacation for a few months in order to recuperate.

MR. ARTHUR H. RICE, of Pittsfield, Mass., has been elected president of the Hoosac Valley Street Railway Co., vice Mr. Frank S. Richardson, resigned. Mr. Rice was formerly vice-president of the company.

MR. A. E. APPLEYARD has been elected president of the Columbus, London & Springfield Railway Co. and the Dayton, Springfield & Urbana Electric Railway Co., vice, Mr. John S. Harshman, resigned.

MR. D. W. BUTTERFIELD, of Brockton, Mass., has been appointed division roadmaster of the Old Colony Street Railway Co., the office having been recently created to relieve the superintendent from outside duties.

MR. WILLIAM G. ROCK, who has been superintendent of the Raritan Traction Co., of Perth Amboy, N. J., for the past four years, has resigned and will enter business as dealer in masons' material, building supplies, etc.

MR. HERBERT E. REED, formerly superintendent of the Northampton Traction Co., of Easton, Pa., has been appointed superintendent of the Trenton-New Brunswick Traction Co., vice Mr. A. C. Harrington, resigned.

MR. W. W. S. BUTLER, of Philadelphia, formerly general manager of the Durham (N. C.) Traction Co., has been appointed superintendent of the Grand Rapids Street Railway Co., the office of superintendent having been recently created.

MR. THOMAS LAYTON has resigned as superintendent of the Homestead & Mifflin Street Railway Co., the resignation becoming effective May 20th. He has been succeeded by Mr. Fred Thorne, who was formerly assistant superintendent.

MR. FRED BILLINGS has been appointed chief engineer of the Sterling, Dixon & Eastern Electric Ry., of Sterling, Ill. The system has just been completed. Mr. Billings was formerly chief engineer of the Manitowoc (Wis.) & Northern Traction Co.

PROF. W. F. M. GOSS, of La Fayette, Ind., addressed the members of the American Society of Mechanical Engineers April 26th on "The Modern Locomotive." This was the last reunion of the winter season and was held at the House of the Society in New York City.

MR. JOHN I. BEGGS, president and general manager of the Milwaukee Electric Railway & Light Co., was recently presented a silver service by the officials and directors of the company. The service is intended for use on a private car which is being built for Mr. Beggs.

MR. ARTHUR WEST, assistant chief engineer of the Allis-Chalmers Co., has resigned that position, and will go to the Mediterranean for a holiday trip. In his letter of resignatoin he states, "for the last couple of years I have been regularly overworked and my most urgent need is rest."

MR. W. F. BUTTERFIELD, formerly engineer on the Boston Elevated Ry., has entered the employ of the Old Colony street railway as division roadmaster of the Brockton division of that company. He will also have supervision of the tracks in the Hyde Park and Quincy divisions.

MR. HARRY J. CLARK, who was formerly in the engineering department of the Syracuse (N. Y.) Rapid Transit Co., and later superintendent of the Oneida Ry., has returned to Syracuse to become assistant to Mr. C. D. Beebe, president and general manager of the Auburn & Syracuse Electric Railroad.

MR. C. E. FLYNN was on April 25th elected vice-president of the Conneaut & Erie Traction Co., of Girard, Pa., and on May 1st assumed the management of the property as resident executive officer. Mr. J. L. Landers has been general manager of this company and will remain in that capacity.

MR. L. C. BRADLEY has been appointed general superintendent of the Scioto Valley Traction Co., with headquarters at No. 142 Board of Trade Building, Columbus, O. Mr. Bradley was connected with Stone & Webster for several years, being superintendent of the Puget Sound Electric Ry., formerly the Seattle-Tacoma Interurban.

MR. BION J. ARNOLD has been appointed consulting electrical and mechanical engineer for the Illinois Tunnel Co., of Chicago, which will install a narrow gage electric railway in the tunnels under Chicago streets, in accordance with the plans which were outlined in general in the "Review" for April.

MR. J. C. M'QUISTON, formerly secretary of the Westinghouse Companies' Publishing Department, has been made superintendent and the responsible head of this department. He will be charged with the matters of advertising, press notices and similar matters of mutual interest to the technical press and the Westinghouse companies.

MR. GEORGE OWEN NAGLE, general manager of the Wheeling Traction Co., is to be married to Miss Helen Sarah Williams, daughter of Rev. Hugh Spencer Williams, of Memphis, Tenn. The ceremony will be at the First Cumberland Presbyterian Church, June 8th.

MR. RICHARD M'CULLOCH has resigned as assistant general manager of the Chicago City Ry., effective June 1st, and will become assistant general manager of the St. Louis Transit Co.

MR. JAMES M. JONES, second vice-president and asssistant general manager of the Indianapolis Traction & Terminal Co., has resigned and for the present will devote his attention to personal matters. He was connected with the street railway company nearly four years. At one time Mr. Jones was mayor of Kansas City, Mo.

THE FIRM OF ENGINEERS heretofore known as the Engineering Offices, of San Francisco, Cal., has been reorganized and will henceforth be known as Cory, Meredith & Allen, the partners being C. L. Cory, Wynn Meredith and W. H. Allen. Mr. Cory is the head of the engineering department of the University of California.

MR. FRANK W. EDMUNDS, who was for many years secretary and general sales agent for the Troy Steel Co., and later secretary of the Q & C Co., representing the Pennsylvania Steel Co. and Maryland Steel Co., at Chicago, has been appointed sales agent for the Dressel Railway Lamp Works at No. 114 Liberty St., Engineering Building, New York.

MR. WALTER T. COOK last month resigned as superintendent of motive power of the St. Louis Transit Co., and on April 12th the employes presented him 152 pieces of silverware as a token of esteem, the presentation being made by Mr. William O. Mundy. Mr. Cook has not decided upon his future course, but has three offers under consideration.

MR. H. V. CROLL, who has been in charge of the Salt Lake City, Utah, office of the Allis-Chalmers Co. several years, and who was before that the representative of the E. P. Allis Co., at Spokane, Wash., has been appointed to the charge of the Allis-Chalmers office in San Francisco, as the successor of Mr. George Ames, resigned. Mr. Croll's San Francisco office is 623 Hayward Building.

MR. FRED S. SMITH has been appointed superintendent of the Middleboro, Wareham & Buzzard's Bay street railway by the receivers of the road. Mr. Smith has been with the road since it started about three years ago, commencing as foreman of a construction gang, and gradually working up to the position of assistant superintendent. His appointment as superintendent is a recognition of the efficient work done in the past.

MR. E. W. CLIFFORD, formerly connected with the freight department of the Illinois Central R. R., has become associated with the Illinois Central Traction Co., of which Mr. William B. McKinley is president, and will have charge of the traffic department. Mr. Clifford was at one time general passenger and freight agent for the Litchfield, Carrollton & Western R. R., and was also in the freight department of the old Peoria & Northern R. R.

MR. ERVIN DRYER has resigned as salesman for the Westinghouse Electric & Manufacturing Co., to go with the Allis-Chalmers Co. He was associated with the Westinghouse company 16 years and is accounted one of the most competent salesmen in the electrical and mechanical field. His wide acquaintance throughout the western part of the country will be of great service to the Allis-Chalmers Co. in the extensive new developments which it has undertaken. Mr. Dryer has entered upon his new duties, his headquarters being at the Allis-Chalmers Co's. offices in the New York Life Building, Chicago. He will give his attention to engine work as well as to the sale of Bullock electrical apparatus, which the Allis-Chalmers Co. now controls through its acquisition of the Bullock Electrical Manufacturing Co., of Cincinnati.

AT A MEETING OF the Fairhaven & Westville Railroad Co., [illegible] recently purchased by the New York, New Haven & Hartford Railroad Co., Messrs. Samuel E. Merwin, Wilbur F. Day and Henry F. Parmelee resigned from the directorate and were succeeded by Messrs. Charles F. Brooker, Arthur D. Osborn and George J. Brush, all directors of the New Haven road. Mr. John B. Carrington, vice-president of the company, resigned his office but remains a director. His successor as vice-president was not elected. Mr. John G. Parker, secretary of the New Haven road, was elected secretary of the electric line and Mr. Leveritt Candee, the treasurer of the trolley company, was made assistant secretary, also.

MR. PUTNAM A. BATES AND MR. JOHN NEILSON have formed a partnership under the firm name of Bates & Neilson for the purpose of conducting the general practice of consulting engineering, with offices at 42 Broadway, New York City. Mr. Bates, who is a graduate of Columbia University, was for seven years associated with the Crocker-Wheeler Co., and held the offices of assistant secretary and sales manager. He is a member of the American Institute of Electrical Engineers and of the New York Electrical Society. Mr. Neilson's professional experience covers a period of about 10 years, principally in connection with central station lighting and power plants. He was formerly vice-president and superintendent of the Larchmont Light & Power Co., and later treasurer of the New York & Stamford Electric Railway Co.

MR. ALBERT MAYER, father of Mr. C. J. Mayer, of the firm of Mayer & Englund Co., of Philadelphia, was severely injured as a result of a collision between a heavy delivery wagon and his carriage, as he was driving with his coachman. The unfortunate accident occurred in the evening, as Mr. Mayer was being driven to his home at Elkins Park, a suburb of Philadelphia. Mr. Mayer's horse became frightened, and was proceeding at a rapid rate and collided with the delivery wagon, so that the vehicles came together with great force. Mr. Mayer's coachman was instantly killed, his death being due to a broken neck. Mr. Mayer was thrown to the side of the street and when picked up was found to have been badly bruised and injured internally. An ambulance was called and he was immediately removed to a nearby hospital. While he has been in a critical condition, it is believed he will recover.

MR. RICHARD H. PIERCE, president of Pierce, Richardson & Neiler, Incorporated, and one of the best known electrical engineers of the country, has been appointed chief engineer of the Louisiana Purchase Exposition. Mr. Pierce was born in Woonsocket, R. I., Nov. 20, 1860. He was graduated from Yale with the degree of A. B. in 1882, and from the Massachusetts Institute of Technology with the degree of B. S. in 1885, being a member of the first class in electrical engineering graduated from that institution. He went to Chicago and became connected with the Western Edison Electric Light Co. During the World's Columbian Exposition Mr. Pierce was at first electrical engineer, under Mr. Frederick Sargent, and afterward electrical engineer in charge of the undertaking. For the past year Mr. Pierce has resided in Boston, where he has had charge of the Boston branch of his company. Mr. Pierce is a member of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers, as well as a foreign member of the Institution of Electrical Engineers of Great Britain.

Obituary.

MR. SAMUEL ANDREWS, of Cleveland, O., father of Mr. Horace E. Andrews, president of the Cleveland Electric Railway Co., died last month at Atlantic City, N. J. With the late John Stanley, father of J. J. Stanley, the general manager of the Cleveland Electric Railway Co., Mr. Andrews organized the Broadway & Newburg Street Railway Co., forming the Cleveland Electric Railway Co. Mr. Andrews was a member of the original firm of Rockefeller & Andrews, which was succeeded in 1870 by the Standard Oil Co.

Richmond (Va.) Street Ry. Y. M. C. A.

The opening and dedication of the Virginia Passenger & Power Young Men's Christian Association Building at Reservoir Park, Richmond, Va., occurred Saturday, April 23rd. A pleasing feature of the occasion was a reception at which the employes of the company and other invited guests were presented to Miss Helen Miller Gould, of New York City, who is greatly interested in the work. The hours for reception and inspection of the building were from 10 to 11:30 a. m., and 3:30 to 5 p. m. The dedication exercises were held at 8 p. m. It was an informal dress affair and the employes who attended were admitted by showing the company's badge or pass books.

Chloride Electrical Storage Co.

[illegible] Storage Co., Ltd., of England, which [illegible] product as the Electrical Storage Battery Co. of America, has its works at Clifton Junction, near Manchester, where the manufacture of the chloride accumulator has been car- [illegible]. A general view of the works from the canal is shown in one of the accompanying illustrations. The company manufactures the batteries complete, with the exception of the glassware. The first department of the works to claim attention is the chemical laboratory, where all raw material is tested by sample before being used in the works. The first process in the manufacture of the positive plate is the casting of the frame, which consists of a lead-antimony mixture. This frame supports the active material which is subsequently expanded into the holes during the forming process. These holes in the grid are cast countersunk on both sides and the molding is done under an air pressure of 500 lb. per sq. in. After molding, all rough edges are cleaned off by means of a punching machine which completes the work with a single stroke. The active material for the positive plate is made of lead tape which is pressed cold under pressure of 4,000 lb. per sq. in. This tape is fed into the button machines, shown in the accompanying illustration, which gimp and cut off the required length, wind it into rosettes and deliver it automatically at the rate of 3,000 lb. per hour. The buttons are placed in filling templates which are placed against the grids and the buttons are

GENERAL VIEW OF WORKS FROM CANAL.

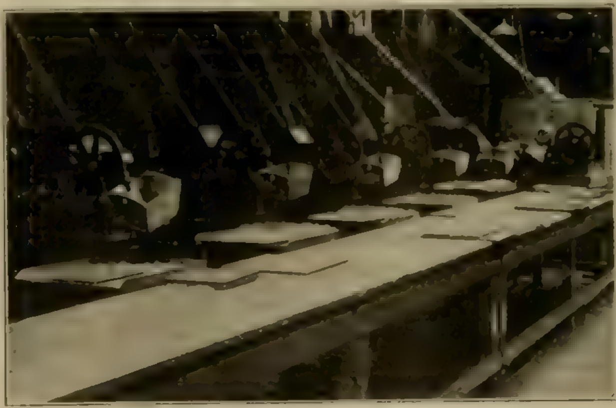
started into their respective holes by means of a stamping press. The plates are next put into a hydraulic press in which the buttons are driven completely home under a pressure of 200 tons.

The pastilles for the active material for the negative plate are cast in iron molds and chloride of lead containing a small percentage of zinc, the latter being added to form a flux when the grid is subsequently cast around the cold pastilles. The new type

FORMING AND REDUCING SHED.

of negative being made by this company, which is called the "Exide" plate, has thin vertical ribs, the edges of which are flush with the face of the plate and which are connected by small bars having a triangular cross-section. The bars are staggered between the faces on either side. The grids are pasted in the usual way.

The forming of the positives and the reduction of the negatives is carried on in a shop 300 x 60 ft., the interior of which is shown herewith. After the completion of the forming process the plates are washed in running water and subsequently given a hydrogen



BUTTON MACHINES.

bath to remove all trace of chlorine, after which spacing blocks are interposed between each plate and they are clamped in position. The tops of the plates project into a mold by means of which the equalizing bar is cast onto the plates. This completes the operation of manufacture.

The various shops are equipped with the finest kinds of tools and numerous labor-saving devices. The machinery is driven entirely by electric motors and the plant is electrically lighted. A commodious mess room is provided for the workmen and another for the heads of departments, foremen and clerical force.

The entire staff is encouraged to offer suggestions referring to improvements or economy of the company's products, and suggestion boxes have been provided for receiving written proposals to these ends. A sum of money is apportioned each month to the originators of ideas which are considered worthy of recognition.

For the Award of the Edison Medal.

The American Institute of Electrical Engineers, through its president, Mr. Bion J. Arnold, has issued an announcement to the educational institutions of the United States and Canada relative to the Edison medal, the responsibility of annually awarding which has been entrusted to the Institute. The Edison Medal Association was founded by friends and admirers of the great inventor and one of its purposes is the establishment of an Edison medal, to be awarded to such qualified students as shall have submitted to the Institute, in accordance with stipulated conditions, the best thesis or record of research on theoretical or applied electricity or magnetism. The gift of the medal to the Institute and the responsibility of conferring it was assumed at the annual dinner held February 11th last to commemorate the event and also to celebrate the fifty-seventh anniversary of Mr. Edison's birth. An Edison Medal committee has been selected from among the members of the Institute, and authorities of educational institutions believed to be qualified to compete are requested to send the names of these institutions to the committee on or before June 1, 1904.

Trolley Service Between New York and Trenton.

The Public Service Corporation of New Jersey began a through trolley service between Jersey City and Trenton May 13th, four daily cars being put on at three-hour intervals, beginning at 8:35 a. m. at Jersey City and at 8 a. m. at Trenton. The time allowed for the trip is 5¼ to 5½ hours. Connections are made at Jersey City with the ferries for New York and at Trenton passengers may be transfered to cars for Camden and will go from Camden to Philadelphia by ferry. Stops are made between Jersey City and Trenton at Newark, Elizabeth, Westfield, Plainfield, Dunellen, Bound Brook, New Brunswick and Milltown Junction.

Steel Axles.*

BY J. L. REPLOGLE.**

Method of Manufacture.

In the early days of steel axles the steel maker had difficulty in proving the superiority of his product, as there were numerous breakages in service for which he could not account, his chemical analysis indicating that the elements were of the proper proportion to the evident requirements of the purpose. In looking for the cause he found that, while his light hammers of probably 2,000 lb. falling weight were sufficiently powerful for building up iron bars probably one to two inches thick into an axle of approximately 5½ in. diameter, they were entirely inadequate for forging steel axles, as steel, not possessing the welding properties of iron, could not be forged in the same manner.

Instead of building up from bars one to two inches thick, he was compelled to reverse the method, and hammer down from a billet about twice the size his finished forging should be.

His hammer not being sufficiently powerful to penetrate throughout the mass, did not give the axle that homogeneous structure so essential in a forging subject to the heavy alternating stresses which a car axle undergoes in service. The internal condition of his axle was revealed to him by the end of his rough forging, which was a deep concave, showing that the surface metal only had expanded and that the inner portion had not received the proper working and consequent homogeneity of structure which he desired. It also showed inclination to "pipe."

He appreciated his position and promptly strengthened it by the installation of heavier hammers of about three times the weight formerly used. While he immediately saw a distinct improvement in his forging (the end now being convex, indicating that the inner portion had received proper attention), the steel axle did not give the absolute satisfaction of which he thought it capable, and an investigation proved to him that heat treatment in the forge was largely responsible.

He reasoned that as no two parts of the axle were forged at the same temperature, internal strains had set in, which were very detrimental to the forging, and which would have to be relieved. This was particularly evident in locomotive driving axles, which, after cutting key-way, thereby relieving strains in the fibers, would often become distorted.

To relieve the injurious strains above stated, he resorted to annealing. By heating the forging to a temperature slightly above the recalescent point (which, in steel of carbon usually found in axles, would be approximately 1,200 deg. Fahr.), he eliminated all crystallization resultant from the cooling from the forging temperature of about 1,800 deg. Fahr. and a fine amorphous structure was obtained.

Crystallization would of course set in again when the forging was being cooled, but as in the annealing he did not approach within 400 deg. or 500 deg. the temperature at which his axle was forged, the resultant crystallization was comparativly small. While the ductility of the annealed forging was greatly increased, it suffered a slight loss in elasticity.

Realizing the importance of having a high degree of elasticity in his material, which was continually subject to severe alternating tension and compression, and often torsional strains, the axle maker started to experiment with a view of not only maintaining the elasticity found in the original forging before annealing, but also to increase it.

Various methods have been used to gain this result, among the more prominent being the "Coffin toughening process" and "oil tempering and annealing," either of which give the following result:

1. The elastic limit is increased to a marked degree.

2. The percentage of elongation and reduction of area are greatly increased.

3. A remarkable degree of toughness is obtained.

4. Steel changes from a crystalline to an amorphous state.

5. Internal stresses are eliminated.

6. Uniformity of structure and strength are obtained. The increase in elasticity is of the greatest possible benefit, as it is a recognized fact that once the elastic limit of metal has been passed and forging therefore distorted, it cannot be depended upon to sustain even minor loads.

In wrought iron forgings the elastic limit probably does not exceed 20,000 lb. per sq. in. Steel of say .45 carbon, properly treated, will show almost three times as much elasticity and is, therefore, much better fitted for the service described.

Realizing that in material of this kind wherein so much depends, that "the best is none too good," the modern steel manufacturer has installed complete chemical, physical and microscopical laboratories which tell him the results obtained throughout the various stages of manufacture, and in the final treatment at the annealing furnace he raises or lowers the physical properties to the required specifications, carefully and intelligently guided by reliable pyrometers which show the operator the exact temperature of his furnace at any and all times.

"The method of manufacture," then, we consider of great importance. Our claim that a steel axle properly forged and afterward properly annealed is infinitely superior in strength or wearing properties to the best iron axle, we think can hardly be disputed.

While the art of steel making has been perfected more and more year after year, the material and skill for making the best quality of iron have, on the contrary, retrograded, and at the present time a good grade of iron is scarce, largely on account of the difficulty in obtaining the necessary good quality of scrap, that now available being composed of inferior iron intermixed with pieces of steel of various grades, which produce imperfect welds and irregularities in the finished axle.

This lack of homogeneity permits the torsional strains and friction to separate the fibers of the metal;—longitudinal seams and rough spots develop which finally result in failure of the axle.

Specifications.

Our opinion as to the best specification would be an endorsement of the present Master Car Builders' specification, with a few exceptions, viz.:

1. We should recommend an increase in carbon, making the limit .40 per cent to .50 per cent instead of .35 per cent to .50 per cent as at present. This would insure greater wear, permitting a higher polish with a consequent reduction of friction, and, if properly treated, greater strength, but would necessitate a slight modification of the present drop test.

2. We should insist upon all axles being thoroughly annealed, as by this method only is the true strength of the steel represented.

3. We would adopt a "maximum weight" clause compelling manufacturers to rough turn forgings on journals and wheel seats to within ⅛ in. of your finishing dimensions, thereby eliminating the necessity of your paying for 50 to 75 lb. of excess material per axle, which also necessitates a vast amount of extra work and expense at the railroad shops, subjecting your lathes to both roughing and finishing duties, which is detrimental to the best results in fitting.

4. We should recommend a maximum limit on phosphorus of .05 per cent instead of .07 per cent as at present, to compensate for the recommended raise of the carbon limit by five points, both elements being hardeners, but carbon affecting the ductility less than the phosphorus, and being conducive to greater wearing qualities.

5. We would modify that portion of clause 1 in the specification relating to the rough turning of axles to read: "Axles must be rough turned on journals and wheel fits to within ⅛ in. of finished dimensions and must be smooth forged between wheel fits."

Rough turning a car axle between wheel fits robs the axle of the tough surface skin which is a very valuable asset.

In this connection, I would cite results of a test made at our works to demonstrate our claim: During a controversy with an inspector of a prominent railroad which specifies rough turning all over, we suggested to him that he take two axles of the same heat, one being rough turned to 5⅞ in. in the center, the other being smooth forged to the same dimension. These axles were subjected to the same treatment throughout and were then tested to breakage. The rough turned axle stood 21 blows of a 1,640-lb. drop from 43 ft. height, and the smooth forged one stood 78 blows, or almost four times as severe a test.

*A paper read before the Western Railway Club, Chicago, May 17, 1904.

**Superintendent of the Forge and Axle Department, Cambria Steel Co.

[illegible] the broken axle [illegible] and [illegible]

[illegible] by one of the leading rail-roads specifying this, show that in axles of the average carbon, the smooth forged axle will stand approximately 43 per cent harder test than the rough turned one. Rough turning an axle also makes it more susceptible to [illegible]

These are but a few tests of many made along this line, the aggregate of which leads us to believe that the railroads of this country are annually expending hundreds of thousands of dollars on this feature, and we are thereby getting an inferior axle.

Broken Axles

In fifteen years' experience in the manufacture of steel axles the writer recollects of but seven of our car axles having failed in service, four of these being due to inferior design, the wheel fits [illegible] under the Master Car Builders' standard dimensions.

We believe this record is due, not so much to the superiority of the steel itself (although the company which I have the honor to represent is the pioneer steel company of America), but to the fact that it is the policy of our company to thoroughly anneal every forging produced, thereby eliminating all forging strains and results of imperfect heat treatment, and restoring to the steel its true strength.

Our experience with broken axles, therefore, is limited and perhaps other members of the club can give more information on this subject than the writer.

We have, however, seen broken axles around in various railroad shops, the examination of which leads us to the conclusion that failures were due to the fact that steel used was too low in elasticity and tensile strength, steel of probably .30 per cent or .35 per cent carbon being used.

The failures were due largely to what has been termed "fatigue of metal" and show a detail fracture, a gradual parting of the steel, extending towards the center of all around the piece, unquestionably caused by the imposed strains repeatedly approaching the low elastic strength of the soft steel.

The substitution of a steel of higher carbon and elasticity would prevent failure of this kind.

The observations of Dr. Chas. B. Dudley, the eminent chemist of the Pennsylvania Railroad Company, are interesting and pertinent to this subject, and we quote him: "It is obvious that the journal of a car axle gets alternating bending stresses—that is, the metal is subject to alternate tension and compression with each revolution and that during the life of an axle, these stresses are many thousand, perhaps million, times repeated."

Again, the metal between the wheels is in like manner subjected at each revolution to the same alternating stresses.

The effect of these repeated alternate bending stresses are almost too well known to need comment. Sooner or later, if the stress is high enough, all metal will rupture under these alternate strains.

A marked characteristic of the fractured surface of a piece of metal which has broken from this cause is that it never presents fibrous appearance in the fracture, but is more or less smooth, possibly due to the fractured parts rubbing each other and having the appearance of an old break. It commences where the maximum stress occurs on the surface of the section and gradually works in from the surface until so small a part of the original area is left unbroken that a sudden shock or stress finishes the rupture.

This breaking slowly, a little at a time, led to the description of this fracture as "detail fracture," which will never be confounded with a rupture produced in any other way.

The experience of the Pennsylvania Railroad Co. on car axles on this point may be interesting: Steel axles were first used on the Pennsylvania Railroad in 1875. The maximum calculated fiber stress between wheels was about 15,000 lb. per sq. in. and the maximum fiber stress in the journal was about 6,700 lb. per sq. in. The steel of these axles was an acid, open-hearth steel, containing from .22 to .28 per cent carbon, and not over .04 per cent phosphorus, and with a tensile strength of about 65,000 lb. per sq. in. and an elongation in two inches of over 25 per cent. So tough was this steel that one passenger car axle was tested under the drop test with 67 blows without rupture. Some 300 of these axles were put in service, and in the course of two years the journals began to fail from detail fracture. The matter became serious, and a consultation was held as to how to meet the difficulty. There seemed but two ways—either to increase the size or to change the nature of the metal. Since an increase in size meant a re-design of all the parts, the latter alternative was chosen, and a metal of 80,000-lb. tensile strength was substituted for the softer steel, no other changes being made. This completely cured the difficulty, and no case of breaking in detail in car axles is known to have occurred since that time, unless the metal was of lower tensile strength than the figure given, or the axle was worn to limit, so that the maximum fiber stress was too high.

Endurance tests made at the Watertown Arsenal by the United States government on wrought iron and .45 per cent carbon steel bars 1 in. diameter, 36 in. long, loaded in the middle so that the fiber stress was 40,000 lb. per sq. in., show a great superiority in favor of the latter.

These bars were rotated 1,500 times per minute, the number of revolutions being recorded.

The average number of revolutions of the wrought iron was 59,000, while the .45 per cent carbon steel bars broke after 976,000 revolutions, or 165 times as severe a test.

Augusta, Winthrop & Gardiner Ry. Express.

The accompanying illustration shows a new express car which was recently built by the Augusta, Winthrop & Gardiner Ry., of Augusta, Me., for service over its system. The car is 31½ ft. long over all, 8 ft. wide and 6 ft. 3 in. high, inside measure. It is built of oak and hard pine timber and sheathed up inside 3 ft. from the floor. It has sliding doors on both sides, the doors being

EXPRESS CAR, AUGUSTA, WINTHROP & GARDINER RY.

hung on the outside of the car. It also has a swinging door at each end, which permits the carriage of long material without difficulty.

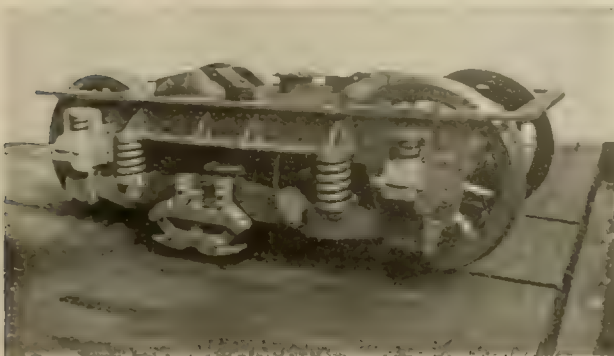
The car is mounted on Peckham double trucks and is equipped with four No. 69 Westinghouse motors, with Westinghouse automatic and straight air brake. The weight of the car complete is 15 tons.

The express business is handled in the following manner: Hoyt's Express Co., S. S. Patten, general manager, is located at Augusta and has an express line running from that city to New York. It operates the express business on the Augusta, Winthrop & Gardiner Ry. in connection with its own business, giving through billing for Portland, Boston, New York and points west and south. Agents at the different points along the line collect and deliver with teams, the car receiving all packages from the teams and delivering to them, also.

The car makes two round trips over the entire line daily, leaving Augusta for Hallowell and Gardiner at 7:30 a. m. and 2:30 p. m., for Togus at 10 a. m., and for Winthrop at 10:20 a. m. and 4:50 p. m. For the illustration presented herewith and for the description of the car and the express business we are indebted to Mr. L. F. Taylor, the superintendent of the Augusta, Winthrop & Gardiner Ry.

Electrification of Liverpool & Southport Ry.

The Liverpool & Southport branch of the Lancashire & Yorkshire Ry. has been converted into an electric road, it being the first steam line in England to be so equipped. The idea originated with the general manager, Mr. J. A. F. Aspinwall, and was carried out by Dick, Kerr & Co., Ltd., who did all the work with the exception of building the rolling stock, which was made at the Horwich and Newton Heath works of the railway company. The work was done



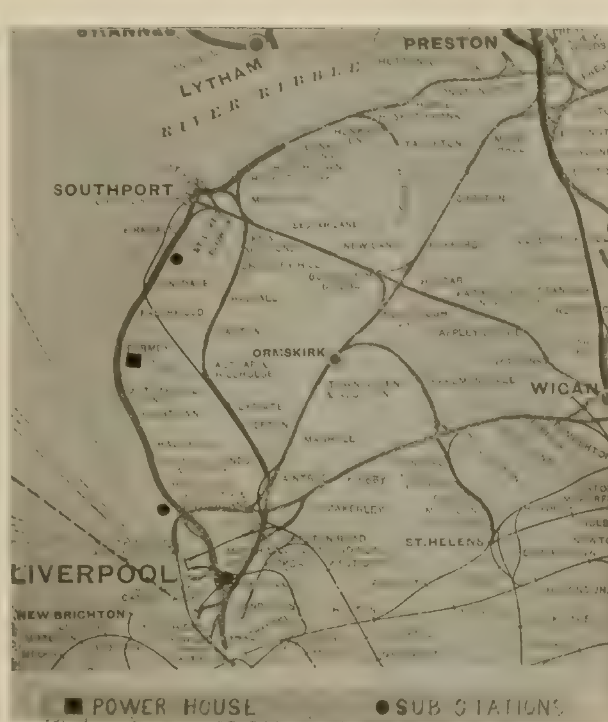
TRUCK LIVERPOOL & SOUTHPORT

inside of 12 months and without interference with the steam service. The distance between Liverpool and Southport is nearly 18½ miles, the total length of track equipped being practically equivalent to 47 miles of single track. The grades are slight and there are but few curves. There are 14 intermediate stations at an average distance of about one mile apart on the southern portion of the route, but more widely separated on the northern portion.

The traffic is almost wholly passenger, consisting of business people going to and returning from Liverpool morning and evening,

MAIN GENERATING UNITS LIVERPOOL & SOUTHPORT

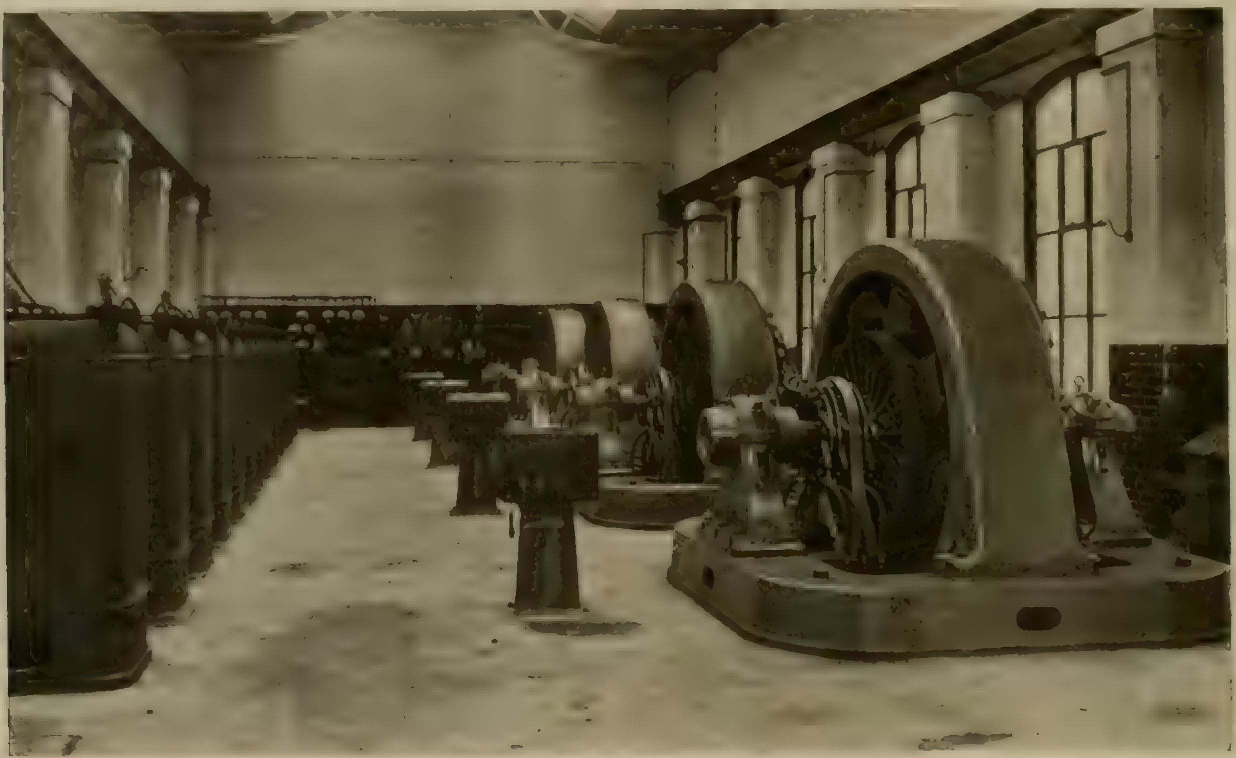
with a considerable shopping and miscellaneous traffic during the day. Under steam conditions 36 trains per day in each direction are run between Liverpool and Southport and a similar number between Liverpool and Hall Road, seven miles from Liverpool. A



MAP OF ROUTE LIVERPOOL & SOUTHPORT

few expresses were put on morning and evening, the total train mileage per diem being about 1,900. With electrified conditions the total mileage will be increased to 3,200. The number of trains in each direction will be increased to 65 between Liverpool and

Southport and 51 between Liverpool and Hall Road, while the running time will be shortened from 51 minutes to 37 minutes in the one case, and from 25 minutes to 17 minutes in the



SUB-STATION ON LIVERPOOL & SOUTHPORT (TYPICAL OF ALL FOUR)

other. The schedule of fast trains will be unaltered, except that an express will run in each direction hourly, and an additional express service will be established to Crossens, a suburb of Southport, giving that suburb a service of 17 trains a day each

ELECTRIC TRAINS ON THE LIVERPOOL & SOUTHPORT RY

way. A special baggage car has been built to take care of the parcel business along the line.

The electrical energy is generated as three-phase alternating current of 7,500 volts, stepped down and transformed to direct current of 650 volts, the maximum voltage at the train being 600 volts. The power house is situated approximately at the center of the line, near Formby, on the Alt River, and it is also used as a sub-station. In addition there are sub-stations at Sandhills, Seaforth and Birkdale. The engine room is 280 x 65 ft. and the boiler house 250 x 50 ft. The building consists of a steel roof in two bays carried upon steel columns which are independent of the brick work.

There are four 1,500-kw. units for normal demands and in addition there is a fifth unit of 750 kw. The four main engines were supplied by Yates & Thom, as were the boilers. They are of the horizontal cross compound type and the normal load of each is

2,130 h. p. with a steam pressure of 160 lb. per sq. in., but they are designed for an overload of 20 per cent. The fifth unit is a vertical cross compound engine, capable of developing 1,180 h. p. running at 94 r. p. m.

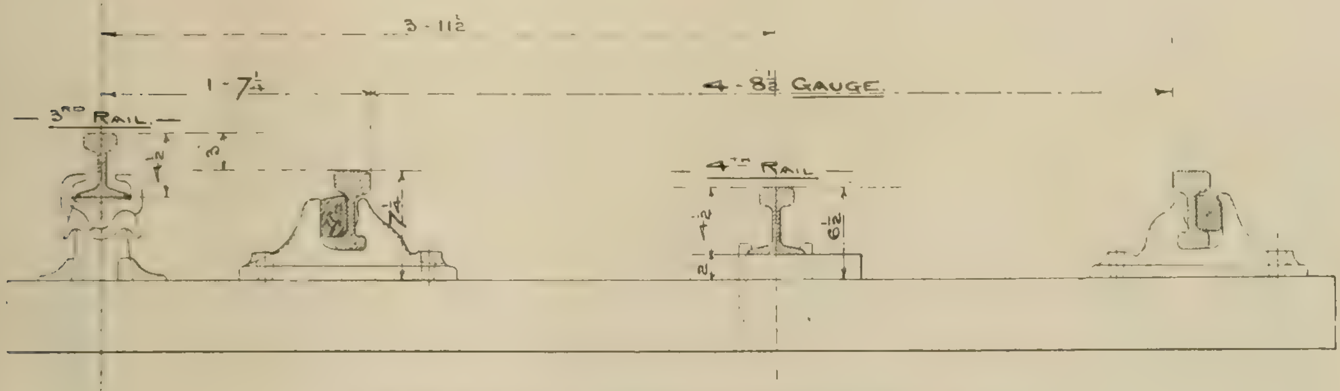
The alternators are three-phase, 25 cycles, the larger running at 75 and the smaller at 94 r. p. m. These machines are made at the Preston works of Dick, Kerr & Co., as was the rest of the electrical plant. There are three direct-current exciter sets, each consisting of a Dick-Kerr 4-pole, 100-kw. generator coupled to a Willans & Robinson high-speed engine running at 380 r. p. m., the working voltage being 125 volts. The main switchboard is erected on a gallery over a fireproof high-tension chamber, 79 x 12 ft., which contains all of the high-tension switch gear, oil switches, instrument transformers and bus bars.

There are 16 boilers of the Lancashire type arranged in two batteries of eight each. The induced draft apparatus was furnished by the Buffalo Forge Co. and the economizers by Green & Son, Ltd.

The sub-station equipments, save as regards capacity, are identical. The three largest have each four rotary converters, and the fourth has three, provision being made in each case for extensions. These converters are 8-pole developing 600 kw. at 600-650 volts at 375 r. p. m. The transformers are of the air-blast type, each with a capacity of 200 kw. The high-tension cables leading from the power house are arranged in each case in triplicate. Under ordinary conditions all three cables are used, but in case of breakdown two can do the work. The cables were made and laid by W. T. Glover & Co., Ltd.

The permanent way is, for the purpose of distributing and returning the current, equipped with two additional rails. One of these current rails is brought alongside each track on insulators, while the other is placed between the running rails, uninsulated on the sleepers, thus forming the principal part of the return circuit. While the joints of both the third and fourth rails are bonded in the ordinary way the fourth rail is also cross-bonded to the running rails. No shoe is provided on the train for the fourth rail, the current being delivered through the wheels to the running rails and thence through the cross bonds to the fourth rail.

The trains consist in most cases of two first and two third class cars, the latter being at either end and equipped with two bogie trucks, each carrying two 150-h. p. motors. Both types of cars are 60 ft. long and 10 ft. wide, with 8-ft. wheel base bogie trucks fixed 40 ft. 6 in. apart between centers. All cars are heated and lighted by electricity and equipped with vacuum brakes.



CROSS SECTION OF TRACK LIVERPOOL & SOUTHPORT RY

One of the most interesting features of the equipment is the method of control, which is the Dick-Kerr direct multiple system.

INTERIOR OF FIRST CLASS CARRIAGE LIVERPOOL & SOUTHPORT RY

The Strike at Huntington, W. Va.

As stated in the "Review" for April, the employes of the Camden Interstate Railway Co., of Huntington, W. Va., went out on strike March 24th, because the company had discharged two men in the transportation department and refused to reinstate them. The employes claimed that the company had violated an agreement entered into eighteen months ago when a previous strike took place. The company was convinced, however, that the men were guilty of violations of rules that warranted their dismissal without trial. Shortly after the last cars had been run into the barns a short time after midnight March 24th the men in the power house at Ashland, Ky., and the sub-stations at Huntington, W. Va., and Cliffside, Ky., left their work, thus tying up the entire street railway system, as well as the electric lighting of the city. The company operates four lines in and between Huntington, W. Va., Guyandotte, W. Va., and Ashland, Ky., and one line in Ironton, O. The men employed on the Ohio side did not strike, but the cars could not run, owing to the power house being shut down.

March 24th the company managed to run out a mail car which made one trip to Central City in charge of a barn man, after which the car was housed. March 25th was pay day and the men were paid in full to date, the company calling for the badges and other property in possession of the men.

March 26th the business men of Huntington and Ashland held mass meetings at which resolutions were adopted requesting the company to start up its lighting plant and street car system as soon as possible and pledging the company the support of the citizens. In fact, the better class of citizens all along the lines stood by the company throughout.

March 31st the company secured the services of two strike breakers from St. Louis, Charles F. Evers and George Candage, who had acted in a like capacity during the strikes at St. Louis, San Antonio, Richmond, Waterbury, Bloomington, Chicago and elsewhere. April 1st the first car was run by the new men. The rails were obstructed at frequent intervals and the crew were subjected to jeers, but nothing more serious occurred. April 2nd the company operated a few more cars until 7 p. m., no night cars being put on until April 6th.

April 5th the company employed eighteen more strike breakers who came from New York in charge of James Farley, who had also won distinction at St. Louis, Richmond, Chicago and other places.

Several strikers secured withdrawal cards from the union and went back to work.

April 7th about 300 persons attacked a crew on a car at Twentieth St. and Third Ave., placing torpedoes on the track, throwing rocks through the car windows, etc., and on the evening of April 8th the rioting was repeated at Twentieth St. and Eighth Ave., when three rioters were arrested. This practically stopped the rioting and since that time the cars have been operated on regular schedule and are well patronized. The company has always been considered a good employer, and with the exception of the two strikes mentioned there has never been any trouble. The men get 17½ cents an hour and average $65 per month.

After six weeks of idleness the men declared the strike off May 6th, the company agreeing to reinstate the old men as far as practicable.

Canadian Notes.

The Montreal Terminal Railway Co. plans to build a belt line near Amherst St. and has applied for the necessary street locations. The company is also seeking authority to extend its system upon the island of Montreal and through the counties of Terrabonne, Montcalm, Joliette, L'Assumption and Berthier, it being the purpose to construct a ramifying system on the north shore of the St. Lawrence River. The recent construction of the Bout de l'Ile Bridge by the Chateaugay & Northern Ry. has removed the main obstacle to the plan. It is proposed to give transfers at all intersecting points and as soon as the company can operate a continuous route from the eastern to the western limits of the city it will sell eight tickets for 25 cents.

The Toronto Railway Co., in accordance with an agreement with the city, will double track and extend two of its lines, the work to be completed by September 1st next. As a result of the recent great fire in Toronto the company has had to relay its tracks between Yonge and York Sts., on Front St. The feeder cables on the south side of Front St. were destroyed, five miles of new wiring being required. The Toronto Railway Co. and the Metropolitan Railway Co. are trying with some success the new brake cam combination designed to give a hand brake 40 per cent more power.

The South Western Traction Co., of London, Ont., has awarded the contract for construction of the power station and road equipment to Bruce, Peebles & Co., Ltd., of Edinburgh, Scotland, for £42,250. The Ganz system will be used and the entire equipment built in Edinburgh. Contracts for the construction of the track and roadbed have been awarded to the Midland Construction Co.

The Montreal & South Shore Auto Car Co. has been organized and will soon establish an auto-car service between Montreal and the towns and villages on the opposite side of the St. Lawrence River. The directors are: S. T. Willett, Chambly, Que., president; Peter Lyall, Montreal, vice-president; R. C. Smith, Montreal; Hon. William Mitchell, Montreal; L. E. Morin, sr., Longueuil; W. B. Powell, Montreal; H. G. Elliott, Montreal; George D. Perry, secretary-treasurer.

The Nipissing, Ottawa & Montreal Railway Co. is seeking power to construct a railway from the east end of Lake Nipissing to Montreal, and also a line from the east end of the lake to a point on Georgian Bay. It plans to acquire, own and operate water powers and generate electricity for lighting and motive purposes.

The St. Catherines, Welland & Pelham Electric Ry., capital, $200,000, plans to build 16½ miles of road. Incorporators: Robert McLaren, St. Catherines; Edward Morris, Fonthill; Dr. Glasgow, Welland; George Arnold, Ridgeville; S. D. Lake, St. Catherines.

Alexander Shaw, L. C. Benton and J. H. Scott, of Walkerton, are the promoters of the Walkerton & Lucknow Railway Co., which will build an electric line to connect Walkerton, Lucknow & Hanover, Ont.

The DuLievre & Ottawa Railway Co. purposes to build a steam or electric road from Ottawa to Buckingham and thence up the Lievre River. McCracken, Henderson & McDougall, of Ottawa, are the company's solicitors.

Mr. John McNamara, civil engineer, of New York, is one of several Americans who are interested in a proposed electric railway from the Yukon to connect with Canadian and American Pacific ports and rival the Canadian Pacific Ry's. White Pass line.

Mr. T. A. Stephens has invited bids for 20,000 ties and 1,000 poles to be used in the construction of the Edmonton, N. W. T., electric railway. The franchise is held by Mr. W. J. Trethewey, of Montreal.

The Winnipeg Electric Railway Co. will build a subway 14 ft. high under the St. James railway bridge to connect with the St. Charles St. and Portage Ave. lines. The walls will be of concrete.

The Winnipeg & St. Norbert Electric Railway Co. has selected a site for a bridge and is to soon begin the construction of its proposed line to run on both sides of the Assiniboia River.

The Preston & Berlin Street Railway Co. will extend its line to Waterloo and will build a power plant.

The Yarmouth Street Railway Co., Ltd., will build a three-mile extension and will purchase two motor cars, one snow plow and three sanders.

The Sarnia Street Railway Co., of Sarnia, Ont., will erect a brick car barn, 32 x 115 ft.

The Electric Railway Co., of Port Arthur, will install a storage battery at the municipal power house at that place.

The commissioners of the municipal street railway of Guelph, Ont., contemplate installing a storage battery.

Kansas-Oklahoma Interurban Ry.

The Kansas-Oklahoma Interurban Railway Co., capital $1,000,000, has been incorporated to build an interurban electric line from Winfield to Arkansas City, Kan., and to Chilocco, I. T., with five miles of city track each in Winfield and Arkansas City, making a total of 33 miles. It is also intended to later extend the road south from Chilocco to either Oklahoma City or Shawnee, and the plans also include the establishment of an electric light plant in Arkansas City, where the headquarters of the company are located. It is proposed to build a side track on each farm en route, so the farmer can load his grain and produce on the standard freight car of any road and ship to any point in the United States.

The directors of the new company are: W. C. Robinson, president of the First National Bank, Winfield; W. H. Somermier, merchant, Winfield; Charles L. Brown, general solicitor for the Southwestern Railway Co., Arkansas City; Thomas Baird, farmer and capitalist; N. D. Sanders, cashier of the Citizens' State Bank; A. J. Hunt, president and general manager of the New Era Milling Co.; L. H. P. Northrup, promoter, the last four also of Arkansas City.

Motor Cars for Bavarian Railways.

Under date of March 9, 1904, Mr. H. W. Harris, United States Consul at Mannheim, Germany, reports that on July 1, 1904, the Bavarian government will open bids for motor cars to be used on the Bavarian railways in connection with the present steam service. For main lines the cars are to be of two sizes, the larger with seating capacity for sixty passengers and the smaller to be capable of seating forty persons. Each car is to furnish standing room for twenty additional persons. They are to be combination passenger, smoking and baggage cars and each will be equipped for drawing trailers. For the branch and local lines the cars will be smaller and will be used for passenger, freight and mail service. In all the cars provisions will be made for first, second and third class passengers. The speed of the larger main-line cars will be forty-five miles an hour; of the smaller, thirty-six miles per hour, while the maximum speed for the branch-line cars will be thirty miles an hour. The general features of the cars, including the kind of power to be used, will be left to the bidders.

The city council of Painesville, O., has granted permission to the Cleveland, Painesville & Eastern R. R. to build two spurs to connect with the Cleveland, Painesville & Ashtabula Ry. tracks, in order that the latter may run its cars into the city over the former's tracks.

The Interborough Rapid Transit Co., New York City, has stationed special officers at the principal elevated stations in its system where the traffic during rush hours is especially heavy. They are known as "elevated specials" and are uniformed similarly to the city police. Although hired and paid by the railway company they are required to report once a month at police headquarters.

The Stone & Webster Properties on Puget Sound.—II.

One of the smaller companies of the group known as the Stone & Webster railway and lighting properties is the Whatcom County Railway & Light Co., of Bellingham, Wash. Bellingham is the name of the new municipality formed in December last by the consolidation of the rival cities of Whatcom and Fairhaven on Bellingham Bay, and is the third place in point of size on Puget Sound. The Whatcom County company in December, 1902, took over the Northern Railway & Improvement Co., which operated under lease the 12-mile line of the Bellingham Bay Street Railway Co. and controlled the electric lighting business in Fairhaven, the electric power business in Whatcom and Fairhaven, and the Whatcom & Fairhaven Gas Co. This last company had a short time before bought the Bellingham Bay Gas Co's. property. The consolidation gave to the new company the electric railway and gas business and the entire electric lighting business of Fairhaven.

The population served by the railway lines of the Whatcom County company is about 23,000 and is rapidly increasing, keeping fully abreast of the other Puget Sound cities, which have enjoyed remarkable prosperity since recovering from the panic of the 90's.

The city of Bellingham is favorably located and a continuation of its present rapid growth is confidently predicted. It is the southern terminus of the Bellingham Bay & British Columbia Railroad which connects with the Canadian Pacific and is also on the lines of the Northern Pacific and the Great Northern Railroads; is the only important point on the Pacific Coast that is reached by three transcontinental railroads. A fourth route is being surveyed by the Bellingham Bay & British Columbia Railroad to extend across the mountains to Spokane, and should this be carried through, Bellingham will be the nearest tide-water port to Spokane.

The territory naturally tributary is rich in timber and the agricultural possibilities are being rapidly developed. The harbor is well protected and Bellingham is nearer the Strait of San Juan de Fuca, the outlet of Puget Sound, than any other of the sound ports; this it is believed will give the city an important advantage, especially in the Alaskan trade.

BIRD'S-EYE VIEW OF BELLINGHAM, WASH.

The Bellingham coal fields are the largest yet discovered on the Pacific coast and cover an area of about 250 sq. mi. Back of the coal lands are the Whatcom County gold fields.

The company has 13.7 miles of track (measured as single track), of which .7 mile only is double. From the central part of Whatcom the shorter routes are from one to one and one-half miles; to Silver Beach on Lake Whatcom is five miles and to the Fairhaven terminus about three miles. This was laid with 40-lb. and 56-lb. rails put down in 1890; the present management is renewing the railroad, replacing old steel with 60-lb. rails. The principal streets have plank pavements and in some instances the substructure of the track when first laid was far from being up to present standards. In new work 12 in. of gravel is put in as a foundation and on this are laid 6 x 8 in. x 8 ft. ties.

SCENE IN FAIRHAVEN

HOLLY ST., CORNER OF ELK ST., WHATCOM

The rolling stock comprises 4 open motor cars, 2 open trail cars, 12 closed motor cars, 1 express car, 1 electric locomotive and 7 flat cars.

Two round trips per day to Lake Whatcom and one round trip

per day to [illegible] the express service. On the lake line a great deal of switching of freight cars is done for the lumber yards [illegible].

The [illegible] County Railway & Light Co. has outstanding

FREIGHT AND EXPRESS STATION.

$175,000 non-cumulative 6 per cent preferred stock, $750,000 common stock, and $450,000 5 per cent bonds. For the last fiscal year gross earnings were $153,343 and net earnings, $51,639.

FREIGHT AND EXPRESS STATION.

The officers of the company are: President, C. D. Wyman; vice-president, J. W. Hallowell; secretary, Henry R. Hayes; treasurer, A. S. Pratt; manager, F. E. Frothingham.

Fitchburg & Leominster Ry's. Park.

The Fitchburg & Leominster Street Railway Co., of Fitchburg, Mass., owns and operates Whalom Park, at which the approximate attendance last season was 400,000, of which number 300,000 persons were carried on the company's cars. This season a figure-8 roller coaster has been added to the park's attractions. Opera is the most remunerative form of entertainment at the park and at the prices charged the theater is self-supporting. The general expense of the park is considered a charge on the railway traffic. The extra park traffic is handled by putting on extra cars as needed. An attractive form of advertising the park which the company has adopted is by means of colored post cards, showing views of interest and attractiveness in the grounds. The manager of the park is Mr. W. W. Sargent.

The New York subway and the elevated railroad tracks are connected at 149th St. and Third Ave., in the Bronx, so that trains may be run from one to the other.

The daily average of passengers carried by the Chicago & Oak Park Elevated Railroad Co. in April was 44,865, a decrease of 361; with transfers the total was 466,452, a decrease of 369.

Electric Car and Tram Brakes.*

BY S. J. KIDDER

When street cars were light in weight and slow in speed, no special demand was apparent for power brakes; but with the advent of heavier cars, faster speed, and a very considerable factor of rotative energy from the revolving armatures acting as a driving force, or power to propel the car when the trolley current was cut off, it was imperative to provide all electrically driven cars with the most efficient means for controlling their speed, as well as to bring them to a stop in the shortest possible distance. That the importance and value of such braking devices has been realized is apparent from the number, and different types, of brakes that have been brought out since the adoption of electric power for operating cars and trains.

The friction brake does not appear of sufficient importance to demand extended consideration, not much having been demonstrated in its favor, it appearing that first cost is about the only thing to invite its serious attention, and it will never attain standing as a power brake in connection with motor-driven cars.

Hydraulic brakes have been experimented with and used to some extent, and, while they exhibit no little ingenuity on the part of the inventors, have not proven sufficiently meritorious to find a field of prominence as a power brake in electric car braking.

Next in order comes the compressed air brake, which is being rapidly introduced on motor-driven railroad cars. Unlike the steam roads, however, we find that in connection with street or electric car braking, straight air can, in many instances, be profitably employed, particularly where the motor car is operated without trailers, such as is usually the practice on street and surface roads.

The straight air brake is of the usual form, having one or more main reservoirs, a brake cylinder, in which the air exerts its energy in applying the brakes through the foundation brake gear usually employed in air-brake practice, one or two engineer's brake valves, or, more properly speaking, motorman's brake valves, and an air gage denoting main reservoir and brake cylinder pressure—the above arrangement being common to the three types of brakes known as storage, axle-driven and motor-driven systems.

With the storage system one or two main reservoirs of liberal capacity are used, the same being charged at a central storage plant to a pressure of from 275 to 300 lb., the plant being able to replenish the car reservoir through suitable hose provided with couplings for convenience in making the connections, in from 10 to 15 seconds. These storage system cars also usually have a smaller reservoir, perhaps 12 in. x 33 in. between the main reservoirs and brake valves, this smaller reservoir furnishing an abundance of air for an emergency application of the brake quite independent of the somewhat restricted capacity of the reducing valve to quickly supply the air required. Interposed between the pipe connecting the storage and reservoir is the reducing valve, just referred to, set at the maximum pressure intended to be permitted in the brake cylinder, thus providing a safeguard against the motorman subjecting the brake cylinder to a higher pressure than intended. A further provision is a safety valve in the lower-pressure reservoir adjusted somewhat higher than maximum brake cylinder pressure to prevent abnormal accumulation of air in the small reservoir in the event of leakage past the reducing valve.

For the axle-driven and motor-driven systems the arrangement of apparatus and stored power is substantially the same as that just described, with the exception that a more moderate pressure is maintained in the main reservoir, the air being furnished from a pump or compressor forming a part of the apparatus on the car. As the name implies, the axle-driven compressor is operated from an eccentric or gear attached to one of the axles. In connection with this compressor there is usually a regulator or governor so arranged that when the maximum pressure intended to be carried in the main reservoir and used in the cylinder has been accumulated, the suction valves are lifted and held from their seats, permitting the pump to run idle or churn until a minimum predetermined pressure has been reached, when the suction valves are dropped to their seats, again throwing the compressors into action. It is apparent

*From a paper read before the Air Brake Association, Buffalo, May 10, 1904.

†Of the American Brake Co., St. Louis.

that when a car with apparatus such as just described is starting out after standing a sufficient time for all the air pressure in the reservoir to become dissipated, it must be run a sufficient distance to produce a pressure competent to operate the brakes efficiently. This is best accomplished by having two reservoirs, the smaller of limited capacity, say 10 in. x 24 in., with a double check valve interposed between this and the larger reservoir, the arrangement being that 30 or more pounds of air may be compressed into the small reservoir before communication is established to the larger one. This provides for a sufficiently prompt rise of pressure in the small reservoir to apply the brakes, which is accomplished by a very few rotations of the car wheels operating the pump. Following this the pressure in both reservoirs increases simultaneously, and on subsequent brake applications air is drawn from the combined reservoirs.

The motor-driven system differs from the axle-driven only in the method of obtaining power to operate the compressors and an absence of the double check valve. The motor-driven air pump is controlled by an automatic governor designed to start and stop the pump at predetermined pressures, usually so constructed that when its operating parts are in normal position the device is "cut in," the "cut out" being effected by air pressure through a small connecting pipe from the main reservoir. At first it may appear somewhat strange that straight air, instead of the automatic brake, is so commonly used in connection with electric car brakes, but because these cars are operated as a single unit the former type of brake has certain features, such as simplicity and promptness in operation, owing to the short cylinder pipe connection between the brake valve and car cylinder, together with the facility and degree of accuracy with which the motorman can increase or decrease the brake cylinder pressure in making stops, and drifting down long hills with varying grades, which makes it especially applicable to this particular form of electric service. An additional factor pertaining to this type of brake, and of no little imoprtance, is what might be termed the high-speed brake feature, it being entirely practical to so manipulate the brake valve that a high initial brake cylinder pressure can be employed, with a gradual or periodical reduction as the speed is decreased, thus contributing to quick stops and the avoidance of wheel-skidding, a valuable desideratum in fast electric car service.

The automatic system of brakes is so widely and extensively used that little is required in the way of description or explanation. The foundation gear is identical to the types of air-brakes already referred to, the only apparatus required in addition to the straight air brake being an auxiliary reservoir and triple valve. With more than one car in a train this brake is preferable to straight air, as in the event of a hose bursting, hose couplings becoming detached, or a disrupted pipe, the brakes are instantly applied automatically; while in similar cases, with straight air, all power control of the brakes is lost. Without question the weakest point in the air-brake system, when more than one car is in the train, is the hose. Used in connection with automatic brakes, they are subjected to the greatest strain when braking power is not desired, while with the straight air brake the maximum strain imposed on the hose is at the time when brakes are set at their highest efficiency, thus having a tendency to invite disaster at the most critical moment.

Within the past decade elevated railroads have attained in our larger cities a very important position as an essential factor in facilitating urban transportation. The earlier of these roads used steam for motive power, the locomotive and cars being equipped with non-automatic vacuum brakes, which, during a considerable period of time, were thought to be superior to other forms of power brakes for the exacting service in elevated railroad operation.

When automatic brakes were first proposed for these roads their adoption was vigorously opposed by both straight air and vacuum brake advocates, among the principal reasons advanced being: Cost; inability of pump to supply the requisite quantity of air; slowness in charging the auxiliary reservoirs, which would render it impossible to restore the depleted pressure with such frequency of stops [illegible] required, [illegible] of the brake release, and, worst of all, the straining and racking of the elevated structure [illegible] to the use of brakes so quick and powerful in operation. The assertions of these critics, however, failed to materialize and [illegible] as evidenced by the almost universal use of [illegible] and [illegible] performance in connection with elevated railroad equipment.

It was clearly apparent to those skilled in the art that the automatic brake was, compared to those before used, best suited for this service, as a pump of very ordinary capacity would be capable of supplying air in abundance, and, so far as the expeditious charging of the auxiliary reservoirs and release of the brakes were concerned, the proposition simply resolved itself into that of feed groove and exhaust port area, which, within any limit demanded for such service, in no wise interfered with brake performance on six or seven cars, the maximum number operated on elevated roads.

During the first few years of electrically-operated elevated railroads, trains were composed of one motor and from one to four or five trailer cars, the former containing all the apparatus for producing the compressed air and controlling the brakes; in other words, the motor and trailer cars bore the same relation to each other in this respect as the steam locomotive and train as generally made up, but with the improvements in electrically-operated trains the more modern practice is what is known as the multiple control system, trains being made up with nearly or even all of the vehicles being motor cars. Each car has its full quota of brake equipment, such as pump, main reservoir, governor, brake valves, etc., the main reservoirs throughout the train being in communication with each other through a second line of pipe, hose and couplings, so that when air is drawn from any one reservoir all contribute to supply the air passing through the brake valve, being operated by the motorman. With the system of multiple control an arrangement is necessary to provide for simultaneous operation of the pump governors, that each pump may do its proportionate share of the work, which is accomplished by having either an electric wire or air pipe connection directly between each and all of them.

With either of the types of air-brakes heretofore referred to a higher brake efficiency can be obtained from the motor wheels than from those not connected with the motors, the armatures being connected to the driving wheels through gearing, the pinion of the armature and the gear-wheel on the axle being of such dimensions that the armature makes several revolutions to each turn of the driving wheel. Thus, when brakes are applied, in addition to the usual influences which must be overcome in stopping the train, the high rotative energy due to the rapid rotation of the armatures may also be provided for by an increased braking power without danger of wheel-skidding. Upon the motorman's brake valve and its manipulation depends the satisfactory operation of the automatic brake.

Uniform piston travel on cars running in trains with a minimum travel compatible with proper shoe clearance, whether operated as a single unit or otherwise, is an important matter in connection with air-brakes, such practice contributing to a very considerable economy in the amount of air consumed, wear and tear of the compressors, and manual labor in frequent adjustment of piston travel. As the brake-shoes wear away an increase of piston travel is inevitable, with a consequent decrease of braking power.

Again, the adjustment of piston travel by hand fails to insure a predetermined piston movement when the car is moving, the running travel being an unknown quantity incident to uneven and continuous wear of the brake-shoes, lost motion in the journals, brasses, center plates, spring of the rods, brake-beams, and the varying leverage employed on cars; and it is obvious that nothing but a mechanical device which will automatically regulate the piston travel when cars are running, with the brakes applied, will insure maximum and uniform brake efficiency.

Various types of automatically-operated air-brake slack adjusters, possessing more or less merit, have been invented, but the one embodying the qualities most essential to fulfill the requirements of such a device is operated by air pressure from the brake cylinder. This adjuster mechanically takes up the slack when the wear of the brake-shoes permits the piston to travel beyond the prescribed limit, thus keeping to a uniform travel the brake piston. The brake cylinder piston itself is a valve which, when it passes a predetermined point of stroke, admits pressure through a connecting pipe to the adjuster cylinder, thus pushing out a small piston whose ratchet pawl turns a nut on the adjuster screw, the jaw on the outer end of which is attached by a pin to the fulcrum end of the floating cylinder lever, taking up the slack in the brake rigging caused by the wearing away of the brake-shoes and thereby maintaining a uniform travel of the piston.

Another form of power for brake service which has been experimented with in various types of apparatus, but has only somewhat

[illegible] means of [illegible] in practical braking [illegible] magnetic brake. With few exceptions, these [illegible] abundant trial, principally owing to the apparatus failing in one manner or another, together with the danger incident to depending on the trolley pole to maintain its connection with the wire at the time of operating the brakes.

A type of electric brake which has developed some signs of promise has a foundation gear similar to that usually employed in connection with air-brakes, with the exception that it has two cylinders and one cylinder lever. This lever is fulcrumed at the center, has two sheaves attached to it, one at either side of the fulcrum, around which a chain extends, this chain being attached to the end of the two long brake rods extending to the live levers. Each cylinder contains three magnetic coils and a plunger, which are directly connected to the cylinder lever outside of the sheaves. Connecting wires lead from these coils to the controller, which is placed alongside the brake staff and geared to it, so that the turning of the brake staff applies the power to the brake. The plungers are simply cylinder pistons actuated by electricity instead of compressed air. With this brake, provision is made that, in the event of the trolley wheel leaving the wire, the motors may be short-circuited through resistance, thus generating the current to operate the brakes, which is accomplished by a further movement of the brake staff handle.

What is known as the magnetic brake is now recognized as a desirable and effective means of utility in practical car braking—desirable because the power employed to operate the brake is generated by the revolving armatures when the trolley current is cut off—and effective because it affords a far greater per cent of braking force on a car than has been found possible with any power brake heretofore employed. The brake apparatus is a combination of a track brake with the ordinary wheel brake. The track brake consists of a system of brake-shoes combined with powerful electro-magnets beneath the car directly over the rails and so arranged that they not only do not interfere with the efficiency of the wheel brake, but add to its normal retardation. The track brake is placed beneath the two pairs of wheels, and instead of being forced upon the rails through an effort from the car, is drawn to the rails by the electro-magnets above referred to, thereby adding its friction to the unimpaired friction of the wheel brake.

The wheel brake heads, shoes and levers are of the type ordinarily used, the top of the latter being connected by an adjustable compression member, while to the bottom of the levers push rods are secured by pins, their opposite ends also being attached to the track shoes. These push rods are telescopic, so that a movement of the track shoe in a direction opposite to that in which the car is running causes the wheel brake-shoe to be applied to the rear wheel of the truck, and through the truck levers and compression rod, to the forward wheel—a stop on the truck frame between the push rod and the brake head connection preventing the lower end of the forward brake lever from following the track brake-shoe. With an opposite movement of the car the same application of wheel brake-shoe is accomplished in the reverse order.

When the brake is not in operation the suspension springs carry the track magnet and shoes entirely clear of the rails. The frictional resistance of the rails to the movement of the track shoes when the brakes are used causes the wheel brakes to be applied with corresponding force. Thus to the ordinary retardation of the wheel brakes is added that of the track brake and also the back torque of the motors, this combination giving a retarding power to the car far in excess of that possible to be attained when the wheel brake is alone employed. The incidental features of the magnetic brake are also of interest and great value. The current generated by the motors declines with the speed during a stop, thereby offsetting the increased coefficient of friction due to the lower speeds, and, at the same time, prevents the unpleasant lurch experienced when brakes are held applied until the car comes to a full stop.

As will be assumed from what has been said, the brakes release regardless of the brake controller position, but, as in the event of a car starting on a heavy grade, the motors will generate sufficient electricity in a movement of 12 or 15 ft. to again bring it to a state of rest, rendering runaways impossible, even should the motorman apply the brake and then abandon his post. When slippery rails prevail—a prolific source of wheel-skidding—the braking power operating the wheel brakes is correspondingly reduced, so that the force of application of the wheel brake is automatically proportioned to the rail friction which rotates the wheels; but should the wheels pick up and slide, at the same moment the track shoe magnet current is extinguished and the pressure of the brake-shoes upon the wheels is instantly relaxed and rotation of the wheels is resumed.

As is well known, when the motion of a car is being rapidly retarded, considerable of the weight normally carried by the rear wheels of the truck is transferred to the forward wheels, and here again the stop above referred to is utilized, constituting as it does a fixed fulcrum for the truck lever, giving a brake-shoe pressure to the forward wheels proportionately greater than that acting upon the rear wheels. The brake-controlling device may be incorporated in the running controller or may be a separate device placed by its side and operatively interlocked with it, so that neither can, through carelessness, be caused to interfere with the operation of the other

Annual Report of the General Electric Co.

In the annual report of the General Electric Co., for the year ending Jan. 31, 1904, it is stated by Pres. C. A. Coffin that the net profits of the company were $6,319,271, which added to the amount of surplus at the end of the preceding fiscal year amounts to $10,801,973, from which was paid in dividends during the year $3,508,284, leaving a surplus on Jan. 31, 1904, of $7,293,689. The profit from the sale of securities was $835,006 less than in 1903.

Total sales (amount billed to customers) during the year were $41,699,617. The orders received during the year, not including contracts, numbered 176,834 and included about 900,000 h. p. of generators, rotary converters and steam turbines; more than 7,000 railway motors, aggregating over 300,000 h. p. capacity; transformers, over 650,000 h. p. capacity; more than 15,000 stationary motors, aggregating over 200,000 h. p. capacity.

Reference is made in the report to the orders received from the New York Central for electrical equipments, and in this connection a comparison of results obtained with steam and electricity is given, using operating statistics of the South Side Elevated Railroad Co. and the Lake Street Elevated Railroad Co., of Chicago, and the Manhattan, New York, all being steam lines which were converted to electric lines and equipped with General Electric apparatus. After the introduction of electricity the percentage of operating expenses to gross receipts decreased from 69.1 to 44.1, from 56.1 to 47.5 and from 55.8 to 44.7, respectively. A list of roads using the Sprague-General Electric control is given, also. Since the organization of the company in 1892 it has sold 92,557 railway motors having a total capacity of 3,420,537 h. p.

Expenditures aggregating $2,500,000 were made for real estate, extensions to existing buildings and the erection of new ones for additional machinery. A table shows the increase in floor space and number of employes during the past six years, the floor space in 1899 being 1,800,000 sq. ft., and in 1904, 3,700,000 sq. ft.; number of employes in 1899 was 8,000 and in 1904, 17,000.

The financial statement gives the total assets as $55,938,962, including factory plants at $6,500,000 and patents, franchises and good will at $2,000,000; total capital stock authorized, $45,000,000; outstanding, $43,866,700. The company has no notes payable.

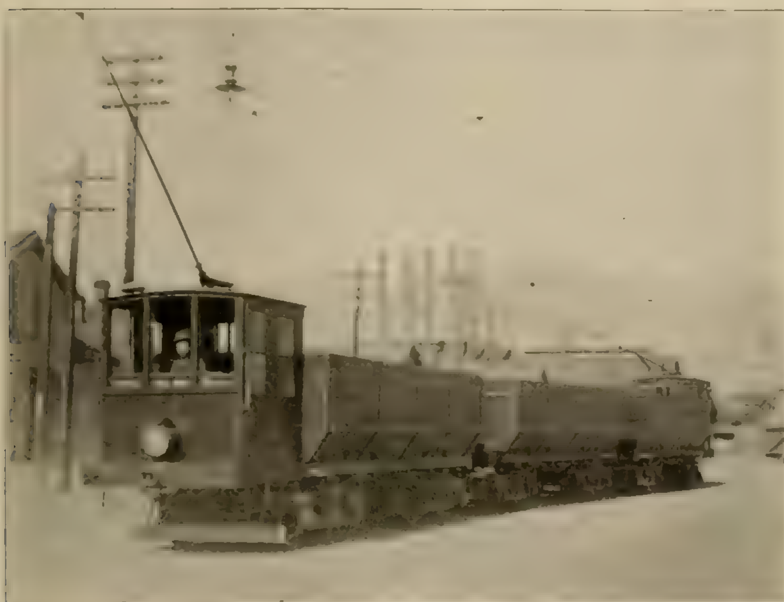
Electric Railways in New Jersey.

The State Board of Assessors of New Jersey has issued a supplemental report which shows that there are 70 electric railway lines in the state. Their gross receipts last year amounted to $9,574,552; expenditures, $5,881,046; dividends paid, $630,150. These figures compare with the previous year as follows: Gross receipts, increase, $680,298; expenditures, increase, $789,755; dividends, increase, $89,510. The total mileage of the lines is 980.56 miles; capital stock, $85,061,880; bonded debt, $67,747,000; other debts, $7,362,968. The estimated cost of roads and equipment is $160,344,176

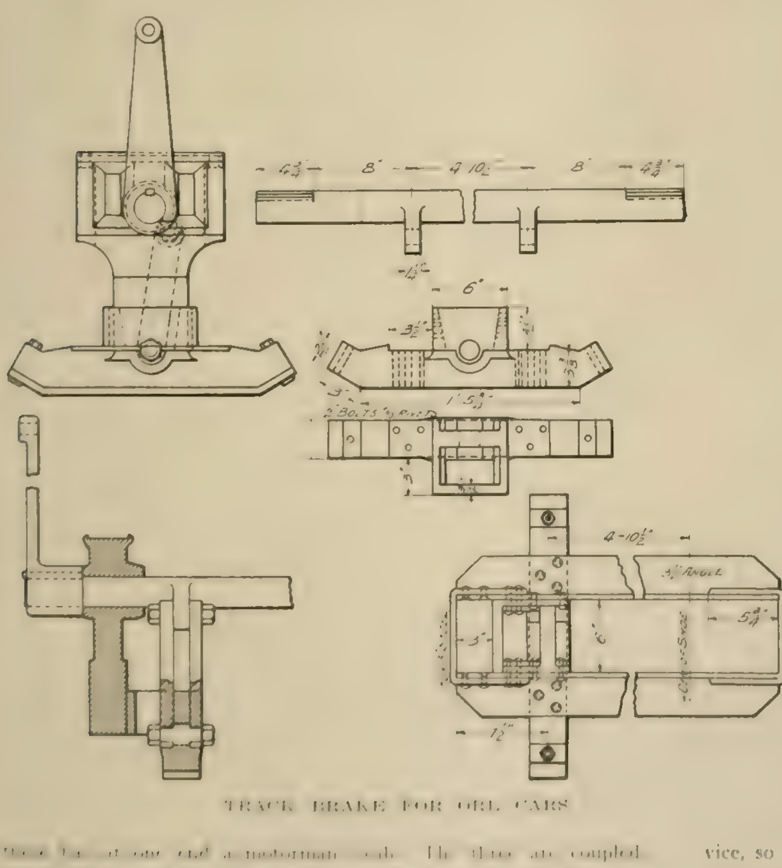
The Camden (N. J.) & Suburban Railway Co. has been leased to the Public Service Corporation of New Jersey for 999 years from May 1st, the annual rental being guaranteed.

Ore Cars for Butte Electric Ry.

In the "Review" for November, 1903, page 807, Mr. J. R. Wharton, general manager of the Butte Electric Railway Co., in his article on some of the interesting features of that road mentioned the fact that there had then just been completed three 60,000-lb. ore cars to be used in transporting ore from the Clark copper mines to the works of the Butte Reduction Co. These three cars have just been placed in service, replacing eight 10-ton cars heretofore used. Only two of the new cars are equipped with motors, and each of [illegible] at one end a motorman's cab. The three are coupled [illegible] at the ends and operated as a train, the arrangement providing a cab at each end of the train.



ORE CARS, BUTTE ELECTRIC RY.



TRACK BRAKE FOR ORE CARS

The cars are mounted on Taylor double trucks and the two motor cars are equipped with four G. E.-52 motors each, also with Christensen air compressors. The type M multiple system of control is used, being operated by the motorman in the cab at the head of the train. The car bodies proper are 20 ft. long and 8 ft. wide, with a gable bottom and doors for side dumping. Each has a capacity of 420 cu. ft.

The entrance of the mine from which the ore is to be taken is at the top of a long grade which reaches its maximum incline of 10¾ per cent at the mine mouth. It is quite apparent that to handle a loaded train on these grades requires extraordinary safety precautions. Besides being equipped with wheel brakes operated by compressed air these cars are also fitted with a track brake, designed by Mr. J. S. Wathey, the general superintendent of the Butte Electric Ry. The track brake, which is intended for emergency use, when it is operated by hand, is shown in the accompanying drawing. The shoes have a bearing surface on the rail of about 18 in. in length and are mounted one near each end of a frame built up of steel angles and placed between the two pairs of wheels. Pressure is applied by means of a toggle. The crank shaft for operating the toggle link is supported on castings secured to the truck sides with depending lugs fitting in guides at the ends of the shoe supporter, and these serve to confine the motion of the shoe and to transmit the stress from the shoe to the car. They have found to meet the requirements of the service admirably.

Compressed Air in Electric Railway Work.–III.

It having been determined that compressed air is a desirable adjunct in electric railway shop work, the choice of a suitable compressing plant becomes a matter of selection from the many reliable types of compressors on the market. The compressor may be driven by steam engine, either direct connected or by belt, but for electric car repair shops the electric motor-driven compressor is undoubtedly the best form to use. For general use in electric railway shops and power houses, a pressure of from 75 lb. to 100 lb. per sq. in. in the main reservoir tank will be found to meet practically all conditions. It is seldom that the higher pressures will be required, and if lower pressures are desired (as for instance for cleaning purposes where 20 lb. would be found advantageous) the air can be taken through a reducing valve.

For very small installations where the air is to be used chiefly for blowing and cleaning purposes, and where pressures above 75 lb. will not be necessary, a single-stage compressor, driven by a small motor, will probably do the work. It should be borne in mind, however, that a single-stage compressor is not economical in its action, and though somewhat less expensive in first cost than a two-stage or compound machine, a two-stage compressor will give far more economical and satisfactory results. When air is compressed, its temperature is rapidly increased, and when compressed to 75 or 100 lb. in a single-stage compressor, the rise in temperature will be sufficient to seriously interfere with the operation of the plant. These difficulties are not encountered to the same extent in a compound compressor, because the first cylinder compresses its charge to about 30 lb. only, the temperature due to this pressure being 200 to 260 degrees F., which is comparatively low and harmless. The air continues its way to the next or high pressure cylinder, and is usually passed through a cooling device, so that it enters the second cylinder comparatively cold at 30 lb. pressure. The temperature due to the compression in the second cylinder from 30 lb. up to 100 lb. is not likely to be over

200 to 250 degrees and the effect of the heat can be overcome by proper water cooling jackets around the cylinders.

For service in electric railway shops, where the air will seldom be used continuously for long lapses of time, a comparatively small compressing outfit with storage reservoir of sufficient capacity will supply all requirements. A shop built to care for 750 or more cars, where the air is to be used for several of the classes of work to which it is applicable, should have a compressing plant capable of compressing about 75 cu. ft. of free air per minute to 100 lb. pressure. However, for a smaller shop, a compressing plant having a capacity from 10 to 20 cu. ft. of free air per minute will give sufficient air for all ordinary cleaning purposes, for blow torch and sand blast uses, and for a limited number of pneumatic tools, providing the air is not to be used for all these purposes at the same time. Any of the accepted types of compressors, such as those furnished by the Ingersoll-Sergeant Drill Co., are available for this class of work. If, in addition to, or in place of, a permanent stationary compressing outfit, it is desired to have a portable compressing plant, it can be selected from the products of the National Electric Co., of Milwaukee, or the Westinghouse Co. Both of these concerns make very compact and serviceable compressing outfits, which include a compressor and storage tanks, mounted on a low truck, and which can be moved readily about the shops to accommodate the work that is to be done.

Concerning the cost of installing a plant for giving air under compression, it may be said that the expense of a complete outfit will run from $350 up, according to the size of plant and use to which it is to be put. As to the cost of running the plant, Mr. E. C. Boynton, a prominent compressed air engineer, gives us the following data: "I have figured the approximate cost of compressing 1 cu. ft. of free air from 0 to 90 lb. The recent tests at the Boston Elevated Railway shops show the average power required to compress 5¼ cu. ft. of free air from 0 to 90 lb. is (by the Christensen compressor) 269,563 watt-seconds. Dividing this by 60 twice gives 750 watt-hours, and again dividing it by 1,000 gives .750 kilowatt-hours. A fair average cost of power at the switchboard of a power station is 0.75 cent per kilowatt-hour, or allowing for various losses, a fair cost is, say, 1 cent per kilowatt-hour. It would cost, therefore, 0.75 cent to compress 5¼ cu.ft. from 0 to 90 lb. Dividing by 5¼ we have 0.14 cent as the cost of compressing one cubic foot to 90 lb., or a little less than 1½ mills." Another engineer states that in running tests on a motor-driven compressor rated at 11 cu. ft. of free air per minute, he has frequently pumped 5 cu. ft. of air to 75 lb. pressure in 2½ minutes, the motor taking about 4 amperes at 600 volts. These are probably average figures, and the cost of power being known, the expense of compressing air for any particular installation can be estimated closely.

The transmitting of air under compression to various points of the shop or even to adjacent buildings involves no serious engineering difficulties, as the losses from friction and condensation for distances up to 1,000 ft. are practically nil, and providing reasonable care is taken to make the transmission pipe air-proof, the losses may be entirely disregarded for installations of the kind under discussion.

Ohio Interurban Railway Association.

The next meeting of the Ohio Interurban Railway Association will be held at the Chittenden Hotel, at Columbus, May 26th, at 9 a. m. Subjects for discussion at this meeting are:

1. What arrangements can be made for the operation of the cars of one company over the tracks of another company?

2. What compensation should interurban companies give newspapers for advertising notices?

3. How to take care of employes from a transportation standpoint, particularly the transportation of track men who are hired for a few days only and to whom the company does not care to give badges or pass books.

4. The benefit of associations among employes and the social relations of employer and employe.

5. The most economical method of keeping cars looking clean and neat.

H. P. Clegg, Dayton, is president, and J. H. Merrill, secretary and treasurer of the association.

Graphical Mathematics. III.

BY A. G. HOLMAN, M. E.

In previous papers methods of addition and subtraction illustrated by a graduated frame filled with bricks, and by a picket fence have been described. Probably no one would think seriously of constructing an "adding machine" upon so cumbrous a scale, but these illustrations show that the principles at least of graphical addition and subtraction are not very intricate.

Disk Adding Machines.

A compact arrangement, however, upon the same plan is now manufactured which is such a good example of the present branch of this study that its main features are here described. The device consists essentially of a graduated circular plate revolving upon a graduated frame, and an additional smaller disk for recording the revolutions of the larger, as shown in

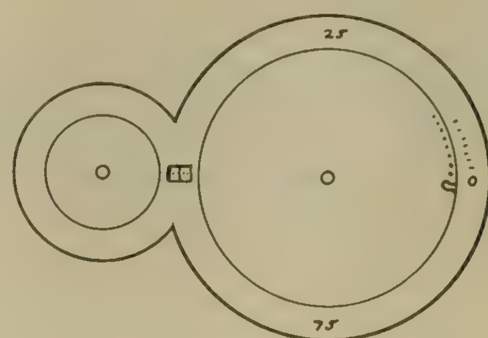


FIG. 21.

Fig. 21. If the larger disk and the frame surrounding it are each marked with 100 equal spaces and notches or holes are provided on the disk for revolving it by a pointed instrument it is evident that several numbers may be rapidly added. Starting with the 0 of the disk at the point where the result is to be read, the disk can be turned successively such distances as to represent the numbers to be added, and without any mental effort the total length, or sum of the numbers, will be shown by the position of the disk. When the larger disk reaches 100 a ratchet movement feeds the smaller disk along one number, so that the hundreds of the result are read from the smaller disk and the tens and units from the larger one. If the motions are correctly made the result will evidently be mechanically exact.

By modifying simply the details of arrangement the revolving disks may be replaced by a series of bands running parallel to each other. In adding a number of columns of figures, if each band is spaced for 100, at each revolution it will feed along the next band to the left for the "carrying" figure. Then two columns can be added at a time, taking units and tens on the first, hundreds and thousands on the second and so on, and each will carry along the tally of revolution to the next band. These motions are actual additions of length, a graphical operation, upon the first disk or band of the simple forms of calculating machines described, but the necessary space for higher numbers is reduced by the device of making each subsequent element perform but one revolution to each 100 of its right-hand neighbor.

Keyboard Adding Machines.

A class of instruments closely related to those above referred to have an automatic arrangement by which keys representing numbers from 1 to 9 engage with ratchet wheels on the addition disks, each key having its appropriate stroke, so that the proper space can be made instantly by simply touching a key. If the instrument is arranged so as to permit revolution in the opposite direction it is possible to perform subtraction or a combination of addition and subtraction by motion in the proper degree and direction.

It is the consideration of numbers as distances rather than as characters that has led to the design of many calculating machines and appliances which have brought profit to their inventors and brain rest to the users.

Graphic Multiplication.

The next process after addition is multiplication. As noted in the "fence" illustration, Part 2, multiplication is in principle only a process of addition several times repeated. Thus it will be seen that 3 could be multiplied by 4 by the adding machine of Fig. 21 by moving a space of 4 three times, but for large numbers this would require an excessive amount of time and labor. In machines fitted with keys for moving the numbered disks it will be seen that the operation would be much more rapid, as it would simply require the rapid movement of the multiplier key as many times as there were units in the multiplicand, to show the product upon the disk. This process and the reverse one of division by repeated subtractions is actually made use of in machines of the keyboard type. But as the direct purpose of these articles is to present methods of calculation by the use of lines rather than by mechanism we will next consider a graphic method of multiplication without the direct use of addition.

Multiplication by Triangles.

Suppose for a simple illustration that 3 is to be multiplied by 4 graphically. In Fig. 22 draw a line AB of indefinite length. Measure a distance AC equal to 1 by any convenient scale, as for instance let ¼ inch equal 1 or unity. Next draw a vertical line through the point C and take a point D so that the distance from A to D will be 3 units, which was one of the numbers to be multiplied, and which will be 3 times AC or three-fourths of an inch. Draw the line AD and prolong it. Then take the point E so that distance AE will be equal to the other factor 4; that is, AE will be 4 times AC or 1 inch. Then draw a line from E parallel to CD until it intersects AD prolonged. Then the distance from A to F will be the required product, in this case 12. The unit AC is taken of some definite length on a scale so that the answer AF can be conveniently read upon the scale.

It is not necessary that CD be drawn perpendicular to AB, for in Fig. 23 where CD is inclined the result is the same, provided that EF is drawn parallel to CD.

It is also evident that if the numbers had been 300 and 400 instead of 3 and 4 the result by the same construction would be 1200, so that by a suitable selection of scale, numbers of considerable magnitude may be multiplied in this way.

Division by Triangles.

Referring again to Fig. 23 it will be seen that the same process in a different order can be used for division. For the division of 12 by 3, first draw horizontal line AB, take AC equal to 1, erect perpendicular or inclined line at C, take the point D so

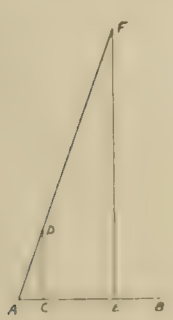


FIG 22

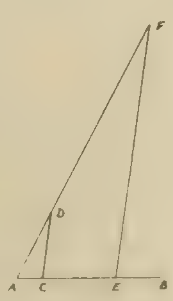


FIG 23

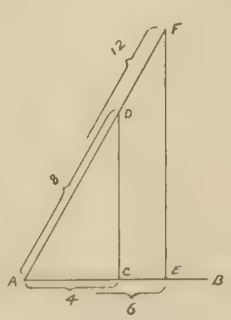


FIG 24

that AD equals the divisor 3 (or 3 times AC). Then draw AD prolonged and take point F so that AF equals the dividend 12. Then if from F a line is drawn parallel to CD it will intersect AB at a point E so that the length AE will be the quotient 4.

As a practical method for ordinary operations of multiplication and division it will be seen that the use of triangles is limited to problems in which there is not too wide a difference in the proportions of the factors. Otherwise the prolongation of the converging lines which meet at F are liable to extend over into the next county and render the accurate measurement of the result impossible.

Later on a method will be explained in which the troublesome extension of the line to represent large numbers is "boiled down" so as to be brought within convenient length, but a little further consideration of triangular methods at this point is important.

Combined Multiplication and Division

An interesting application of triangles is in a problem combining multiplication and division, which is extremely simple by this process but would be troublesome by the step by step method.

Suppose, as a simple illustration, that we wish to multiply 6 by 8 and divide the result by 4. If the reader should not happen to be familiar with any mathematical science except arithmetic please do not be startled by some of these diagrams, which may look like geometry. They are only the pictures of sums in arithmetic drawn to scale. Some knowledge of higher mathematics may be useful in designing a certain machine, but when the design is on paper as a working drawing it represents the result of the calculations in shop language. Mathematics is like a ladder and the exact point where it arrives at "highness" is difficult to locate.

In Fig. 24 AB is a horizontal line of indefinite length. Measure off a distance AC by any convenient scale so that it is equal to 4, the given divisor, and a distance AE equal to 6, one of the factors to be multiplied. Then draw parallel vertical or inclined lines from C and E, and set a point D on the line CD so that AD equals 8, the other number to be multiplied. By prolonging the line AD until it meets the line erected from E, the distance AF is 12, the answer.

The next paper will explain a graphic method for obtaining the area of an irregular figure, which is an important problem and in which a familiarity with the method of triangles just explained is necessary.

Westinghouse-Parsons Steam Turbine.

The Westinghouse Machine Co., of East Pittsburg, Pa., has just issued a Westinghouse-Parsons steam turbine catalog which calls for more than passing mention. It is believed to be the most comprehensive work on this subject ever issued, and it contains much interesting reading matter and many pertinent illustrations. It comprises 46 pages, 6 x 9 in. By way of introduction there is a terse comparison between steam turbines and piston engines, followed by a brief sketch of the development of the Parsons turbine, reference being made to the reaction turbine of Hero (120 B. C.) and the impact turbine of Branca (1629 A. D.), to show that the turbine is both the oldest and newest of steam engines. The Parsons turbine combines the reactionary and impact principles, its present type being called the parallel flow turbine.

After years of experimenting Mr. Parsons produced his first commercial turbine in 1884. It was 10 h. p. and ran at 18,000 revolutions per minute. With steam at 92 lb. pressure and running non-condensing, it used but 35 lb. of steam per h. p. h. Today over 500,000 h. p. in Parsons turbines are in operation abroad, including about 83,000 h. p. in marine service. In this country and Canada contracts have been made during the past two years for about 175,000 h. p. of Westinghouse-Parsons units, one-third of which are in daily use, while the rest are practically ready for shipment, or are nearing completion. They are in units ranging from 600 h. p. to 8,000 h. p.; each is capable of carrying 50 per cent overload. Many Parsons turbines have been running as long a time as ordinarily constitutes the life of steam machinery, and are reported to be still in perfect condition. The turbine has steam-proof frictionless glands and requires no internal lubrication.

The Westinghouse Machine Co. acquired the right to manufacture the Parsons turbine in the United States and Canada in 1895, and the Westinghouse-Parsons turbine was first put on the market in 1898. It embodies the original Parsons principles, "but has in addition an important individuality developed by long-continued experiments." One of the first installations made by the company was at the plant of the Westinghouse Air Brake Co., where three 400-kw. turbo-alternator units were put in operation in 1899. A fourth unit was added later, and direct steam operation was entirely displaced in 1900. Tests showed a saving of 40,000 lb. of coal a day at that time as the result of the use of turbines and the electrical distribution of power. In 1901 the largest steam turbine unit in commercial use in the United States was installed in the plant of the Hart-

ford Electric Light Co. The turbine is practically of 2,000 kw., or 2,700 h. p. capacity, though it was sold as of 1,500 kw. capacity. The plant is now being augmented by two turbine units of 1,000 kw. each to supplant reciprocating engines.

The catalog states that every facility has been provided for the manufacture of turbines on an enormous scale, including a testing department which occupies 15,000 sq. ft. of space on the main floor, in addition to the room occupied by accessories placed beneath the floor. Purchasers or their technical representatives are at liberty to witness tests at any convenient time.

The principles and the details of construction of the Westinghouse-Parsons turbine are clearly set forth in this catalog and the different parts and the manner of their assemblage are clearly illustrated by half-tone views. Space is devoted, too, to the commercial features of the turbine, and it is stated that the special field of application so far covered by the builders of the Westinghouse-Parsons turbine has been the direct generation of electric power for all purposes. The list of standard units for this purpose comprises capacities up to 10,000 kw. Other applications of the turbine will be made as rapidly as possible.

Recent additions to its manufacturing facilities place the company in a position to contract for any size of units with an assurance of being able to make prompt delivery. Turbines are shipped with all the main parts assembled and permanently adjusted and it requires but a comparatively few days to erect a turbine. It is stated that a 600-h. p. turbine can be erected and placed in service in from one to three days, if connections are ready beforehand.

To show the performance of these turbines tables are incorporated in the catalog prepared from tests made with turbines of 400 kw. and 1,000 kw. capacity, giving actual performances under various conditions. Table No. 1 gives the results of four tests of a 400-kw. turbine unit using steam superheated to about 100° F. Table No. 2 shows results with a turbine of the same size using steam superheated to about 50° F. Tables Nos. 3 and 4 show results with similar turbines using dry saturated steam at different temperatures. Each also shows results with varying loads. Tables Nos. 5 to 13 show the results of tests of like character made with 1,000-kw. machines.

Power Supply System of the Brooklyn Rapid Transit Company.

A very interesting paper upon this subject was presented before the Brooklyn Engineers' Club on the evening of May 12th by Mr. Charles B. Martin, first assistant electrical engineer of the Brooklyn Rapid Transit Co. The speaker used a large map of the city of Brooklyn showing all the lines, stations and sub-stations of the company, and frequent reference was made to this map.

There are two main arteries of travel in the city of Brooklyn—one leading to New York across the Brooklyn Bridge, and the other leading to the Broadway Ferries and Williamsburg Bridge in the Eastern District. The travel along the former route is very congested, the travel across the Brooklyn Bridge being heavier than across any other bridge in the world. Branching from these trunk lines the service is extended through areas of medium density to the outlying districts where the travel is light in winter and heavy in summer.

The problem then is to supply economically a system with two congested areas, a zone of medium density, and outlying districts of alternately light and heavy travel.

The power for the operation of this system is developed by both direct current and alternating current generators. All the alternating current, with the exception of the power procured from the Edison company, is developed at the central power station of the Brooklyn Rapid Transit Co., located on Third Ave. and Second St. There are, however, in this station two direct current, 2,700-kw. units.

The direct current stations and their capacities are as follows: Kent Avenue, 11,900 kw.; Central Station, 5,400 kw.; Southern Station, 4,800 kw.; Third Ave., 4,400 kw.; 39th St., 3,500 kw.; Brooklyn Bridge, 800 kw. Total, 30,800 kw.

The alternating current stations are: Central, 16,200 kw.; 65th St. (Edison), 2,850 kw. Total, 19,050 kw.

It will be seen therefore that the total power which the company will have available by July 1st is 50,000 kw.

The direct current stations need no description, the current simply passing from the generators through the feeders, to the trolley wires and passing back through the return circuit.

From the alternating stations the power passes through high tension feeders to the sub-stations, where it is converted into direct current and passes out through direct current feeders and returns to the sub-stations.

The overhead feeder system of the company consists of 700 miles of 500,000-c. m. and 13 miles of 1,000,000-c. m. weather-proof wire;

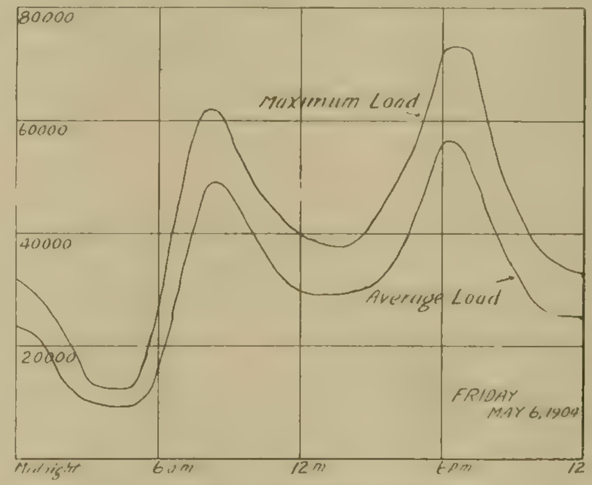
BROOKLYN RAPID TRANSIT SYSTEM

40 miles of 1,000,000-c.m. and 3½ miles of 2,000,000-c. m. lead covered, underground wire. It will be seen, therefore, that for the operation of this system about 900 miles of positive feeders are required. For the high tension circuits connecting from the central and Edison Stations to the various sub-stations, 65 miles of cables have been installed.

There have been completed and are now in operation five sub-stations. These have been carefully located at the strategic points of the system, and as near to the load centers as practical conditions will permit. These sub-stations and their capacities are as follows:

Halsey, 6,000 kw.; Bridge, 5,000 kw.; Tompkins, 3,500 kw.; Essex, 3,000 kw.; Coney Island, 3,000 kw.

There is in process of completion a sixth sub-station at Parkville, with a capacity of 2,000 kw. The location of these various sub-stations will be noted on the accompanying map.

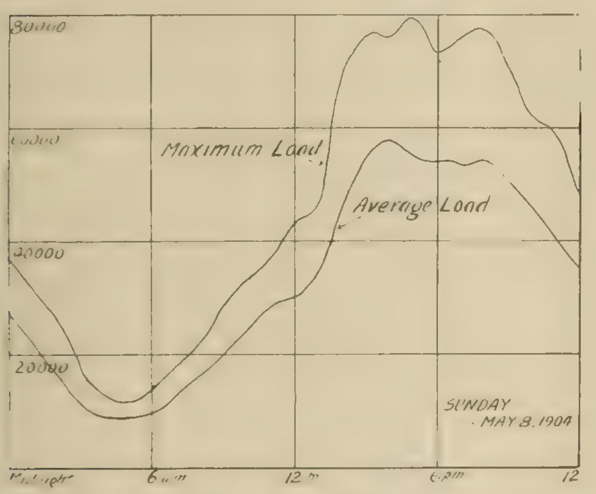


TOTAL LOAD WEEK DAY

Referring to the congested routes of travel, it will be seen that the Bridge, Tompkins and Essex sub-stations are located directly upon the heavy lines leading to the Brooklyn Bridge, and that the Halsey sub-station, by means of a very short feed, is able also to supply power to this route. Upon the routes leading to Broadway Ferry will be found the Kent Ave. Station, the Halsey sub-station and Essex sub-station, and the next station to be erected by the company will be at the junction of Broadway and Myrtle Ave.

In the outlying districts where the travel is light in winter and heavy in summer are the lines terminating at Coney Island, Bowery Bay, Bergen Beach and Jamaica. All these places are far removed from the company's direct current stations along the harbor waterfront. These loads are taken care of by sub-stations and by boosting. In the Coney Island section the summer load becomes so heavy that the construction of sub-stations becomes a necessity. The Coney Island sub-station is located so as to feed all the lines terminating at Coney Island and Parkville sub-station is located so as to feed into the intermediate district between the d. c. stations and this sub-station. The Jamaica load is carried by boosting from Essex sub-station in the usual manner and the Bowery Bay load by boosting with a 1,000 kw. rotary from Halsey sub-station. This is accomplished by connecting the static transformers in Y relation and connecting the negative lead to the station bus and the positive lead to the Bowery Bay feeder. The load towards Bowery Bay is increasing so rapidly that it will shortly be necessary to construct a sub-station in that section to be equipped and operated only in summer all transforming apparatus to be removed in winter. A total of thirteen sub-stations are contemplated and are to be erected as the city develops.

The great advantage of the alternating system to the company is due to the fact that during the winter the power can be utilized in the congested districts for the heating of the cars and in summer,



TOTAL LOAD SUNDAY

sent to the extremities, principally to Coney Island, Parkville and Essex sub-stations to provide for the sea-side and excursion business. During the winter some of the apparatus in these outlying stations will be moved into the congested districts and thus made to follow the load.

All the sub-stations are thoroughly fireproof and all the apparatus has been installed in a thoroughly workmanlike manner, with the result that the operation of the sub-stations has thus far proved very satisfactory.

The return circuit for the power has been carefully provided for and a capacity equal to twice that of the outgoing circuit has been arranged for. This return circuit consists of the tracks, the elevated structure and special ground wires. The tracks are bonded with two No. 0000 bonds in the outlying sections, but near the stations and sub-stations this is increased to six No. 0000 bonds. Wherever special work is encountered two 500,000-c. m. wires per rail are placed around it; thus avoiding the great expense in bonding all the short sections of the special work. A contract has recently been entered into for the installing of 5,000 electrically welded joints throughout the system. These are expected to materially aid the return circuit in addition to increasing the life of the tracks.

The elevated structures are fully utilized, the Brooklyn elevated structure having four longitudinal girders, is regarded as equal to 22½ million c. m. wires; whereas the Kings County structure having but three girders is equal to but 16 million c. m. wires. These [illegible] c. m. bonds in accordance with their nearness to a station or sub-station. Wherever possible sub-stations are located adjacent to these elevated structures, not only to reduce the length of feed but to take advantage of their capacity for returning the current.

The special ground wires are in the main buried in the earth, although some are run in ducts and others are strung aerially. Some of these circuits are of considerable magnitude, such as the one on Third Ave. between Flatbush Ave. and the Central and Third Ave. stations. This consists of twenty 500,000-c. m. cables as far as Union St., and 30 from Union St. to the stations. The return circuits to the other direct current stations are also very heavy and at the Kent Ave. station there is one ground wire of 5,000,000-c. m. capacity, connecting to Broadway, a distance of 2,200 ft. This wire is installed in ducts and is believed to be the largest ground wire in use in the country.

In closing the speaker presented two load diagrams showing the different characteristics of a week-day and a Sunday load. It will be noted that of a week-day there are two peaks of short duration, while on Sunday there is but one peak of much larger size. On the Sunday illustrated it is estimated that 100,000 passengers were carried to Coney Island.

An electric weld of a 9-in. girder rail was exhibited and specimens of the various high tension and low tension wires in use were shown.

At the close of the paper the speaker replied to numerous questions covering a wide range of topics in relation to the system.

Strike Averted at San Francisco.

The street car men of San Francisco employed by the United Railroads, which comprise nearly all the street railway lines in the city, recently made demands upon the company for a new agreement to go into effect May 1st, calling for increased and uniform wages and providing that none but union men shall be employed. The company submitted an agreement, granting an increase, but insisting on the "open shop" policy. The carmen's union took the matter up and called for a secret ballot to decide whether the men should accept the company's proposal or not. The result of the balloting was 2,031 against and 141 in favor of accepting the company's terms. The company gave it out that no further concessions would be made and a strike was confidently predicted.

The main point at issue was the demand of the union that all employes of the company should in 60 days after entering the service become members of the union. The threatened strike was averted by the acceptance by the carmen's union of terms which the company submitted through Mayor Schmitz. The terms of the new agreement include the recognition of the union, but the company will not compel employes to join the union, and the company agrees not to discriminate against any of its members. The company further agrees, in the event of the discharge of any member, to notify the president of the union, except when the dismissal is for a failure to register fares. The agreement was signed on the part of the company and the employes and is effective until May 1, 1905.

The employes have been discontented for a long time, claiming that although the company had heretofore agreed to recognize the union it never did so as completely as the union desired. It will be remembered that last year the services of an arbitration board were required to bring about a settlement of differences then existing. Mar. 16, 1903, the union made demands which annulled a contract which had been made Apr. 26, 1902, in settlement of a strike which had been declared April 19th preceding. At that time the company granted practically all the demands except the recognition of the union, the settlement providing for a flat rate of 25 cents an hour and 30 cents for overtime, a workday not to exceed 10 hours and all runs to be finished within 14 hours. Afterwards, at the request of the employes, the settlement was amended to make 11 hours constitute a workday and runs to be finished within 15 hours.

Of the demands of Mar. 16, 1903, it was agreed to refer those relating to hours and wages to an arbitration board composed of Mr. Patrick H. Calhoun for the company, Mr. W. D. Mahon for the union and Mr. Oscar S. Strauss, who was mutually agreed upon by the other two. In the findings of this board, the meetings being held in New York, Messrs. Mahon and Strauss concurred, while Mr. Calhoun dissented. By the testimony presented to the board it was shown that only four street railway companies out of 345

of which the figures were obtained were paying a higher rate than the San Francisco company, and these four are located in Montana, where the cost of living is high. The average rate paid by the ten companies ranged from 27.5 cents to 20 cents per hour. Of the other companies only four pay as high a rate as the San Francisco company.

In comparing the hours of service on the 345 roads it did not appear that the hours in San Francisco were longer or more arduous than the average. As for the cost of living, while it was claimed by the employes that living had increased 20 to 30 per cent since 1902, it was claimed by the company that there had not been a greater increase than 3 per cent. Mr. Calhoun, in giving his reasons for not concurring in the findings of the arbitration board, stated that the wages paid by the company were higher than were paid in large cities where the cost of living is more expensive, and that there was an abundance of labor in San Francisco seeking employment. He claimed that the statement that the cost of living had increased to 30 per cent was unreliable and that "the general conditions of the country do not now call for advances in wages, but on the contrary for the most prudent, careful and economical management of corporate properties."

The award of the arbitration board was in effect to grant the men who had been employed under two years prior to Apr. 1, 1903, an increase of 5 per cent above 25 cents an hour and those in the company's employ two years and over prior to Apr. 1, 1903, an increase of 10 per cent above 25 cents an hour, and for overtime in both cases a like percentage of increase should be granted. Employes who work by the day were to receive 5 and 10 per cent increases, also. The questions of hours and schedule were left the same, it being the opinion of the board that these matters could always be amended by mutual agreement.

When the employes presented their demand in March, 1903, one of the conditions was that 24 men who had been suspended for refusing to sign vouchers for students should be reinstated. The company, being willing to meet the men more than half way, reinstated the men. The request that the company should adopt the "closed shop" plan was respectfully declined, although the company agreed to receive the officers of the union and grievance committees at any time. It was made clear to the men, however, that the company must be permitted to run its own business, so far as hiring and discharging men were concerned.

After the arbitration board completed its labors, a new agreement was entered into last November, in which the company agreed, in case it should continue its system requiring that an employe instructing a student shall sign a card that the union should be given a duplicate of such card. The company also agreed to all times treat directly with the union through its duly accredited officers concerning all business or disagreements arising between them. It was also provided that the president or vice-president of the company should pass upon appeals at least once a month. The wage scale recommended by the arbitration board was adopted, and the general manager has recently stated that it cost the company a quarter of a million dollars to secure peace last year. The agreement was deemed to go into effect May 1, 1903, and to continue until May 1, 1904.

New Lines and Extensions Opened.

The Detroit, Monroe & Toledo Short Line Co. began through service to Detroit May 10th, transfers being made at Sibley's to the Detroit United Ry. cars, on acount of a crossing still to be constructed.

The Burlington County Traction Co. opened its new line to traffic between Moorestown and Mount Holly, N. J., April 30th.

The first interurban car of the Louisville Railway Co. to make the trip over the extension to Jeffersontown, Ky., was sent over the line April 29th.

The Detroit, Flint & Saginaw Ry. instituted regular service on the completed section of its line, between Saginaw and Bridgeport, Mich., Sunday, May 1st.

The Sterling, Dixon & Eastern Electric Ry. opened the city system in Sterling, Ill., to regular traffic May 5th.

The West Chester Street Railway Co's. extension to Coatesville, Pa., is completed and cars began to make regular trips over the line May 7th.

Mineral Lubricating Oils.

On May 16th Mr. J. N. Bruck, president and manager of the Bruck Solidified Oil Co., Boston, Mass., delivered a lecture on this subject before the four engineering associations of Boston.

The speaker briefly reviewed the history of petroleum discoveries and the growth of the oil-producing and refining industries and then took up the petroleum products suitable for lubrication. The great rival of the Pennsylvania, Ohio and Virginia oil today is the Texas and Louisiana oil, which is superior in cold, gravity and viscosity tests and is used to improve the quality of the eastern oils, refiners buying the Texas oil to blend with the eastern products.

Crude oil is converted into commercial products by the process of distillation, being boiled in huge stills and the vapor condensed in pipes surrounded by cold water. The first distillate to come over from the still is crude naphtha or light benzine. When the gravity of the distillate reaches 68 Beaume it is cut off from the light benzine tank and turned into another receiving tank, the product being known as heavy benzine. The next "cut" is a light kerosene oil which will stand a fire test of about 110; this is mostly sold for exportation to Europe. The next "cut" is water-white kerosene which has a fire test of 150 and a gravity of 47. When the distillate becomes heavier than 32 or 33 gravity, it is known as "paraffine sops," or wax distillate. What remains in the still is received as lubricating stock to be filtered and combined with lubricating oils. The lighter distillates mentioned, crude naphtha and benzine, are treated by mixing with sulphuric acid, introduced by means of compressed air, and after treating to clean the product of coloring matter and impurities, caustic soda is added to neutralize the acid and then the product is washed.

The gravity figures mentioned refer to the Beaume scale and indicate how much lighter than water the fluid is.

Pennsylvania crude petroleum refines about as follows: Crude benzine, 10 per cent; water-white kerosene, 58 per cent; paraffine wax, 15 per cent; lubricating stock, 17 per cent.

The lubricating stock is filtered through animal charcoal and is manufactured into cylinder and engine oil, vaseline, etc.

Mr. Bruck next called attention to the sample of crude oil which he secured in Louisiana last fall, and which on analysis proved to contain a new base which was neither asphaltum nor paraffine. After analysis by Prof. F. C. Thiele, of Beaumont, Tex., the new base was named terpena. This oil is chiefly derived from the action of subterranean gases on the deposits of marine flora and some of the heavier ingredients are recognized as originating in deposits of marine fauna. The analysis of this oil shows no sulphur and asphaltum and the test for paraffine proved negative.

This oil with the terpena base is the one which Mr. Bruck solidifies. When solidified, the oil can be used as a lubricant for bearings of any size from 1 in. to 18 in. in diameter, the solidified oil not being affected at temperatures as high as 175° and as low as —40° F. The lubricant is recommended as a sure and reliable one for electric car motors, automobiles, locomotive marine propeller shafts and engines of every description.

Mr. Bruck states that although solidified oil has been in the market for only 16 months it is in use on 200,000 car motors in the United States, England and France and in the largest electric power plants in this country.

Christensen Air Brakes in Peru.

The first electric railway to be operated in Peru, South America, is the line between Lima and Chorrillos, which was opened to traffic last February. All the cars used on this road were manufactured in the United States and they are equipped with the Christensen straight air brakes. The National Electric Co., manufacturer of these air brakes, has just issued a 24-page publication which designates where more than 11,500 of the Christensen equipments are in use throughout the world. Among the recent foreign orders received by the company are those from the Sao Paulo Tramways, Brazil; Manx Electric Ry., Isle of Man; Cape Town Tramways, Cape Town, Africa, and the British Columbia Electric Ry., Vancouver, B. C.

The Detroit, Ypsilanti, Ann Arbor & Jackson Ry. has equipped one of its cars with ball-bearing trucks as an experiment.

Exhibits at the World's Fair.

ELECTRIC STORAGE BATTERY CO., Philadelphia. This company has what is probably the most extensive and comprehensive exhibit that has ever been made of storage batteries and auxiliaries. It is located in Block 20, Electricity Building. A conspicuous feature is a map about thirty feet in height by forty-five feet in length, which, by an ingenious arrangement, shows the distribution of chloride accumulator installations throughout the United States. Illuminated glass jewels designate the locations and characters of the installations, whether for railway, central station, isolated lighting and power service, yacht plants, telephone installations, etc. There is set up in a model battery house a complete operating installation of chloride accumulators for railway service. Specimens of chloride accumulators ranging in size from a 61-H type of cell to the smallest laboratory cells, are also shown, together with a complete exhibit of the "Exide" battery used for electric automobile work. In another section of the exhibit there are five types of switchboards, together with end cell switches, storage battery recording instruments, etc.

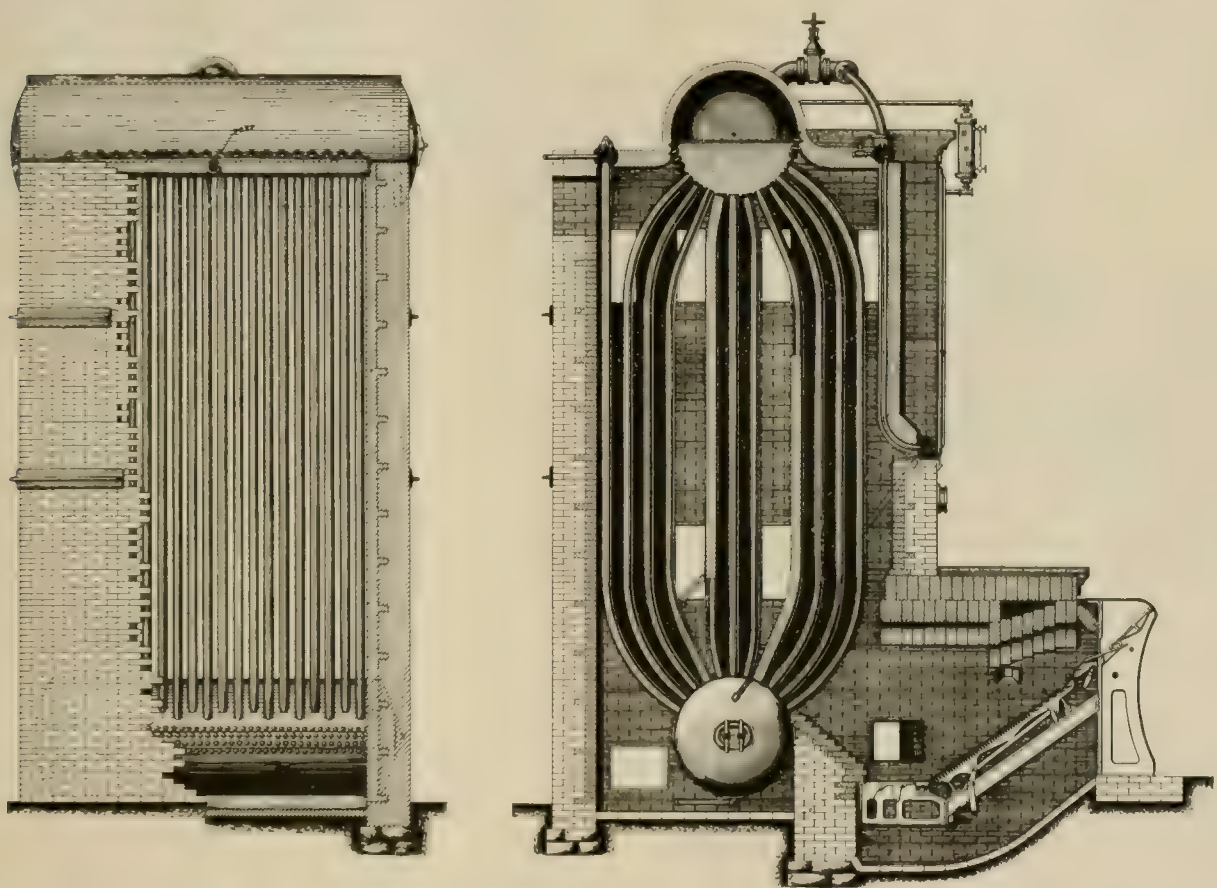
MICA INSULATOR CO., 218 Water St., New York. This concern has incorporated the exhibit of its well-known specialty, "Micanite," with that of the state of North Carolina, in the Mines and Metallurgy Building. The exhibit is an interesting object lesson showing to what utility and extent mica can be put in the ever-expanding field of electrical insulation. Micanite in all kinds of [illegible] shown, flat sheet of various thicknesses, generator and motor commutator segments, and rings, of many of the standard types. Micanite tubes from ⅛ in. in diameter to the immense tubes entering into the construction of induction coils for X-ray purposes, each article exemplifying that electrical insulations, to meet up-to-date requirements, must be of a permanent and indestructible nature. It will well repay electrical engineers to take [illegible]

[illegible] Lima to Chorrillos, Peru, opened Feb 17th

The Milne Water-Tube Boiler and Superheater.

The acompanying illustrations show longitudinal and cross sections of the Milne water-tube boiler and superheater, which is manufactured by the Milne Boiler Co., of New York. This apparatus consists of a combination of four parts: Upper and lower drums, connected by sections and 4-in. seamless drawn steel tubes and an independent feed-water section composed of a single staggered row of tubes. The tubes are all curved to a 5-ft. radius and there are but five different bends in a complete set of tubes, the front and back rows being interchangeable. The tube spacing is such that any of them can be removed or replaced without disturbing the brick work or adjacent tubes.

The feed-water section, which, as stated, consists of a single staggered row of 4-in. tubes, extending across the back of the boiler. The tubes in this section are expanded into an independent header which receives the feed water. The feed water section takes up considerable heat which would otherwise be wasted, as it presents a cool surface to the gases escaping from the boiler furnace.



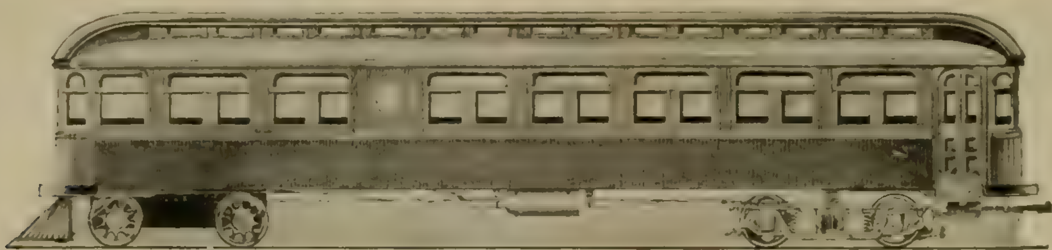
ELEVATION AND SECTION OF MILNE WATER-TUBE BOILER.

Particular attention is directed to the furnace design and the arrangement of the heating surface. The fire brick arch covering the furnace is designed to maintain the high temperature required to ignite and burn fuel gases, and as the heating surface is placed at the back of the furnace and bridge wall the highest furnace temperature is maintained until combustion is complete. The vertical position of the tubes prevents the collection of dust and ashes, and as the gases of combustion have to travel about 70 ft. over the heating surface and finally over the feed-water section before escaping, high fuel economies are secured. One manhole gives access to every tube in the boiler and any of the mechanical rotary cleaners now extensively used will clean the tubes in a most direct manner. The Milne superheater is of a most simple form, consisting of upper and lower steel headers, into which the ends of the superheating tubes are expanded. The superheater is located in front of the boiler, where it is directly accessible for any purpose, and if necessary, can be removed entirely while the boiler is under pressure. The company construct these boilers and superheaters

in di[illegible] up to 1,000 h. p. and for any steam pressure desired. The design permits of ample grate area for capacities considerably in excess of the grading. The points of superiority claimed for the design are: Simplicity, high efficiency, low cost for maintenance, large water capacity, ample steam liberating surface, good circulation and ease in regulating the degree of superheat. The office of the company is at 95 Liberty St., New York.

Gasoline Car for Interurban Roads.

The Prouty Pierce Locomotive Manufacturing Co. is building combination cars for interurban service which are operated by gasoline motors. One of these cars is shown in the accompanying illustration. The lowest grade of gasoline is used for fuel, and this is carried on the truck in a tank having walls over ½ in. thick. It needs refilling but twice a day. The gasoline is not fed by gravity, but moves only by mechanical action when the engine is running. The engine is four cycle improved vertical type and in the standard sizes but one cylinder is used. The valves are large in diameter and have but slight lift. The exhaust valve is opened by a cam and the intake valve by a vacuum. The gasoline is mechanically measured and injected with force into the air current as it is being drawn into the cylinder by the down stroke of the piston. Between the charges the gasoline discharge nipple is firmly locked and the gasoline is not moved by the motion and jarring of the car. The discharge is controlled by an automatic governor having a lever which is within easy each of the motorman. The motion of this lever increases or decreases the speed of the engine.



PROUTY-PIERCE GASOLINE INTERURBAN CAR

The feeding and regulation of the gasoline is entirely mechanical and changes in temperature have no perceptible effect on the operation of the engine. The gas is ignited by an electrical spark, the engine is water jacketed and the cooling water is circulated by a centrifugal pump. The engine operates continuously in one direction and power is transmitted to the driving axle by means of a Prouty impinging reversible clutch. By means of this device the car is run in either direction while the engine runs continuously one way. The friction faces are locked by impinging wedge wheels on an eccentric shaft, one set of which only can act at a time. These wheels are operated by a lever and the quickest motion of the lever by the driver will not damage any of the parts of the cars. The friction faces are lubricated with oil and lubricating graphite and are parallel surfaces which are just as lasting as an ordinary large journal. All the wearing parts are made of the best crucible steel. In addition to the clutch just mentioned there is an auxiliary reduction gear which can be used for starting heavy loads or on grades, curves, etc.

In the construction of the truck one axle rocks at the center so that the weight of the car rests on three points only. By this means the wheels follow the rails with uniform adhesion. One end of the car body is mounted on a truck swiveled on the bolster in the usual manner. The other end of the body has a section of the floor removed to accommodate the elevated part of the engine within the car body. A partition separates this open section from the passenger compartment and the driver occupies the front of the car at the open section. The car shown herewith contains cross seats with a capacity for 42 passengers.

April 20th service on the Auburn & Syracuse (N. Y.) Electric Railroad Co's. system was badly deranged on account of snow. In some places the drifts were four feet deep.

Judgments Against New York City Ry.

By a decision of Judge William J. Lynch in the third district municipal court, New York City, April 29th, judgments were entered against the New York City Railway Co. to the amount of $1,500 and costs. In all there were eight cases tried, involving 30 refusals to give transfers. In one instance a woman's fare had been paid by her escort and counsel for the company argued that because she did not pay her own fare she could not be aggrieved under the provisions of the railroad law and had no claim to the penalty of $50. The judge decided that although the escort had paid two fares he was not entitled to two transfers, while the woman, as a passenger, was entitled to a transfer whoever paid her fare.

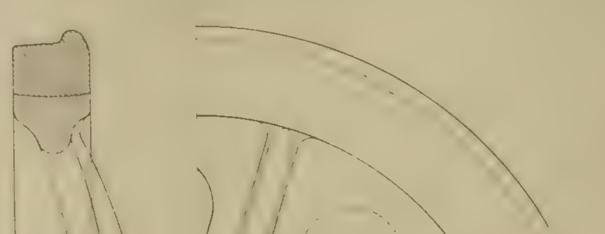
Press for Making Steel Frames.

The Federal Manufacturing Co., of Cleveland, O., recently constructed a large press especially for the manufacture of steel frames such as are required in building automobiles, although the work which may be performed by the press is by no means confined to automobile manufacture. Work up to 17 ft. in length and 24 in. in width can be formed in this press, which exerts a pressure of 1,200 tons. The press is 15 ft. high and 18 ft. long, and its weight is 50,000 lb. It is provided with a lever, so that the stroke, either up or down, may be stopped instantaneously. A vertical adjustment of 18 in. is provided.

Fused Steel Tired Wheels.

The accompanying illustration shows in elevation and section a fused steel tired wheel made by the Taylor Iron & Steel Co. and used by the New York City Railway Co (the Metropolitan system).

The advantages claimed for the steel tire besides an increased mileage fully proportionate to the increased cost over chilled wheels



FUSED STEEL TIRED WHEEL.

are: Less rail wear, less truck repairs, greater safety and consequently a reduction in accident and damage expenses, better control of cars due to absence of slipping on the rails and better holding of brake shoes, absence of flat wheels with corresponding saving in wear and tear on the car equipment.

Semi-Convertible Cars for Spokane Traction Co.

The Spokane Traction Co., of Spokane, Wash., which was incorporated last year and is the successor to the Spokane & Montrose Motor R. R., has lately added to its equipment a number of semi-convertible cars of the Brill patented type now in use. Numerous extensions are proposed, and a power house is being built by the American Car Co., of St. Louis. The cars are vestibuled at both ends and have folding gates as well as folding doors at the entrances. The seats are of the walk-over type, 36 in. long and

CAR FOR SPOKANE—AMERICAN CAR CO.

provide seats for thirty-six passengers. The interior is finished in ash with decorated birch ceilings.

The principal dimensions are: Length over the end panels, 25 ft. 4 in.; over crown pieces, 34 ft. 9 in.; width over sills, 7 ft. 8½ in.; over posts at belt, 8 ft.; sweep of posts, 1¾ in.; from center to center posts, 2 ft. 8 in.; thickness of side posts, 3¼ in.; corner posts, 3¾ in. The side sills are 4 x 6⅞ in. with 12 x ⅜ in. plates on the inside to which the bases of the posts are attached; the end sills are 5¼ x 6⅞ in. The cars are mounted on Brill "Eureka" maximum traction trucks with wheel base of 4 ft.; diameter of driving wheels, 33 in., and of pony wheels, 20 in. The trucks have solid forged side frames and are equipped with 38-h.p. motors. This truck carries the car body low, so that the platform step is but 15¼ in. from the rail, and from step to platform 13 in.

Motor Driven Car Hoist.

The accompanying engraving illustrates a motor driven positive geared car hoist now being manufactured by the Pittsburg Machine Tool Co., of Allegheny, Pa. The construction is fully apparent from the engraving. The columns are located in a pit below the level of the tracks and the car is run in over the I-beams

MOTOR DRIVEN CAR HOIST.

of the regular track. [illegible] the I-beam under the [illegible] of the car and power is applied to the [illegible] shaft at the base of the machine and the car is evenly raised. This lower [illegible] the right size to accommodate [illegible]

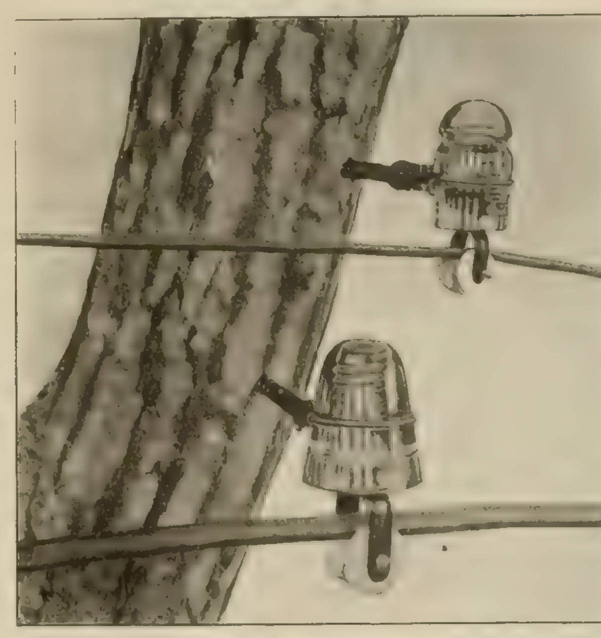
R. D. Nuttall Co. in Chicago.

The R. D. Nuttall Co., of Pittsburg, Pa., has appointed J. M. Gallagher its Chicago representative, the appointment becoming effective June 1st next. During the past two years Mr. Gallagher has been the Chicago representative of the Mayer & Englund Co., of Philadelphia, with offices in the Merchants Loan & Trust Building, and he will continue to act in that capacity. His territory for the Nuttall company will be practically the same as for the Mayer & Englund Co., embracing Michigan, Minnesota, Wisconsin, Iowa, Illinois and northern Indiana. In addition to the well-known lines of the Mayer & Englund Co., which include "Protected" rail bonds, insulation material, brackets, etc., Mr. Gallagher will handle all of the Nuttall company's products, including gears, pinions, Union standard trolley bases, poles, harps, wheels and other parts.

The Brodie Tree Insulator.

The Brodie tree insulator provides a means for effectually insulating high-tension transmission lines against short circuits and grounds caused by the wires coming in contact with trees—a frequent cause of annoyance in high-tension work. This specialty is handled by the Brodie Electric Co., of Manchester, N. H., and is made in various forms, with single or double petticoat insulation, and with either drive lag-screw or cleat support.

This type of insulator in the form here illustrated was used on



BRODIE TREE INSULATOR.

all the transmission lines of the Manchester (N. H.) Traction, Light & Power Co., whose property is described elsewhere in this issue, and it is stated that the lines thus protected have never been out of service through tree-grounds.

The Brodie Electric Co. also makes a specialty of a porcelain single pole primary switch and cut out, intended especially for use with transformers.

The Evansville & Eastern Electric Ry. was recently incorporated with a capital of $10,000 to build a line from Evansville through Newburg to Rockport, Ind., passing through Vanderburg, Warrick and Spencer counties. The line will be 32 miles long. It is being surveyed by James D. and M. Saunders and franchises are being prepared. The company will do its own construction work and expects to build a first-class interurban line. Work will begin within 90 days. The incorporators are John C. Haines, president; J. W. Fuquay, vice-president; Lewis E. Fricke, secretary; M. S. Sonntag, treasurer; William I. Rudd, Fred W. Retz and William L. Sonntag. The last named is the general manager and is well known in connection with electric railway work, having just completed and put in operation the Evansville & Princeton Traction Co.'s system.

The Macdonald Forge.

Herewith is illustrated the Macdonald forge, which is principally utilized for heating rivets, but which may be used to excellent advantage on outside steel construction work upon which pneumatic tools are used and compressed air is therefore available. Instead of the blast for blowing the fire being produced by a manually operated wheel or lever employed to rotate the blower, the blower is revolved by a small jet of compressed air striking against the blades of the fan and any speed of blower fan can be immediately

MACDONALD FORGE

secured by adjusting the needle valve to give the desired degree of blast.

In practice the ordinary coal fire is used and the amount of compressed air required to operate the forge is from 5 to 7 cu. ft. of free air per minute. This forge is the invention of John and Thomas Macdonald, of Glasgow, and has found much favor in Great Britain and on the continent, where it is in general use in shipyards, bridge shops, boiler shops, and general engineering plants.

The Ingersoll-Sergeant Drill Co., 26 Cortlandt St., New York City, has obtained the sole right to manufacture and sell the Macdonald forge in this country and Canada.

Test of Break Strain Insulators.

The W. R. Garton Co., of Chicago, recently sent several of its wooden break strain insulators to one of the large railroad companies, which made thorough tests to determine the tensile strength of the insulators and afterward submitted to the Garton Company the following interesting report of the result:

"Referring to the wood break strain insulators furnished us recently, we have today put the same to a test and think the result will be of interest to you. The test was made by bringing a strain on the insulator with our wheel press, first with a 5-16-in. strand span wire run through each eye of the insulator. Under a pressure of five tons the wire broke. We then ran two pieces of 5-16-in. strand wire through each eye of the insulator and the insulator parted after a strain of ten tons. The break occurred in one of the castings of the insulator. We are mailing you under separate cover the wood break strain in question and by examining same you will note that there was a flaw in the casting that parted. Had the casting been perfect the breaking strain would no doubt have been increased."

In commenting upon this report the Garton company points out that it will readily be conceded by engineers that a strain insulator made to withstand 3,000 to 4,000 lb., and which will withstand 20,000 lb., even though there is a flaw in it, is made on a very conservative basis, and the company submits this as an illustration of the class of material which it furnishes to its customers, its motto being, "Not how cheap, but how good," and this is the reason the company is enabled to hold its constantly increasing business which has reached large proportions.

The Garton company is distributing to the trade, upon request from responsible customers, its catalogs Nos. 11 and 12, issued in sections, which illustrate poles, brackets and construction material, as well as all types of trolley line hangers and pull-offs. The company desires in every case where a request is made for these catalogs that the company or individual making the request furnish the name of the railroad company, together with the number of cars operated and the names of the officials. The company is anxious to secure the data thus furnished for reference purposes and it feels that the exchange is a fair one, as the catalogs are the result of months of tireless effort and are exceptionally valuable and attractive. The Garton company claims for its devices that they have mechanical features never before employed which are strikingly impressive, and the insulation used in its overhead material is made in the Garton factory and proven by tests to be all that is claimed for it.

Medal Awarded to John A. Brill.

The Franklin Institute of the State of Pennsylvania, acting through its Committee of Science and Arts investigating the merits of the Brill convertible and semi-convertible cars, has awarded the John Scott Legacy Premium and Medal to Mr. John A. Brill, vice-president of the J. G. Brill Co. The report of the committee discussed the reasons for the introduction of the convertible and semi-convertible cars and the advantages which they offer in increased comfort of passengers and decreased cost for the railway companies operating them. The concluding paragraph of the committee's report is as follows: "The ingenious and practical devices which have been developed and applied by the J. G. Brill Co. for the production of these improved cars merit the unqualified approval and commendation of the Franklin Institute."

Carborundum Safety Treads.

The use of safety treads on the steps of electric railway cars has become an acknowledged necessity, as an effective non-slipping tread tends to decrease the number of accidents caused by passengers slipping or missing their footing when getting on and off

THREE-PIECE TREAD FOR STRAIGHT STEP.

cars. The Empire Safety Tread Co., of No. 331 and 332 Adams St., Brooklyn, N. Y., has placed on the market a new form of safety tread in which the non-slipping material is carborundum, which, as it is well-known, presents a hard gritty surface, that will withstand an enormous amount of rubbing and wear without becoming smooth or slippery. The tread has for its foundation a

THREE-PIECE TREAD FOR CURVED STEP

rolled steel plate, with a series of grooves, alternately dovetailed, every dovetailed groove being filled with carborundum.

For car steps, the tread is supplied in pieces (three to each tread) 5½ in. x 24 in., and 5½ in. x 28 in., the usual sizes required, each piece being slightly beveled on one end, so that the pieces can be laid either in a straight strip or in a slightly curved strip, to conform with the contour of the edge of the step. The tread can also be supplied in long strips, various widths, for running-boards, stair-cases, or anywhere that a non-slipping safety tread may be desirable.

The Western Ohio Railway Co. and the Dayton & Troy Electric Railway Co. have effected a traffic agreement whereby through limited cars are run between Lima and Dayton, O., 83 miles.

Ferrosteel Flanged Fittings.

The Crane Co., of Chicago, has issued a circular letter on the subject of "Ferrosteel Flanged Fittings," from which we quote as follows:

"The practice of superheating high pressure steam is becoming quite general, the increase in temperature varying from 75 degrees to 300 degrees. With the higher temperature have come increased expansion strains, and to provide against them is the greatest problem engineers have to contend with. Not only is it essential to have the piping system designed with great care, but the quality of the material employed must be very high.

"To meet these conditions we have for some time been furnishing extra heavy flanged fittings made of Crane 'Ferrosteel' instead of cast iron. This metal has an average tensile strength of 32,500 lb. per sq. in. The weakest test bar in 31 heats was 30,135 lb. per sq. in. The majority of the bars were within 5 per cent of the average, showing a remarkable uniformity. Ferrosteel is about 50 per cent stronger than the cast iron used in our flanged fitting foundry, which we believe is equal to any iron used for the purpose, and is more than 50 per cent stronger than the ordinary run of cast iron, which rarely exceeds 19,000 lb. tensile strength and quite frequently runs 14,000 to 16,000 lb.

"A property of this metal which makes it very desirable in heavy fittings is that of maintaining the close character of the grain in large sections better than cast iron. The result of this is, that while a ferrosteel test bar 1 in. square is 50 per cent stronger than a cast iron test bar of the same size, a heavy ferrosteel fitting will probably be 60 per cent stronger than a cast iron fitting made from the same pattern.

"The extra heavy ferrosteel fittings for working pressures of 250 lb. are made from the same patterns as the cast iron, so that the full benefit of the difference in strength is obtained.

"Ferrosteel fittings 12 in. and smaller are tested under 1,500 lb. hydraulic pressure per sq. in., and 14 in. and larger under 1,000 lb. hydraulic pressure per sq. in."

Advertising Literature.

THE ELECTRIC STORAGE BATTERY CO., of Philadelphia, has issued Bulletin No. 82 on "The Installation of 'Chloride Accumulators' in Small Central Stations."

THE CROCKER-WHEELER CO., Ampere, N. J., has issued Bulletin No. 44, it being a description of the "Conneaut & Erie Interurban System," reprinted from an article published in a technical paper.

THE SPRAGUE ELECTRIC CO., of New York City, has issued Bulletin No. 216, "M. C. Type Motors, Direct Current." Also an index to catalogs and bulletins published by the company. Also Catalog No. 308, "Electric Fans, 1904."

THE OHIO BRASS CO., of Mansfield, O., has issued a pamphlet on "The Development of an Insulation," being "a few side lights on the history of Dirigo," which the company manufactures. The pamphlet is illustrated and contains 12 pages, 3½ x 6 in.

THE GREEN ENGINEERING CO., of Chicago, is sending out the following notice: "Do not fail to see 3,200-h. p. Green traveling link grates exhibited in Steam, Gas and Fuel Building, Louisiana Purchase Exposition, St. Louis, Mo."

THE O. M. EDWARDS CO., of Syracuse, N. Y., has just issued a shade roller catalog, 18 pages, 6 x 9 in., treating of tin barrel shade rollers, sash balances, awning rollers, worm gear brackets and other [illegible]. This company's [illegible] are used upon a number of the [illegible]rgest railway systems in the country.

THE BUDA FOUNDRY & MANUFACTURING CO., of Chicago, has issued its May Bulletin, treating of a line of ratchet and friction jacks which the company has recently added to its other manufactures. The jacks and repair parts are clearly illustrated and all necessary information is appended, including price lists.

THE LUMEN BEARING CO., of Buffalo, N. Y., maker of electric bronze bearings, issues an exceptionally attractive monthly calendar suitable for home or office. Each month a colored repro[illegible]n of a painting by a celebrated artist adorns the calendar, the [illegible]ect chosen for the May calendar being entitled "Music Hath [illegible]

THE MAYER & ENGLUND CO., of Philadelphia, in the Keystone Traveller for March displayed International fare registers, International punches, Garton lightning arresters, Union standard trolleys, Knutson trolley retrievers, Nuttall gears and pinions, Heeren badges, pole brackets, ears and, last but not least, the "Protected" rail bonds for which this company is widely known.

THE PROUTY-PIERCE LOCOMOTIVE MANUFACTURING CO., of Kansas City, Kan., is distributing a circular, 18 x 24 in., illustrating its gasoline passenger locomotive, gasoline locomotive for general service, gasoline combination suburban car and gasoline yard and switching locomotive. The views are large halftones printed on embossed paper and give an excellent idea of the general appearance of the carriages.

THE J. G. BRILL CO., of Philadelphia, has issued a catalog describing the "Eureka" maximum traction truck (patented), a single motor truck for low and narrow city cars. The catalog contains 32 pages and is illustrated. The "Eureka" truck has been adopted in Boston, Baltimore, London, Liverpool, Paris, Sydney, Tokio and elsewhere, including New York City, where the New York City Ry. uses 4,000 of the trucks and the Brooklyn Heights R. R. has adopted them as standard.

THE J. F. TENNEY CO., 152-8 Lake St., Chicago, issues Catalogs Nos. 10, 69 and 70, which are of special interest to street railway purchasing agents, and which describe and illustrate a complete line of ticket punches, conductors' badges, baggage checks, stencils, canceling machines, dating and numbering and other stamps, and in fact everything of that nature that is needed in the office or shop. The company is an old and reliable one and it would pay anyone interested to send for these catalogs.

THE UNDER-FEED STOKER CO. OF AMERICA, Marquette Building, Chicago, in the Publicity Magazine for April, illustrates several large plants which have been equipped with the Jones under-feed system of mechanical stoking. This publication, which is just one year old, is replete with interesting reading matter, including a diversity of subjects, although, of course, the Jones stoker is predominant. It is carefully edited and excellently printed. It should be in the hands of every owner or manager who is likely to be interested in the question of economical stoking.

THE FOREST CITY PAINT & VARNISH CO., of Cleveland, O., has issued a 68-page catalog, 5½ x 7½ in., treating of its paints, colors, enamels, lacquers, leads, oils, stains, varnishes and numerous other products for which it is so widely and well known. The catalog is carefully indexed and illustrated. It contains many items of especial interest to the street railway field and all persons interested should send for this catalog without delay. The Forest City Paint & Varnish Co. gives a most satisfactory guarantee with its products that cannot fail to appeal to the prospective buyer.

THE JOSEPH DIXON CRUCIBLE CO., of Jersey City, N. J., has issued a folder treating of the proper care of driving chains by the use of Dixon's graphite motor chain compound; also, a 12-page booklet treating of Dixon's pipe joint compound, a valuable graphite product useful to pipe fitters, engineers, machinists, etc.; also a folder containing remarks upon the proper care of elevating and transmission ropes, with special reference to Dixon's handy graphite rope dressing. Dixon's Graphite for May contains an interesting paper by W. H. Wakeman on "Repairing and Adjusting Machinery."

THE GENERAL ELECTRIC CO. has issued the following publications: Bulletin No. 4,340, "Meridian Lamps with Prismo Glass Shades." Bulletin No. 4,369 (supersedes No. 4,262), "Direct Current Motor Controllers for Power and Mining Machinery." Bulletin No. 4,370, "Three-Phase Air Blast Transformers." Bulletin No. 4,371 (supersedes No. 4,231), "Electrostatic Ground Detectors." Bulletin No. 4,372, "Blue Printing with Enclosed Arc Lamps." Publication No. 9,130, "Notes on Series Street Incandescent Lighting." (This is a reprint of a paper read by Mr. Welles E. Holmes before the New England Association of Electric Lighting Engineers, Mar. 18, 1903.) Price List No. 5,121 (supersedes No. 5,063). "General Electric Porcelain Specialties." Errata to accompany Bulletin No. 4,367. Page 12, first table, Catalog No. 32,221, should read Catalog No. 33,221.

THE INGERSOLL-SERGEANT DRILL CO., main office 26 Cortlandt St., New York City, has issued Catalog No. 81 treating of "Flowing Oil Wells with Compressed Air." The catalog contains 48 pages, 6 x 9 in., and is freely illustrated. It tells why compressed air is to be preferred to steam and describes the Moran

[illegible] system besides giving suggestions as to the best manner of installing and operating the system. The catalog also contains an interesting sketch of the Ingersoll-Sergeant Drill Co's. plant, and considerable space is devoted to the air compressors which are made by the company and have a most favorable and world-wide reputation. The illustrations showing the compressors and other Ingersoll-Sergeant machinery are excellent. As an appendix there is a detachable question sheet for the flowing device, the sheet to be filled out by those interested and mailed to the Ingersoll-Sergeant Drill Co's. Cleveland office.

THE NEW YORK CENTRAL & HUDSON RIVER R. R. issued in 1901, in anticipation of a conflict between Russia and Japan, and in anticipation of the opening of China and Korea to the commerce of the world, a map of Asia and the Chinese empire, which turns out to be the only accurate map of the seat of the present war in existence, and it is in great demand. The map was incorporated in No. 28 of the "Four Track Series" of books of travel which are published by the railroad company, and more than 100,000 copies of it have gone to all parts of the world. Recently there has been a renewed demand for this map, especially from army officers in the Far East, and the company announces that it will send a copy of No. 28 containing the map to any address, postpaid, upon the receipt of 5 cents. This offer has just been made in a pamphlet entitled, "The Open Door to Japan, Korea and Manchuria Admits the New York Central R. R." Address the general passenger agent, George H. Daniels, Grand Central Station, New York City.

ROEMHELD & GALLERY, contracting engineers, 719 Chamber of Commerce Building, Chicago, licensees for the Strauss trunnion bascule bridge, have issued a pamphlet, with appendix, descriptive of the Strauss bridge and illustrated by drawings. It is claimed for the Strauss bridge that it is simpler and more economical than other bascule bridges, owing chiefly to there being no expensive or unusual pieces, such as the rollers, tracks, plates, screws, etc., common to other types. It is a trunnion bridge of the type built in Rotterdam in 1878, in London in 1894, and latterly in Chicago and Milwaukee. It differs from these principally in the shortening of the tail end and the pivotal attachment of the counterweight thereto, so that no portion of the moving structure reaches the water line. The counterweight is carried in a structural steel box either above or below the roadway, the box being swung between the trusses on tail end pins or trunnions, and is guided by a pair of links, so that as the bridge opens the counterweight box moves down vertically and thus also clears the water line.

Trade Notes.

THE ENGINEERING MAGAZINE, on May 1st, removed its offices to 140-142 Nassau St., New York City.

THE PITTSBURG COAL CO., Pittsburg, has ordered its thirty-eighth "White Star" oil filter from the Pittsburgh Gage & Supply Co., Pittsburg, Pa.

CHARLES HENRY DAVIS AND PARTNERS, engineers and architects, 25 Broad St., New York City, announce the dissolution of the firm on May 1st.

JULIAN L. YALE & CO. announce the removal of their offices May 1st from the Monadnock Block to Suite 619 Railway Exchange Building, Chicago, Ill.

THE GREEN FUEL ECONOMIZER CO., the sole maker in the United States of the well-known Green economizer, has received a repeat order from the Malden (Mass.) Electric Co.

THE TAYLOR IRON & STEEL CO. wheel department, of which Knox Taylor is sales agent, has removed its offices to 253 Broadway, New York City, in the Postal Telegraph Building.

THE UNDER-FEED STOKER CO. OF AMERICA, Marquette Building, Chicago, has established a southern agency in the Empire Building, Atlanta, Ga., in charge of B. C. Fennell, M. E.

CORLETT BROTHERS, of Chicago, advertisement designers, removed May 1st from 173 Washington St. to larger and better equipped offices at the southeast corner of Dearborn and Harrison Sts., Chicago.

MAY 1ST THE CHICAGO offices of the St. Louis & San Francisco Railroad system were established at No. 606 Merchants Loan & Trust Building, corner Adams and Clark Sts. F. C. Reilly is general agent.

H. M. BYLLESBY & CO., engineers, New York Life Building, Chicago, have become interested in and have been appointed engineers for the Muscogee (I. T.) Electric & Gas Co. and the Muscogee Ice & Power Co.

THE EQUIPMENT MANUFACTURING CO., 820 Mutual Life Building, Philadelphia, has purchased the Barrett slow feed controller handle and all the patents, both foreign and domestic, covering this device.

THE M'GUIRE-CUMMINGS MANUFACTURING CO., of Chicago, recently opened a branch office in No. 505 Kemper Building, Kansas City, Mo., in charge of W. H. Schofield, manager of the Kansas City branch.

THE GOULD STORAGE BATTERY CO. has announced that, beginning May 1st, it occupies the entire eighth floor of the New Century Building, No. 1 W. 34th St., New York City, having removed from its former location.

JILSON J. COLEMAN announces that on May 1st his office, together with the New York office of the Indiana Northern Traction Co., and the office of Henry F. Coleman, was removed to the Aldrich Court Building, 45 Broadway, New York City.

THE RHODE ISLAND SUBURBAN RAILWAY CO., Providence, R. I., has placed a repeat order for two Green economizers, for immediate delivery, with the Green Fuel Economizer Co., the sole maker in the United States of this well-known specialty.

THE FIRM OF J. B. M'CLARY & CO., of Birmingham, Ala., has among the electric railway specialties handled by it, gears and pinions, Hunter fenders and life guards and Hunter illuminated car signs. The firm carries a general line of electrical supplies.

THE NATIONAL LOCK WASHER CO., 65 Johnson St., Newark, N. J., has succeeded to the business of the American Washer & Manufacturing Co., of the same city, and has purchased all the latter company's patents on lock washers, nut locks and machines.

THE NERNST LAMP CO. recently removed its Boston office from 131 State St. to 501 Atlantic Ave. The office, as heretofore, will be in charge of George C. Ewing, district manager, and will carry a complete stock of Nernst lamps and supplies, insuring prompt service.

THE SCHENECTADY RAILWAY CO. has adopted as its standard the recording register manufactured by the Recording Fare Register Co., of New Haven, Conn., and has recently entered into a contract with that company for the equipment of all the lines with registers of this type.

THE CANADIAN business of the Allis-Chalmers Co., which recently acquired the Bullock Electric Manufacturing Co., of Cincinnati, will hereafter be conducted by a new organization known as Allis-Chalmers-Bullock, Ltd. The works and principal offices of the Canadian company are in Montreal.

THE WILLIAM TOD CO., of Youngstown, O., builder of heavy duty corliss engines, Reynolds pumping engines and blowing engines, hoisting and gas engines, has established an office at 29 Broadway, New York, and has appointed as its eastern agent George F. Woolston, formerly of Woolston & Brew.

AT THE ANNUAL MEETING of the Joseph Dixon Crucible Co., Jersey City, N. J., the old board of directors was re-elected as were the following officers: President, E. F. C. Young; vice-president and treasurer, John A. Walker; secretary, George E. Long. Judge Joseph D. Bedle was also re-elected as counsel.

THE BUDA FOUNDRY & MANUFACTURING CO., and the Paige Iron Works, which is the frog, switch and crossing department of the first named company, removed their offices on April 16th from 427 Monadnock Block, Chicago, to 637 Railway Exchange Building, Chicago, to which latter address all future correspondence should be addressed.

THE FOREST CITY PAINT & VARNISH CO., of Cleveland, O., advises us that its business increased more than 12 per cent in April, 1904, over the same month last year. Among this company's customers are a number of the largest electric railway companies in the country, and its products are being more and more sought in this field, owing to their unquestioned merit.

JOHN BOYLE & CO., of New York City, manufacturers of and dealers in cotton duck, awning materials and high grade leather goods, have removed from the building on Fulton St., which they occupied for more than 40 years, to Nos. 112-14 Duane St., extending through to 70-72 Reade St. The constant growth of their business has made necessary the enlargement of their facilities.

THE SHEPHERD ENGINEERING CO., of Franklin, Pa., has established a branch office at Boston, Mass., in the new Oliver

Building, corner of Milk and Oliver Sts., in charge of W. N. Clifford, who will hereafter handle the New England business of the company from the new office. Other branches which have been established by this company are located at Chicago and Philadelphia.

FREDERICK BROWN, well known in connection with various southern and South American engineering works, has organized a company under his name, with a paid capital of $50,000, to engage in all sorts of engineering work in the sections named. Offices have been opened in the Hibernia Bank Building, New Orleans, La., and branches will shortly be established in Mexico and the West Indies.

PORTER & BERG, INCORPORATED, Chicago, announces that beginning May 1st its offices will occupy the second floor of the Plymouth Building, 303-305 Dearborn St., two doors north of its former location. The change was made necessary by the growth of the firm's business. The space occupied by the new offices is about twice that of the old and the facilities for transacting business are improved in proportion.

THE RAILROAD SUPPLY CO., of Chicago, announces that the office of its eastern sales department has been removed from the Engineering Building, 114-18 Liberty St., to the Central Building, 143 Liberty St., New York City. H. H. Greene has retired from the service of the company, having held the position of eastern sales agent, and George S. Bailey and H. M. Buck have been appointed eastern representatives with headquarters as stated.

THE GREEN ENGINEERING CO., Western Union Building, Chicago, advises us that it has just closed with the Toledo Railways & Light Co. for 2,400 h. p. of its chain grate stokers, after the railway company had for years bought a competitor's device. Other orders recently received include the following: International Harvester Co., third order; Nelson Morris & Co., third order; University of Illinois; Winona Agricultural and Technical Institute, Indianapolis, Ind.

THE CROCKER-WHEELER CO., of Ampere, N. J., on May 10th opened a branch office in the Hibernia Bank Building, New Orleans, La., in charge of W. P. Field, of the St. Louis office of the company. Although the Crocker-Wheeler Co. has fifteen branch offices from Boston to San Francisco, including St. Louis and Atlanta, the establishment of this new office was necessary in order to accommodate the steadily increasing market for electrical machinery in the South and Southwest.

THE LAGONDA MANUFACTURING CO., Springfield, O., is in receipt of the following letter from the Wamsutta Mills, of New Bedford, Mass., relative to the Lagonda "Weinland" cleaner: "The turbine tube cleaner that we bought of you in February we have used every day since, cleaning our economizer tubes, and find that it works just as well at present (May 3d) as it did when new. We have not worn out one set of cutters and have never found a machine that did better work."

THE OWEGO BRIDGE CO., with plant at Owego, N. Y., has been reorganized by the Transit Contract Co., of Philadelphia and New York, which company recently secured control of the Owego company. E. S. McNaul, lately with the King Bridge Co., has been made president of the new company and W. N. Conger, of the National Bridge Co., is now vice-president of the Owego Bridge Co. The new company plans to greatly enlarge the shops and make a specialty of railway bridges and structural work.

THE WHEEL TRUING BRAKE SHOE CO., of Detroit, Mich., has an attractive exhibit at space No. 117 in the Electricity Building at the World's Fair, where it shows various sizes and designs, adapted for different uses, of the wheel grinding brake shoe made by this company. The shoes exhibited include those for the removing of flat spots from chilled wheels of electric cars, and for dressing down flattened or grooved locomotive driving wheel tires. A representative of the company is in charge of the exhibit.

THE J. F. TENNEY CO., 152-8 Lake St., Chicago, makes a specialty of ticket punches, conductors' badges, baggage checks, stencils, canceling machines, dating and numbering stamps and numerous other devices which are used in street railway offices, and it emphasizes the fact that it will pay purchasing agents to deal direct with the manufacturer and thereby save the profit which would otherwise go to a middleman. The Tenney company is one of the oldest and best known manufacturers in this line in the country. [illegible] large stock on hand, thus insuring prompt service, and its prices are right.

THE O. M. EDWARDS CO., of Syracuse, N. Y., writes that it is furnishing window fixtures and trap doors for quite a number

of electric cars, among recent orders being the following: International Railway Co., Buffalo, N. Y., window fixtures for 35 Brill cars; Des Moines City Railway Co., Des Moines, Ia., window fixtures for 20 American Car Co. cars; Chicago & Milwaukee Electric Railway Co., Chicago, window fixtures and trap doors for six Jewett Car Co. cars; Schenectady Railway Co., Schenectady, N. Y., window fixtures and trap doors for six Jones' Sons cars; Westinghouse, Church, Kerr & Co., trap doors for 16 John Stephenson Co. cars.

THE TROLLEY SUPPLY CO., of Canton, O., advises us that it recently received an important inquiry from the Barking Town Urban District Council, of Barking, Essex, England, which will undoubtedly result in the introduction of the company's well-known Knutson trolley retriever into that district. The company's trade has increased remarkably, not only in the United States, but also in foreign countries, and shipments which the company has made abroad cover the following countries: Mexico, South America, England, France, Germany, India, Japan, Australia and other

NORTHERN PACIFIC RY'S. "WONDERLAND."

"Wonderland" for 1904 has just been issued by the Northern Pacific Ry., the Yellowstone Park Line. "Wonderland" is a 116-page book descriptive of the Northwest. It was written and compiled by Olin D. Wheeler. Among the subjects treated of are the following: "The Haunts of Wild Game," "The Lignite Coal Area in North Dakota," "The Yellowstone Park," "Irrigation of the Northwest," and "The Travels of Lewis and Clark." It is illustrated with many half-tone views. Its colored cover design is very handsome.

This number of "Wonderland" is quite different in newness, variety of text and illustrations from the preceding numbers. The chapter on the haunts of wild game conveys to the reader an excellent idea of the game fields of the Northwest, the best hunting and fishing to be found being in the region served by this railroad. The chapter on lignite tells the story of the almost inexhaustible supply of lignite fuel found in the treeless plains of North Dakota. It is easily mined and costs but little. The chapter on the Yellowstone Park includes an account of the recent improvements upon which the government has spent $600,000. The chapter on irrigation is confined mainly to irrigation in the two large valleys of the Yellowstone in Montana and the Yakima in Washington. The chapter on the travels of Lewis and Clark tells of the experiences of the first band of explorers sent out by the United States government 100 years ago. And there are several other good things in the book.

"Wonderland" is printed for general distribution and can be easily obtained by sending six cents in postage stamps to Alexander M. Cleland, general passenger and ticket agent, St. Paul, Minn.

STREET RAILWAY REVIEW

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The Louisiana Purchase Exposition.

Historical Sketch of Events Leading to the Exposition—Plan of Exposition Grounds—Power and Lighting Plants—The Pike.

The great exposition at St. Louis, now open to the world, finds its reason for existence in the desire of the people of the United States to fittingly commemorate the first centennial of the "purchase of Louisiana," an event by which was acquired from France a great tract of land—nearly equal in extent to one-third the present area of the United States—lying between the Mississippi River and the Rocky Mountains, and which includes, in whole or in part, 14 states and territories, as follows: Missouri, Oklahoma, Minnesota, Wyoming, Indian Territory, Arkansas, South Dakota, Nebraska, Louisiana, Montana, Iowa, Kansas, Colorado, and North Dakota.

THE MAIN PICTURE LOUISIANA PURCHASE EXPOSITION

The annexation of Louisiana has been declared to be an event in national history ranking in importance next to the signing of the Declaration of Independence and the adoption of the Constitution, for it not only removed a constantly recurring cause for petty disputes between the struggling United States and several European nations, but [illegible] opened the way by which the national empire was to take its course westward to the Pacific.

The historical events which brought about the acquisition of this territory are interesting. Prior to the purchase the settlers in Kentucky, Tennessee and on the upper Ohio lived with more or less constant friction with the Spanish settlements and hostile Indians along their western border, and on several occasions open warfare was avoided only by the diplomacy of President Washington and President Adams. In 1801 the western people were again intensely excited by rumors to the effect that Spain had secretly ceded Louisiana to France and that Napoleon, then first consul of the French Republic, was about to take military possession of the land. President Jefferson appreciated that the time for action had come, and at once opened negotiations with Napoleon for a peaceful acquisition of the Louisiana tract. These negotiations were consummated on Apr. 30, 1803, by a treaty with France, by which the United States acquired over 875,000 square miles of territory lying west of the Mississippi for the sum of $15,000,000. It is of interest to record that this sum is scarcely one-quarter the amount of money that has been spent on the buildings and grounds of the exposition that has been built to commemorate the first centennial of the treaty.

The popular demand for a celebration of the centennial was first formulated by a meeting of the Missouri Historical Society in September, 1898, at which a ways and means committee consisting of 50 citizens was appointed. In December, 1898, the governor of Missouri issued a call inviting the governors of all the Louisiana Purchase states to send delegates to a convention, which finally met in St. Louis in January, 1899. The movement met with hearty

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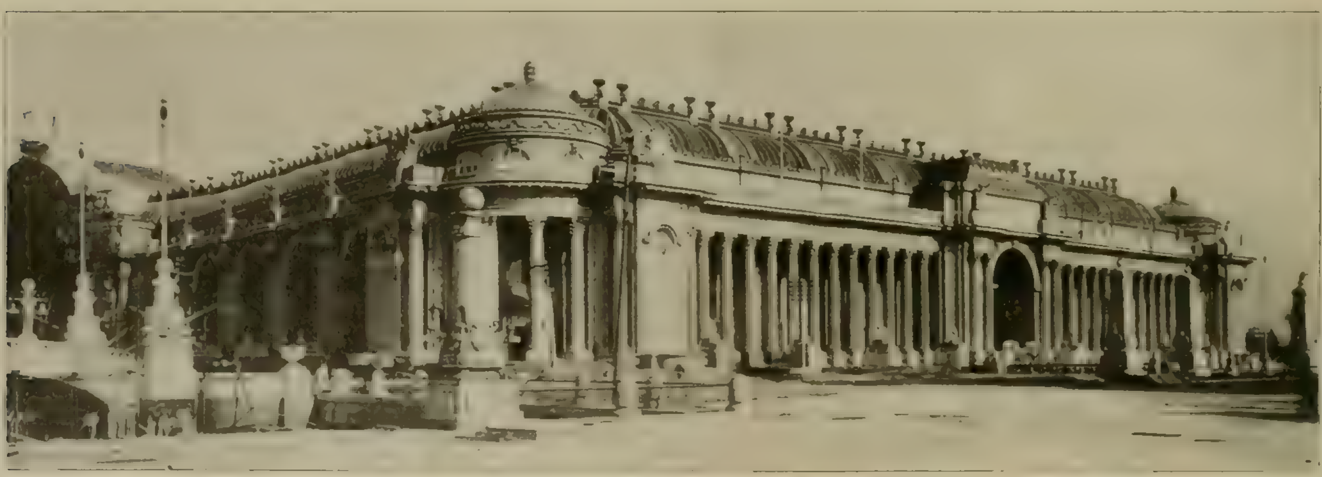
response from all of the states directly interested, and St. Louis, as the chief city of the Louisiana Purchase states, was asked to take the lead in making plans for a World's Exposition that would eclipse any other similar enterprise of recent years. Over $4,000,000 in private subscriptions was immediately raised, the city of St. Louis voted a municipal subscription of $5,000,000, and the state of Missouri appropriated $1,000,000 for World's Fair purposes.

In June, 1900, Congress voted to provide $5,000,000 provided the city of St. Louis raised $10,000,000. On Mar. 3, 1901, it having been represented in the Senate that St. Louis had fulfilled this condition, the act of Congress appropriating $5,000,000 to the Louisiana Purchase Exposition was sent to President McKinley for approval and became a law.

PALACE OF TRANSPORTATION.

The following year was passed in persuading the rest of the states and the world at large to take an active interest in the World's Fair movement. By Apr. 30, 1902, four of the great exhibit buildings were well advanced towards completion, and it was then believed that the exposition could be made ready by Apr. 30, 1903, which had been selected as the opening date. Owing, however, to labor troubles, the financial situation in the country at large, and the difficulties and delays involved in getting the legislative machinery under way in the various states and foreign governments, it was decided that the complete success of the exposition scheme would be better assured by postponing the opening for one year. With two years' time still available for the preparation of exhibits the good effect of the postponement soon became apparent. Foreign governments that had declined or hesitated to participate in the movement began to reconsider and accept. The postponement also made possible a further enlargement of plans.

The fair grounds have a total area covered of 1,240 acres, or twice the area provided for the Columbian Exposition at Chicago and larger than the Chicago, Paris and Buffalo expositions combined. Forty-four of the forty-five states of the Union have independent exhibits and have spent nearly $7,000,000 thereon. Fifty-three foreign governments are represented by official exhibits, on which the sum of $7,500,000 has been spent.



PALACE OF MANUFACTURES.

In addition to the original appropriation of $5,000,000 by the federal government, a further grant of $1,488,000 was made by Congress for federal buildings and exhibits, and at the last session of Congress the further sum of $4,600,000 was loaned to the Expo-

sition company to be repaid out of gate receipts and other earnings. The St. Louis Exposition, as it stands today, has cost over $50,000,000.

General Plan of Grounds.

The 1,240 acres devoted to the Exposition lie in the western half of Forest Park, which is situated on the extreme western limits of the city of St. Louis about five miles from the commercial center of the city. The grounds occupied are in the shape of a parallelogram. Eight of the large exhibit palaces are placed on a comparatively level plain in the northeast section of the parallelogram, and these eight buildings, with the lagoons and broad avenues between, constitute what has been termed "the main picture" of the exposition. This section of the grounds is roughly fan-shaped, with the avenues and lagoons converging toward a crescent-shaped hill at the handle. With proper manipulation this mound or range gave itself very readily to the formation of the central picturesque feature of the fair. At the top of the range in the center has been placed the Festival Hall, surmounted by a dome nearly as large as St. Peter's at Rome. Flanking Festival Hall on either side is a magnificent "Colonnade of States" following the contour of the crescent and terminating at either end in dome-shaped pagodas. The Colonnade of States is appropriately dedicated to the 14 states that have been formed from the Louisiana Purchase Territory, and the entire group of structures, including Festival Hall, the Colonnade and the two Pagodas, is embellished with friezes and statuary. In front of Festival Hall is the central cascade, which first makes a clear fall of 20 ft. to the level of the terrace and then spreads out into a stream 45 ft. wide, which gradually widens as it leaps down the long slope of ledges or steps until it gains a total breadth of 150 ft. before the final plunge into the Grand Basin.

PALACE OF ELECTRICITY.

PALACE OF MACHINERY.

On either side of the main cascade are smaller cascades, which have their origin in fountains near each pagoda, and which also plunge down the side of the crescent hill in a series of gradually widening steps or ledges until they reach the grand basin below. The effect will be greatly augmented by a series of fountains and jets of water, some of which attain a height of 75 ft. This panorama of water effects, including the artistic grouping of statuary with the work of the landscape architect, will very well stand comparison with the famous gardens of Versailles near Paris.

PALACE OF ELECTRICITY ILLUMINATED.

Along the radiating avenues of the fan-shaped picture are most of the main exhibit palaces, including Electricity, Transportation, Machinery, and Manufactures. Other of the main palaces, as Agriculture and Horticulture, will be found to the west of the fan-shaped picture. In the main the larger exhibit buildings are built entirely of wood covered with staff. The style of architecture is a free treatment of the Renaissance. The color scheme of the buildings is white throughout, with touches of color on the roofs and decorative towers.

Visitors who are especially interested in electric railway matters will find their interest chiefly centering in the Palace of Electricity, Palace of Transportation, Palace of Machinery, the electric railway test tracks at the side of the Transportation Building, the various outdoor electric railway exhibits, and the Steam, Gas and Fuels Building. Another feature worthy of study is the model street, which will be found immediately inside the main entrance. This street is 1,200 ft. long, and is the joint exhibit of various cities for the purpose of illustrating the latest ideas as to what a model street should be as regards paving, curbing, sub-surface conduits and structures, etc.

Power at the Exposition

With the exception of a few isolated plants built for private use by some of the individual concessioners all the power required in the entire enclosure constituting the Louisiana Purchase Exposition, for lighting, pumping and the operation of various motors, including the Intramural Ry., is developed in Machinery Hall and its annex, the Steam, Gas and Fuels Building. The generating apparatus, although all housed in Machinery Hall, is divided into two separate power plants. One is known as the Exhibitors' Power Plant, and is made up entirely of apparatus entered as exhibits by more than 90 engineering firms, including many of the leading manufacturing concerns of the United States as well as several from foreign countries. The total generating capacity of the Exhibitors' Power Plant is stated to amount to about 40,000 h. p. with an output of about 25,000 kw. of electrical energy at normal load.

In addition to the plant supplied by exhibitors, there is the Exposition Power Plant, made up of machinery leased by the Exposition Co. as a service plant for furnishing power during the pro-Exposition period as well as during the time the fair is open. The Exposition Power Plant has capacity of 8,000 kw. in electrical powers.

The following is a statement of each separate entry to be found in Machinery Hall, and in the Steam, Gas and Fuels Building, which is virtually the boiler house for Machinery Hall. Detailed descriptions of many of the entries will be found elsewhere in this issue under descriptions of individual exhibits. A description of the Exposition Power Plant will be found under the description of Westinghouse Interests at the Fair, by whom this plant was installed.

The Exhibitors' Power Plant is divided into several separate systems, each with its distinct characteristics, and a separate work to perform; in some of these as many as 12 or 15 different exhibitors are represented.

Power for Intramural Ry.

The Intramural Ry. plant constitutes one of the systems of the Exhibitors' Power Plant. The generating units for the Intramural are divided into two groups.

The first consists of three steam engines and a water wheel all driving 550-volt direct current generators furnished by the Crocker-Wheeler Co. The four generating units in question were furnished by the following exhibitors:

The Lane & Bodley Co. exhibits a 900-h. p. cross-compound engine, with cylinders 20 and 40 in. by 54-in. stroke, direct connected to a 600-kw. generator making 85 r. p. m.

A 750-h. p. single cylinder Murray-Corliss engine with 26-in. cylinder and 48-in. stroke furnished by the Murray Iron Works, this being direct connected to a 500 kw. generator operating at 100 r. p. m.

A NIGHT SCENE.

The other engine of the group is from the Harrisburg Foundry & Machine Works; it is the Fleming type, four-valve, tandem compound with cylinders 15 and 40½ in. with 26-in. stroke, with a reheater between the high and low pressure cylinders, and run-

ning at 150 r. p. m. This engine is direct connected to a 400-kw. generator.

For this group the Alberger Condenser Co. furnished a surface condenser with pumps complete; the Harrison Safety Boiler Works furnished the steam and oil separators, and A. Sorge, jr., & Co., the traps.

A unique feature of this installation is a tangential water wheel exhibited by the Abner Doble Co., of San Francisco. This wheel develops 160 b. h. p. at 700 r. p. m., and is direct connected to a 100-kw. generator. Water for driving the wheel is furnished at a pressure of 300 lb. per square inch, by a triple expansion condensing pump from the Jeanesville Iron Works.

The second group of the Intramural Plant consists of a 1,400-h. p. cross-compound Buckeye engine with cylinders, 26½ and 50 in. and 48-in. stroke, direct connected to a 900-kw. generator, operating at 100 r. p. m., together with two Brown-Corliss vertical cross-compound engines, with cylinders 18 and 36 in. and 36-in. stroke, running at 135 r. p. m., each direct connected to a 500-kw. generator. All the generators of this group were also furnished by the Crocker-Wheeler Co.

The Wheeler Condenser & Engineering Co. furnished for this group an Admiralty type of surface condenser with pumps complete. This condenser also takes care of the exhaust steam from a Greenwald 600-h. p. cross-compound engine, which is direct connected to a Fort Wayne Electric Works 400-kw. 250 volt d. c. generator used on lighting load.

The Greenwald engine has cylinders 18 and 36 in., and 42-in. stroke, and operates at 100 r. p. m.

The Walker Electric Co., of Philadelphia, furnished the complete switchboard installation for the entire system.

The generation of power for the Intramural involves no special engineering features except those arising from the fact that power is secured from so many different classes of units. The switchboard is a typical railway board with the usual machine and feeder panels. Direct current is generated at 550-575 volts, and passes out over aerial feeders. Inasmuch as the power plant is approximately in the center of the Intramural line which takes the form of an irregular circular belt, the problem of feeder distribution was a comparatively simple one, the chief requirement being to provide sufficient carrying capacity in copper for the heavy traffic anticipated.

Lighting and Power.

The largest individual unit forms part of a three-phase, 25-cycle, 6,600-volt system situated in the central block of Machinery Hall. This consists of an Allis-Chalmers 5,000-h. p. vertical and horizontal compound engine, direct connected to a Bullock 3,500-kw. alternator; the engine is of the Manhattan type with horizontal high pressure cylinder and vertical low pressure cylinder, both

delivered to the cold wells by a De Laval motor driven centrifugal pump.

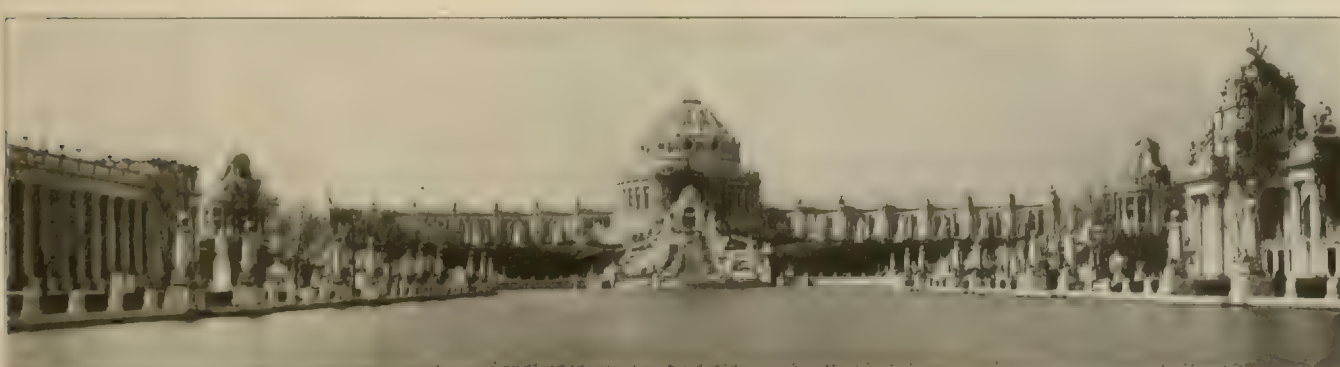
A. L. Ide & Sons, of Springfield, Ill., installed a 300-h. p. Ideal engine direct connected to a Bullock 200-kw., 250-volt, direct current generator, part of the current produced being used for exciting the 3,500-kw. alternator, the remainder passing through a Bullock balancer and used for operating the variable speed motors

PALACE OF MACHINERY AT NIGHT.

of machine tools shown by various exhibitors in Machinery Hall.

The Steam Appliance Co., of Milwaukee, furnished the steam and oil separators, and exhaust heads for this system, while the Deming Co., of Salem, O., supplied a pump for draining the vacuum oil separator.

The next system is one delivering a three-phase, 25 cycle, 6,600-



PANORAMA OF TERRACE OF STATES AND FESTIVAL HALL.

working on the same crank, the cylinders are 44 and 94 in. in diameter, stroke 60-in. and r. p. m., 75.

The exhaust steam is taken care of by a barometric tube condenser furnished by the Alberger Condenser Co., a vertical Alberger engine drives both the vacuum and circulating pumps, the latter being a rotary pump furnished by the Connersville Blower Co. That part of the water required for boiler feed is

volt current. It consists of a 1,500-h. p. Rateau turbine direct connected to a Bullock 1,000-kw. alternator making 1,500 r. p. m., and a 2,250-h. p. vertical cross-compound engine with cylinders 34 and 68 in. by 54 in., direct connected to a National Electric 1,500-kw. alternator operating at 83 r. p. m.

Both the turbine and vertical engine are exhibited by the Hooven Owens Rentschler Co., of Hamilton, O.

The Stilwell-Bierce & Smith-Vaile Co., of Dayton, O., furnished two condensers, with pumps, one for the turbine, designed to maintain a vacuum of 28 in., and the other for vertical engine to carry a vacuum of 26 in.

The steam and oil separators were furnished by the Baum Separator & Machine Co.

In connection with the arc lighting system there is a complete installation consisting of boilers, engines, condenser and pumps from the Societe Anonyme des Etablissements Delaunay Belleville, of Paris, with a generator from the Societe L' Eclanage Electrique, also of Paris; a complete installation of engine, condenser, pumps, and generator from the Societe Alsacienne de Construction Mecaniques, of Mulhouse, Germany and Belfort, France; also a complete engine installation made by the engineering firm of C. H. Bradley, jr., & Co., of Pittsburg.

The Belleville exhibit consists of three marine type boilers of 500 h. p. each, a 1,500-h. p. engine, a condenser complete with pumps, and a 1,000-kw., 2,400-volt, three-phase, 50-cycle alternator.

The Mulhouse engine is of the horizontal, tandem, compound type, with cylinders 600 mm. and 1,100 mm. in diameter, and stroke 1,300 mm., developing 1,000 h. p. at 94 r. p. m.

The generator from the Belfort branch of the same company is of 700 kw. capacity, and delivers a 2,300-volt, three-phase, 50-cycle current.

The Bradley installation consists of a 1,000-h. p. Willans central valve engine direct connected to a Stanley 600-kw., three-phase, 60-cycle, 2,300-volt alternator; a 50-h. p. Willans engine direct connected to a Northern Electric 30-kw., 110-volt, direct current generator; a Worthington surface condenser with Worthington circulating pump driven by a Northern Electric 25-h. p. motor, and a Blake twin air pump. The Direct Separator Co. furnished the steam and oil separators; Crane Co., valves and fittings; and the Philip Carey Manufacturing Co., pipe covering.

The General Electric Co. is exhibiting a 2,000-kw. Curtis turbo set complete, the condenser and pumps being supplied by H. R. Worthington, of New York. This turbine will operate at 750 r. p. m., and has a capacity for short periods of 100 per cent overload; the current delivered will be three-phase, 25-cycle, 6,600 volts.

Greenwood & Batley, of Leeds, England, are exhibiting a De Laval turbine of 225 b. h. p., operating generators of 150 kw. capacity, 500 volt direct current. The generators are four-pole type, two in number.

The Buffalo Forge Co. is exhibiting a 175-h. p. horizontal tandem compound engine direct connected to a Stanley 132-kw., 2,400-volt, two-phase, 60-cycle alternator for which the Northern Electrical Manufacturing Co. furnished the exciting set.

The Skinner Engine Co. furnished a 200-h. p. engine direct connected to a Warren 150-kw., 2,300-volt, single-phase, 60-cycle alternator, the Wagner Electric Manufacturing Co. providing the exciting set.

The American Engine Co. has a 200-h. p. engine direct connected to a 125-kw., 110-volt, direct current generator of its own make.

The Laidlow-Dunn-Gordon Co. exhibits two air compressors, for which the National Oil Burner & Equipment Co., of St. Louis, supplied the traps, the Gardner Governor Co. the steam separator and exhaust head, and the Holmes Metallic Packing Co. the packing for rods.

The Famous Filter Co., of St. Louis, provided a central oil filtering plant to provide for the filtration of oil from the various engines.

H. R. Worthington is exhibiting three pumps, each with a capacity of 30,000 gallons per minute, to supply water for Cascades; also fire and sewage pumps.

The following companies are exhibiting cranes and apparatus connected with hoisting machinery, for use in Machinery Hall, in erecting and dismantling machinery.

Shaw Electric Crane Co., 60-ton electric traveling crane; Pawling & Harnischfeger, 50-ton electric traveling crane, with 10-ton auxiliary hoist; John Fowler & Co., of Leeds, England, road locomotives and traction wagons; Brown Hoisting Machinery Co., locomotive cranes; Lidgerwood Manufacturing Co., hoisting engines and derrick irons; Neal & Brinker, blocks; Yale & Towne Manufacturing Co., triplex blocks.

LIBERAL ARTS—U. S. GOVERNMENT BUILDING—MINES AND METALLURGY.

Amongst other exhibitors participating in the power plant in Machinery Hall, are the following:

American Steam Gage & Valve Co., recording steam and water gages; Crosby Steam Gage & Valve Co., recording vacuum gages; Fisher Governor Co., pump regulators; The Bristol Co., recording steam and water gages; Reliance Gage Column Co., steam traps; The Burt Manufacturing Co., oil filters; Pittsburg Gage & Supply Co., exhaust head; John Acton, reducing valve; Walter L. Flower & Co., oil filter.

The coal for boilers is supplied to mechanical stokers by an overhead link belt conveyor and the ashes removed in cars traveling in tunnels under the aisles. This conveying apparatus was supplied by the Link Belt Machinery Co.

The following companies furnished steam pumps for boiler feed water: National Steam Pump Co., two horizontal; Stilwell-Bierce & Smith-Vaile Co., one horizontal and one vertical; Cameron Steam Pump Co., one horizontal; Warren Steam Pump Co., two vertical; The Reliance Machine & Tool Works, one horizontal.

In addition to these the Goulds Manufacturing Co. exhibits a motor driven boiler feed pump with capacity of 277 gallons per minute.

The Harrison Safety Boiler Works, Dearborn Drug & Chemical

Works, and Pure Water Engineering & Construction Co. have furnished apparatus for the treatment of boiler feed water.

Friedrich Goetze, of Burscheid, Germany, supplied metallic packing rings for use in steam and exhaust lines of boiler feed pumps and engines of induced draft installations.

An exhibit of considerable interest is contributed by the American Steam Meter Co., of Chicago, consisting of a steam meter in pipe line to boiler feed pumps, this meter being provided with a dial to register actual quantity of steam used regardless of pressure.

The Lagonda Manufacturing Co. has provided tube cleaners for use during Exposition period.

R. D. Wood & Co. installed a complete gas generating plant with capacity of about 30,000 cubic feet per hour and the Weber Gas & Gasoline Engine Co. has provided a gas generating plant consisting of a suction gas producer, a 125-h. p. gas engine and a 75-kw. direct current generator.

Steam, Gas and Fuels Building.

A separate fireproof building is provided for the installation of boilers, gas generating plants, briquette machinery, and other apparatus for use in connection with boilers and fuels.

The exhibitors' boilers have a rated capacity of more than 15,000 h. h. p., this being provided by a number of different varieties but all of the water tube type.

The largest installation is that made by the Aultman & Taylor Machinery Co., which furnished 16 horizontal and three vertical Cahall boilers with a total rating of over 8,000 h. p. The horizontal boilers are installed in batteries of two each; two of these batteries are designed for a steam pressure of 225 lb. per square inch and supply steam for the operation of the turbines, the steam being delivered at throttles with pressure of 185 lb.

The remaining boilers carry steam at 175 lb. per square inch, this being delivered to engines in Machinery Hall at 150 lb.

The Aultman & Taylor Co. provided chain grate stokers in connection with all Cahall boilers.

The Heine Safety Boiler Co. has an installation consisting of eight 400-h. p. Heine boilers, for which the Green Engineering Co. provided the mechanical stokers.

The boilers provided by the Belleville Co., of Paris, to furnish steam for the Belleville engine, are three in number, of the Belleville marine type.

J. & A. Niclausse, of Paris, are exhibiting two of their marine boilers, each of about 400 h. p.

The Buffalo Forge Co. furnished a complete induced draft installation for all the last mentioned boiler exhibits.

The Clonbrock Steam Boiler Co. provided two Climax boilers, marine type, one of 300 and the other of 250-h.p.; the Dusseldorf-Ratinger-Rohrenkesselfabrik (formerly Durr & Co.) of Dusseldorf, Germany, a 500-h. p. marine type boiler; and the Schuette-Kessel-Konsortium, of Geestemuende, Germany, a 500-h. p. Conti marine boiler.

The Pike.

The Pike at St. Louis is what the Midway was at the Columbian Exposition in Chicago, only more so. Its dominating spirit is appropriately indicated by the group of statuary placed at its entrance, which represents a company of cowboys "shooting up" a western town. Here are grouped in the widest profusion circuses, shows, delusions, mechanical effects, and fakes, constituting a world of its own. Here are also gathered representatives of nations and peoples from every corner of the inhabited globe. It is safe to say that here the visitor will be separated from more of his money than he will care to compute at the end of a week's visit, but it is also safe to say that with the feeling of sadness at the flattened pocketbook will come the cheerful recollection that he has received his money's worth. The electric railway visitor will find much among the confusion of the Pike that will be worth examining as possible attractions for electric railway parks, as well as other available material.

Among the amusement features to be found on the Pike may be mentioned the following: "Tyrolean Alps"; "Irish Village"; "Under and Over the Sea"; "Streets of Seville"; "Hunting in the Ozarks"; "Hagenbeck's Animals"; "Mysterious Asia"; "Moorish Palace"; "Fair Japan"; "Hereafter"; "Glass-weaving"; "Paris"; "Ancient Rome"; "Creation"; "Palais du Costumes"; "Infant Incubator"; "Indian Congress and Wild West Show"; "Siberian Railroad"; "Deep Sea Divers"; "Cairo"; "Chinese Village"; "Constantinople"; "Esquimaux and Laplanders"; "Magic Whirlpool"; "Cliff Dwellers"; "Battle Abbey"; "Naval Exhibit"; "Jim Key," an

TYPICAL THROUGH STATION, INTRAMURAL RY.

educated horse; "Old Plantation"; "Galveston Flood"; "Hale's Fire Fighters"; "New York to the North Pole"; "Jerusalem"; "Observation Wheel"; "Miniature Railway"; "Poultry Farm"; "Transvaal Spectacle"; "Colorado Gold Mine"; "Shoot the Chutes"; "Scenic Railway", and "Temple of Mirth". On the Pike and scattered around the grounds will be found several novel forms of slot machines adaptable to electric railway parks.

The Intramural Railway.

This is a double-track, overhead-trolley, electric railway running around the edge of the main exposition enclosure and designed to give visitors a convenient means of reaching every section of the World's Fair grounds. As originally proposed, the Intramural Railway was in itself to comprise an interesting exhibit of the exposition, the plans providing for a road that would exemplify the highest developments in each phase of electric railway engineering. As finally constructed, however, the Intramural is an everyday

TRAIN ON INTRAMURAL RY.

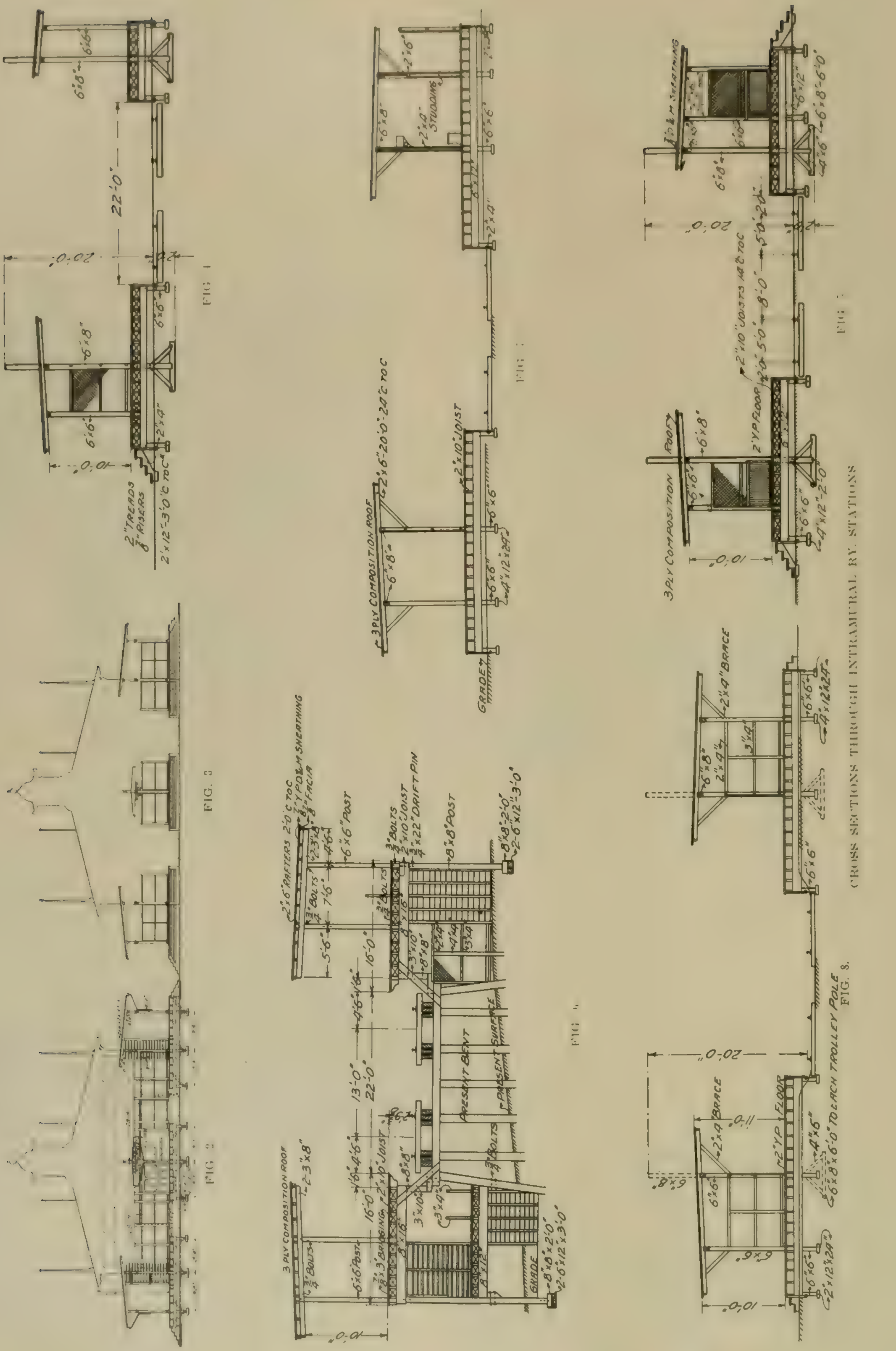


FIG. 1. FIG. 2. FIG. 3. FIG. 4. FIG. 5. FIG. 6. FIG. 7. FIG. 8.

CROSS SECTIONS THROUGH INTRAMURAL RY. STATIONS

TERMINAL STATION, INTRAMURAL RY.

overhead trolley electric railway, possessing but few features of more than ordinary engineering interest.

The road runs partly on the surface and partly on trestle work, following the topography of the grounds. It is built on a right of way seven miles long, giving about fourteen miles of track. The right of way is to be fenced and stops are made only at regular stations. Its two terminals are located inside the grounds, respectively east and west of the Lindell or main entrance. The two terminals are about 600 ft. apart, leaving a broad avenue between, so that the road does not deface the fine central view of the "main picture." For a considerable portion of its route the Intramural skirts the enclosure of the Exposition. For about two miles of its course it runs directly through the heart of one of the most interesting portions of the Fair grounds. For about one mile it runs through the fine oak forest of Forest Park. The rails are 65-lb. The road is A. S. C. E. standard T-section, standard-gage and cinder ballasted. Center pole construction was adopted except where the road runs through the woodland. The overhead material is of various makes.

There are 51 closed cars and seven 14-bench open cars, it being the intention to use the open cars only on days of very heavy traffic.

The closed cars were built by the St. Louis Car Co. and are of very handsome and durable construction. They will be sold after the Fair is over, and should realize very nearly their first cost, as they are of a type now largely used for regular interurban electric railway service. The cars measure 34 ft. over body, with 5-ft. platforms, making 44 ft. over all. Each car has seating capacity for 52 passengers.

The closed cars are fitted with General Electric type M. train control, with four G. E. 70 motors to each car. Both platforms

TERMINAL STATION, INTRAMURAL RY.

are vestibuled and are protected with folding gates. There are no car steps, as the loading and unloading platforms at the stations are built to come flush with the car platforms.

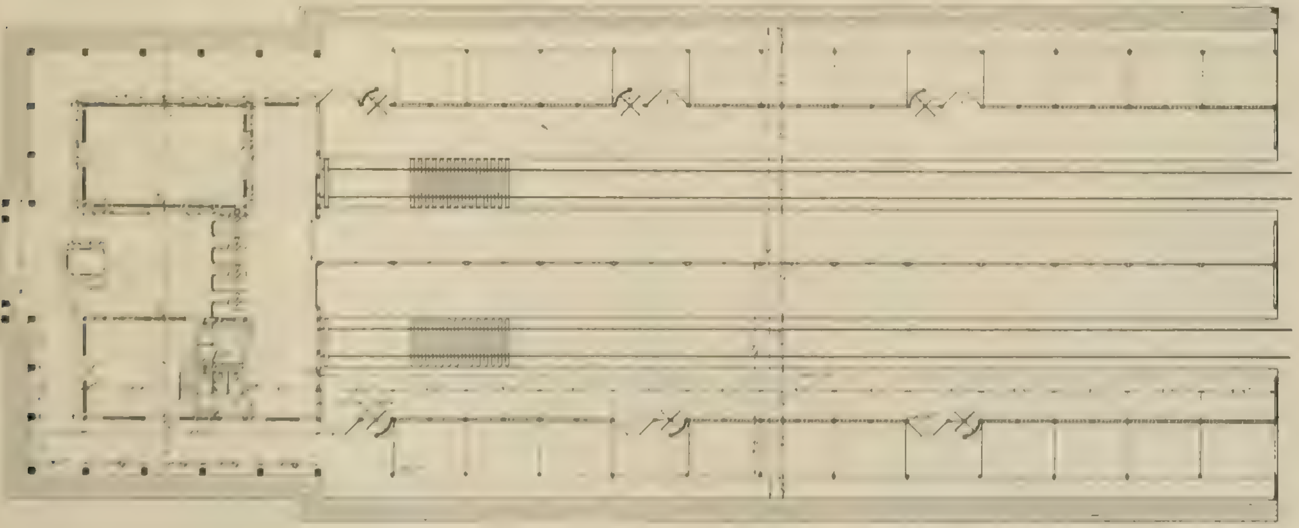


FIG. 1.

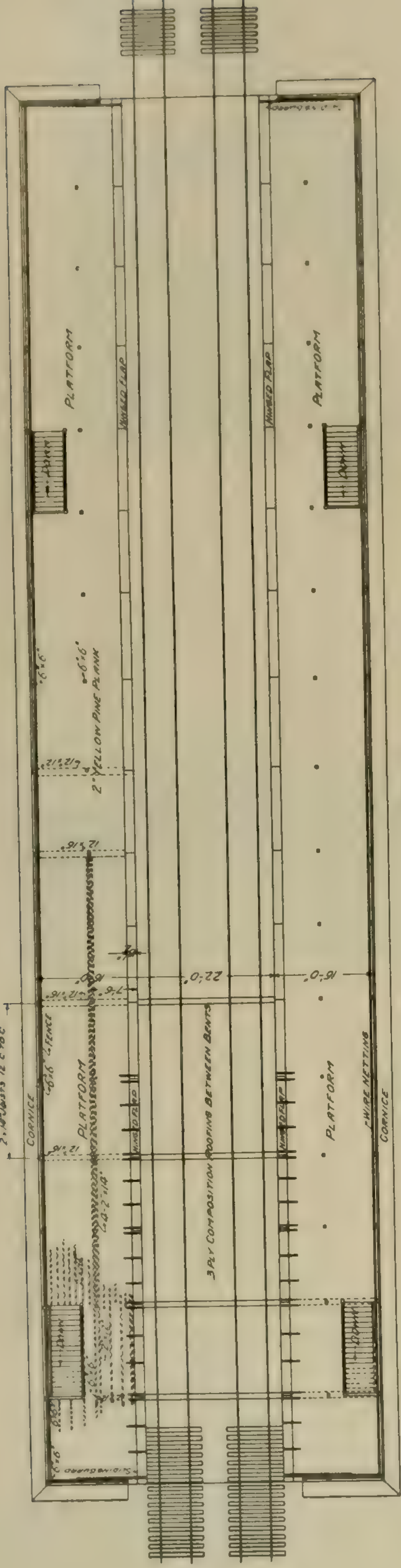


FIG. 9.

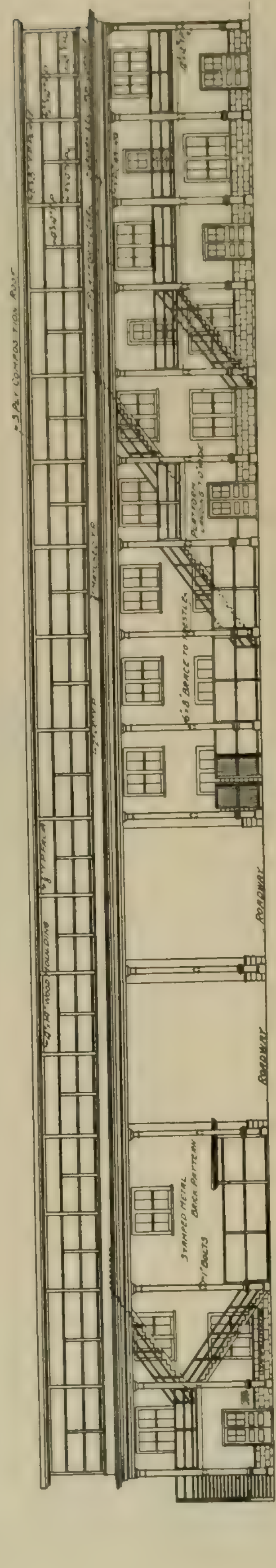


FIG. 10.

The cars are mounted on St. Louis double trucks fitted with Shoen solid forged and rolled steel wheels. Each car is equipped with Christensen air brakes with motor driven compressor of the latest type. Van Dorn automatic couplers are used.

There are 17 stations on the Intramural route. These stations consist essentially of covered platforms with turnstile exits. The same platform is used for loading and unloading.

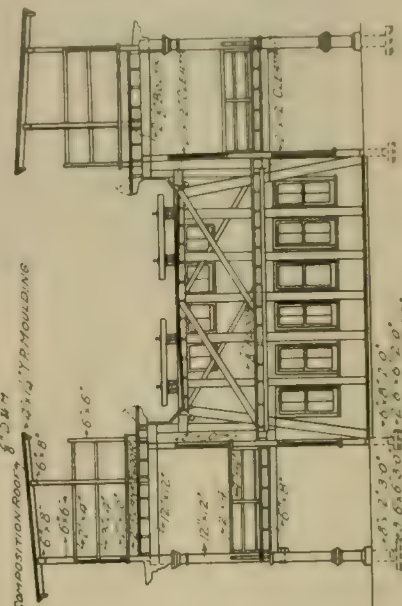


FIG. 12.

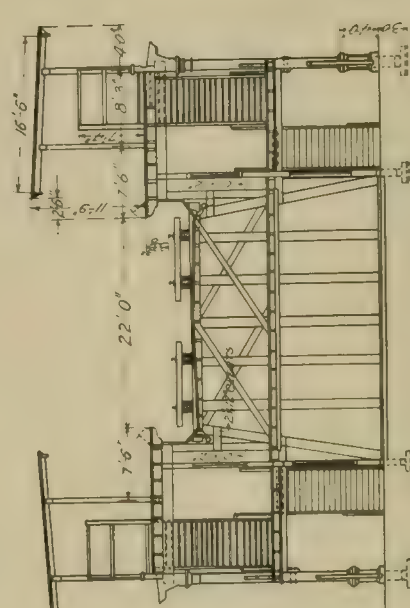


FIG. 11.

For the present the fares are collected on the cars, but when the crowds atending the Exposition become large enough to warrant it tickets will be sold at the stations and passengers will pay their fare before entering, passing to the loading platforms through turnstiles.

Wherever there are hills along the route the stations have been placed at the top of the hill, so that the passengers are saved much of the fatigue of climbing hills.

In the operation of the road it is the intention to give frequent service rather than to run cars at high speed. It is believed that visitors will use the Intramural as a means for obtaining a general, or as it were a sky-line survey of the exposition as a whole, and will desire to travel at a rate of speed sufficiently slow to enable them to enjoy each building and special feature along the route. It is also believed that visitors will find a trip around the Intramural a pleasant means of resting from the fatigue of walking through the exhibit palaces and grounds. For these reasons cars will be run on headways of five minutes or less and will consume about 42 minutes in making the circuit from terminal to terminal. When traffic is comparatively light cars will be run singly, but when travel is heavy they will be operated in two- or three-car trains, as the traffic may require.

The fare from any station to any other station is 10 cents.

Repair and storage shops for the Intramural cars have been built in the extreme southwest corner of the grounds. The shops are temporary in character and are fitted with pits and such small tools

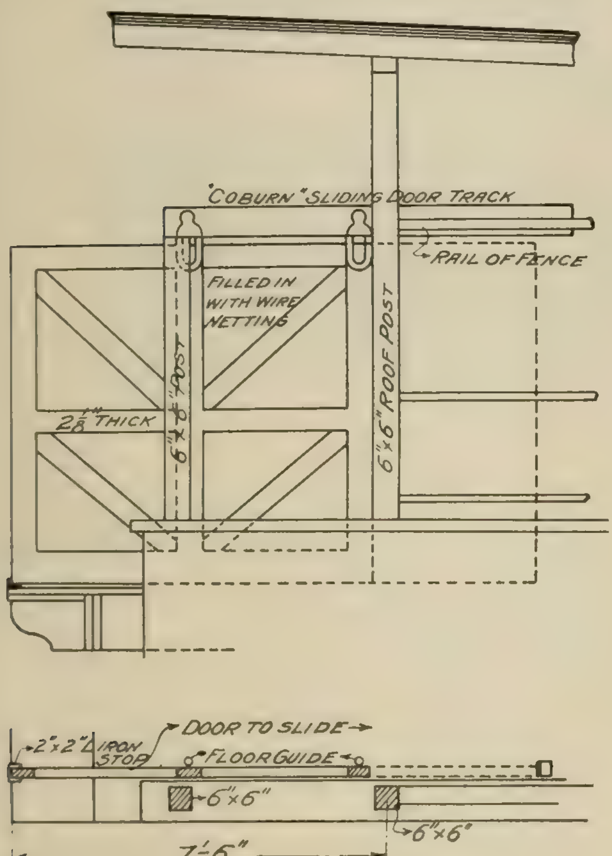


FIG. 13.

as will be required for making light repairs. No heavy repair work will be attempted.

The two terminal stations of the road are simple dead-end stations, each containing two stub tracks, so that cars may arrive and depart without conflict.

Power for the Intramural road is supplied from a group of 600-volt generating units of accepted railway types located in Machinery Hall, as described elsewhere in this issue.

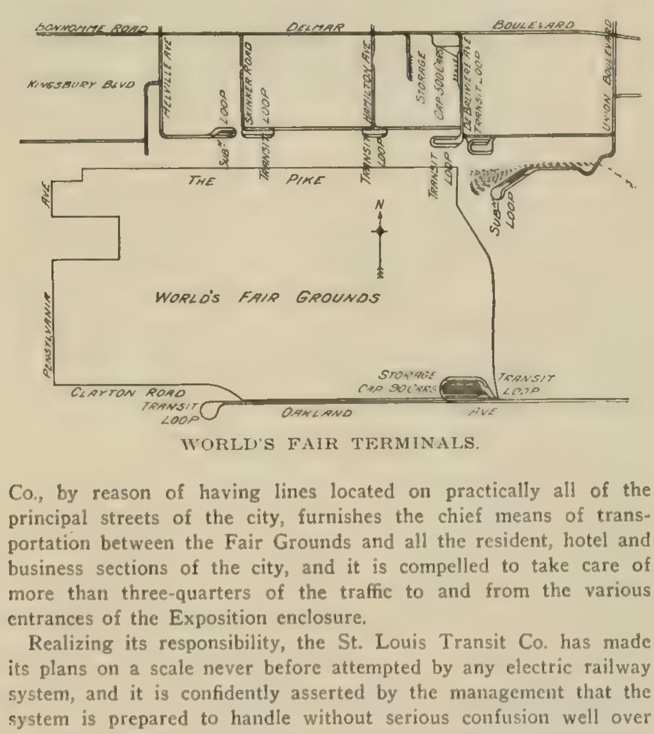
The accompanying illustrations show detail views of several typical stations on the Intramural Ry. Fig. 1 shows the first floor plan of the terminal stations, Nos. 1 and 17. These two stations are larger than the other stations along the line and they contain three platforms, one at either side of the double track and a double platform between the track. The latter is used for the loading platform and is entered by means of the turnstiles at one end of the building. The two outer, or unloading, platforms are provided with three exits. Fig. 2 is a cross section through station No. 17, and Fig. 3 is an end elevation of the same station. Figs. 4 and 5 show cross sections of a type of station which is used at a number of places on the line. This construction is common to Intramural stations Nos. 2, 3, 8, 10 and 11, in all of which the tracks are on the ground level. Intramural station No. 4, which is at the suburban entrance to the fair grounds, is shown in cross section in Fig. 6. Station No. 14, which is located near the southeast gate to the grounds, differs somewhat from the other stations where the tracks are on the ground level in that the platforms are wider. Figs. 7 and 8 show sections through this station. Figs. 9 to 12, inclusive, show the plan, side elevation and sections of station No. 16 at 5th St. The ends of the platforms on this station are provided with sliding guards, the location of which is shown in the plan, Fig. 9. A plan and elevation giving the details of these guards are shown in Fig. 13.

The total length of track measured as single track is 12.26 miles, in addition to which there is .75 miles of storage track for Intramural cars. The length of single track trestle is 1.19 miles.

The officers of the Intramural Ry. are: John Scullin, director of transportation; T. W. Murphy, general manager; John J. Lichter, general superintendent; Richard H. Phillips, engineer in charge during construction; J. H. Foster, chief engineer of power.

Traffic Arrangements for Handling the Exposition Crowds at St. Louis.

The responsibility of handling the bulk of the traffic to and from the World's Fair Grounds in St. Louis falls upon the St. Louis Transit Co. The St. Louis & Suburban Railway Co. and the Wabash R. R. shuttle trains are also called upon to handle a considerable portion of the Exposition crowds, but the St. Louis Transit



WORLD'S FAIR TERMINALS.

Co., by reason of having lines located on practically all of the principal streets of the city, furnishes the chief means of transportation between the Fair Grounds and all the resident, hotel and business sections of the city, and it is compelled to take care of more than three-quarters of the traffic to and from the various entrances of the Exposition enclosure.

Realizing its responsibility, the St. Louis Transit Co. has made its plans on a scale never before attempted by any electric railway system, and it is confidently asserted by the management that the system is prepared to handle without serious confusion well over a million passengers in a single day in case so many persons present themselves for transportation on its cars. In proof of the truth of this assertion it is stated that on the opening day of the Exposition the system carried over 927,000 people.

The city of St. Louis lies on the west bank of the Mississippi River, and the Fair Grounds are located approximately five miles due west from the business heart of the city. This situation throws the bulk of the exposition travel onto seven main east and west lines. During the Exposition period all the cars on these seven lines will run from the down-town section direct to the Fair Grounds and the north and south lines will be used as feeders, transfers being given at all intersecting points where the north and south lines intersect the east and west lines.

The Market St. lines will reach all the Exposition entrances on the south side of the grounds.

The Laclede line will reach the southeast entrance only.

The Taylor Ave. line will run to the southeast entrance.

The Olive St. and Delmar Ave. cars will run direct to the north-east or Lindell entrance, which is the main entrance to the Fair grounds.

The Page cars will run to the northwest entrance, which is the next in importance.

The Easton cars will run to the north middle entrance, which is at the center of the Pike.

At the present time the loop at the Lindell entrance is the only one that is fenced and provided with exit and entrance turnstiles. If the crowds warrant it, however, the other loops will be so provided.

The details of this terminal were shown in the "Review" for April.

At the Lindell entrance loop passengers buy tickets at ticket

ST. LOUIS TRANSIT CO. LOOP IN FRONT OF MAIN ENTRANCE TO EXPOSITION

booths, show these tickets at the entrance turnstiles and deliver them to the conductors after having entered the cars. The use of these entrance turnstiles enables the crowds to be held in check and more easily controlled, as intending passengers are admitted to the loading platforms only in numbers that can be handled by the cars immediately in sight. The use of tickets has been adopted at this entrance, as many of the temporary hotels and boarding houses are within a comparatively short distance of the grounds, and it would be impossible for conductors to collect all the fares on the homeward-bound cars before a considerable portion of the load would be discharged. The tickets are dated for each day and are accepted only on the date of sale, so that even if the ticket is not collected by the conductor it will not be honored for a second ride.

At all these various entrances are loop terminal stations, the capacity of each loop being determined by the importance of the entrance. It is interesting to notice that at none of these loops have arrangements been made for storing or banking cars in anticipation of heavy rushes of traffic. In other words, it is the aim of the management to prevent massing of cars, the idea being to keep each of the main lines so completely filled with cars that banking will be unnecessary and the cars will come and go fast enough to absorb any crowd that can possibly concentrate at any of the gates. Cars that would ordinarily be stored at the terminals in anticipation of heavy homeward-bound traffic will be kept out on the lines, where they will be picking up many fares that would be lost if the cars were bunched and were all sent out in one direction. It is believed that the service over the entire system as a whole will thereby be greatly improved.

In pursuance of this policy all of the terminal loops at the Fair grounds have been connected by auxiliary double-track lines, so that cars may be run from any loop to any other one. This gives a degree of flexibility that would seem to preclude any possibility of serious congestion at any one point, for if it is seen that the bulk of the homeward-bound crowds is tending toward any one terminal loop cars can be immediately called from any or all of the other lines to the assistance of the overburdened line. Moreover, if any obstacle arises in the operation of any one loop the traffic can be directed to the nearest one of the other loops. It would seem, therefore, an utter impossibility to tie up the whole system by any other cause than the total failure of power.

As a final precaution the company has located one of its main car houses within two minutes' run from the Lindell entrance. This car house, with its yards, has capacity for 500 cars, and if a serious interruption of service should occur on any of the main Exposition lines cars could be started from this barn to any of the north-side entrances in order to fill in the gaps.

All of the terminal loops have a double set of loop tracks, so that two lines of cars can be unloaded or loaded at the same time. One or two of the terminals have a short stub track in the center of the loop for storing private or special cars or for taking care of a disabled car.

The rolling stock at the disposal of the Transit Co. consists of something less than 2,000 cars of various sizes and types. The new cars purchased for Exposition requirements are chiefly closed cars with 33 ft. 5 in. bodies, measuring 44 ft. 8 in. over all, and were built by the St. Louis Car Co. Various types of trucks are used, there being a number of maximum traction type. The latest cars are mounted on du Pont trucks, with four-motor equipments. The double-truck cars have unusually long platforms at the rear end, the platform being divided into three sections by means of two iron pipe railings, a development of the "Detroit" platform. This gives large carrying capacity on the rear platform and at the same time prevents congestion in front of the rear door of the car.

Power for operating the Transit system is generated in four main power houses, all of which have been thoroughly described in previous issues of the "Street Railway Review." Up to the present time the company has been hampered by lack of sufficient power, as it had been relying upon securing most of the additional power required from the new station of the Union Light & Power Co. The completion of this station has been delayed, but it is expected that within the immediate future the Union station will be sufficiently equipped to provide the Transit Co. with power equivalent to 9,000 kw. capacity, which will be enough to meet all demands.

DO your best at all times.—Buzzard's Bay Philosophy.

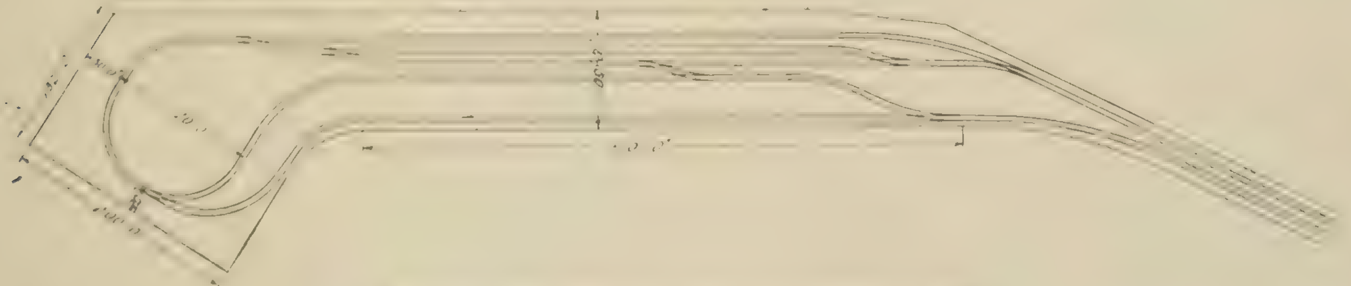
Exposition Preparations Made by the St. Louis & Suburban System.

BY J. C. CASSELMAN, CHIEF CLERK, ST. LOUIS & SUBURBAN RAILWAY CO.

The extensive preparations commenced last fall by the Suburban Railway System have been about completed and this system is now more than able to take care of its share of the crowds expected at the World's Fair in the near future. With its 195 cars of the latest type the company will be able to give a minute schedule service to the Fair Grounds or two cars to every block in the down-town district, and a very good service and one sufficient to meet the demands will be given on the various county lines. The company's standard car has seats for 52 persons. The cars were built by the St. Louis Car Co. and have cane cross seats with reversible backs, large windows and 12 mirrors along the sides. They are equipped with air brakes and have Westinghouse and General Electric equipment, four motors to a car. The cars are of very substantial build, the total weight of each being about 40,000 lbs.

The main line of the Suburban System extends from 4th and Elm, along Fourth St. to Locust, to 13th St., to Lucas, to 14th, to Washington, to Leffingwell, to Franklin, to Grand, to Morgan, to 4000 Morgan, thence over private right of way through to DeHodiamont and the Suburban Garden. The track is all newly laid, the city district being laid with 9-in. girder rail up to the private right of way, and from there to the Suburban Garden the rail is 80-lb. T section, the line being double track throughout. The main junction point or point of transfer is at Sarah St. where the cars go to the Meramec Division and O'Fallon Park Division. O'Fallon Park is almost directly north from Sarah St. Junction which is on the private right of way between Morgan St. and West Belle. The Meramec Highlands and Maplewood Division cars go south from Sarah St. Junction along Sarah St. to Manchester Ave., then west on Manchester Ave. through Benton and several other small suburbs until they reach Maplewood. West of Maplewood is what is known as the Meramec Highlands Division. The larger portion of this division is private right of way, extending through Edgebrook, Old Orchard, Webster, Cheltenham, Kirkwood and to Meramec Highlands. Meramec Highlands cars go direct to town or the World's Fair every eight minutes.

Sarah St. and Manchester Ave. have been newly laid with 9-in. girder rail. The distance from Meramec Highland to 4th and Elm is 18 miles. Numerous hotel accommodations can be had along the line and there is a first class hotel located at Meramec Highlands, which is considered the prettiest spot in St. Louis County.



SUBURBAN LOOP DE BALIVIERE AND LINDELL AVES.

The next junction point is at Fairmount Ave., where the cars branch off of the main line to the main entrance of the Fair Grounds, the cars going along Union Ave. to the main entrance loop. This loop is on what is known as the Catlin tract, and it is the nearest street car terminal to the main entrance of the Exposition. Numerous tracks or side branches extend from this loop or rather are enclosed within the loop to give ample room for storing cars to meet the heavy demands at certain hours. A sketch of the loop is given herewith.

The Union Ave. junction point with the main line is very close to Fairmount Avenue one block westwardly, and the cars going south on Union Ave. take the main entrance loop. Going north these cars go as far as the Union Jockey Club race track, the cemeteries and Walnut Park.

The next junction point from the main line is at Maple Ave. Cars going to the Skinker or Administration entrance loop leave the main line or private right of way at Maple Ave., go west to 66th St. and from there directly south to the Fair Grounds. These cars run direct from the city to the loop without transfer and from it visitors enter the Fair Grounds at the west end of the Pike or where the Pike and foreign buildings are located.

MAP OF THE ST. LOUIS & SUBURBAN RY.

The B. C. & St. L. division also branches from Maple Ave., passing the World's Fair Grounds at the "Convention" entrance. This branch extends through Clayton, Brentwood, and along this line is located the St. Louis Country Club and the County Court of St. Louis County. The road is single track from Brentwood through Webster to Kirkwood where it connects with the Meramec Highlands division. From this branch the World's Fair can be reached also via Log Cabin branch at Clayton to the Filipino entrance or via Forest Park to the Agricultural entrance on the south side of the Fair Grounds. This gives the Suburban System five entrances to the World's Fair Grounds, namely: Main entrance, extending from Union Ave.; Skinker or Administration loop entrance, via DeHodiamont and Maple Ave.; Convention entrance, reached by the County divisions and also via DeHodiamont and Maple Ave.; Filipino entrance, at Torrence Road, via the Log Cabin line; and the Agricultural entrance via the Forest Park division. The Forest Park division connects with the Chouteau Ave. lines of the St. Louis Transit Co. at West End Heights. The Chouteau Ave. lines go direct to the city.

There is one more junction point on the Suburban System, at Suburban Garden, located in the extreme west end of the city, where cars connect with the Ferguson and Florissant divisions. These divisions extend out into the county for about 10 miles through some rich Missouri farm lands. Normandy, Pine Lawn, Kinloch, Florissant and Ferguson are reached by this division. Florissant, formerly known as St. Ferdinand, was the original French settlement and was incorporated as a city long before St. Louis. It plays an important part in the early French history of the Louisiana territory. It is located in Florissant valley, which is noted for its rich soil and large productions of wheat, corn, and fruit.

Suburban Garden is a modern summer resort, the chief attraction being high class vaudeville and an electric fountain.

The general offices of the company are located at DeHodiamont, about one block north of Maple Ave., where the transfers are made to the county lines going to Webster, Brentwood, Kirkwood, Meramec Highlands and Clayton. The cars going to Skinker loop or Administration entrance also pass here, but these cars go through and it is not necessary for the passengers to transfer. At this point is also located the main power station.

The power for the system is furnished from one power station, direct current being generated for the central district or lines within a radius of five or six miles of the plant, while for the outer division the current is transmitted as high tension, alternating, to

SUBURBAN LOOP, SKINKER ROAD.

transformer stations where it is transformed to direct current and stepped down to the proper voltage.

The power station is equipped with the following engines: Two single Hamilton-Corliss engines and one single Allis-Chalmers engine, all direct connected to 800-kw. General Electric direct current generators; one cross compound engine made by the Fulton Iron Works, direct connected to one 1,200-kw. General Electric alternator; two Allis-Chalmers cross compound engines, connected to same style alternator; one Hamilton engine belt connected to two 300-kw. General Electric alternating current generators; two Allis-Chalmers engines direct connected to 800-kw. General Electric direct current generators. The Suburban System was one of the first roads in the west to transmit power by alternating current and at present is the only electric railway in St. Louis producing this character of current. The alternating current, 6,600 volts, is sent over the high-tension lines to the sub-stations which are equipped with five 600-kw. General Electric rotary converters. The boilers are of O'Brien make, 600 h. p. capacity, water-tube feed boilers, equipped with Jones underfeed stokers.

The pumping equipment comprises six Worthington plunger pumps which feed the city water through five pressure heaters manufactured by the Goubert Manufacturing Co., of New York. Steam heaters and piping are of recent construction.

The car barn which was destroyed by fire in February, 1903, has been rebuilt, and is entirely fireproof, with 12 entrance tracks. The barn is divided into sections with fireproof walls, and has a capacity for over 100 cars. The special work leading into the barn is so arranged that cars leaving and entering can branch off onto any one of the 12 tracks connected with the main line.

The various divisions of the line are being connected with the main office by Kinloch telephones; the loops at the Fair grounds and the principal stations and thoroughfares along the line will be equipped with these telephones, thereby enabling the operating department to keep in touch with the movement of all cars. The work will be completed before July 1st and the company will then have 45 telephones at different points on the system. These telephones will also be connected with the regular public Kinloch telephones.

June 2nd a Kent-Ravenna car of the Northern Ohio Traction & Light Co. jumped the track on a long hill and collided with a car on the other track, damaging both cars and injuring four persons, one fatally.

Notes from Foreign Commissioners.

China.

BY FRANCIS A. CARL, VICE-COMMISSIONER FROM CHINA.

The electric railway has not yet entered China, as when the writer left at the beginning of the present year not a single mile of electric railway was in operation. The opportunities for future development, however, are very great, and I believe that the next ten years will bring about wonderful changes in China. As electric railways have proved their usefulness elsewhere, there is no reason why they should not also succeed there. The field is virgin soil and the harvest should be rich for any company with sufficient enterprise and capital to tide over the first few years during which the ground is being prepared. Cities like Peking, Tientsin, Shanghai, Hankow and Canton could easily support street railways, but whether franchises could be obtained is a question which the writer cannot answer. The matter is well worth investigation by American capitalists, who are the acknowledged leaders of the world in electric railway development.

Electric Tramways in Ceylon.

BY STANLEY BOIS, COMMISSIONER-GENERAL FOR CEYLON

Ceylon has one electric trolley system, established in its capital city, Colombo, eight years ago. It is owned by the Colombo Electric Tramways & Lighting Company, Limited. The whole of the equipment for the cars, and the generators, were supplied from the United States. At present the line consists of two routes, each 3½ miles in length, from the vicinity of the harbor to the north and the east. The municipal council now has before it an application from the company to be allowed to link up these lines at their outer ends. Another line to serve the south part of the city may be proposed in a year or two. The service is from 6 a. m. to 11 p. m. at five-minute intervals, with a daily average number of passengers of 25,000. The charges are according to distance, and are small, as the traffic is almost entirely native. The enterprise is, however, a paying one. The power house has five generators, two alternators and one motor-alternator. The alternator plant is for lights and fans in the public buildings, mercantile offices and hotels. A small power station for electric lighting, previously erected in the Fort (the European center), obtains its power from the main station.

Costa Rica.

BY MANUEL GONZALEZ, COMMISSIONER-GENERAL FROM COSTA RICA TO THE LOUISIANA PURCHASE EXPOSITION.

The republic of Costa Rica is crossed by the interoceanic railroad and has not further developed a railroad system. The capital city, San Jose, which is situated near the center of the republic, has an electric railway with suburban lines extending to some of the more important nearby villages. While electric railways have not been developed, the topography of the country, which is to a great extent mountainous, makes it a desirable field, as there are numerous waterfalls that would provide a constant and cheap source of power. At the present time there are 303 coffee mills, 149 of which employ animal power, 85 steam, 68 water power and one electricity. In the banana fields, which have in the aggregate under cultivation more than 70,000 acres, there is not a single farm that can avail itself of electric transportation to reach the shipping points. There are some 5,000,000 bunches of bananas shipped annually.

The industrial impulse which it is expected that Costa Rica will receive in consequence of the Panama Canal would insure the opening of numerous industries which as yet are unexploited. Among the resources of the country are mines, and forests, and extensive fields of particularly fertile soil, to the development of which electric tramways would be almost absolutely necessary.

Another point that should not be overlooked is that the highways are very expensive to build and difficult to maintain in good condition because of the soil and water conditions. With electrical transportation the rich natural resources of the country would be made available, commerce and agriculture both receiving an extraordinary impetus.

The Republic of Costa Rica is advantageously located, geographically, being an equal distance from North and South America. The people love peace and the country is not entangled with her neighbors nor disturbed by revolutions at home. In the soil lands and forests lie wonderful treasures which are waiting only for capital and labor to become valuable. The country is healthful and hospitable.

The government is fully disposed to concede ample and generous concessions to individuals or to companies which will establish electric railways in the country, and investors from abroad may be sure of a hearty welcome and magnificent financial results.

Street Railway Systems of Buenos Aires.

BY GUILLERMO A. PUENTE, MEMBER NATIONAL COMMISSION OF ARGENTINE REPUBLIC, ST. LOUIS PURCHASE EXPOSITION.

Buenos Aires, capital of the Argentine Republic, has long been know as "the city of trams," there being a line in almost every important street of the central part of the city, which is laid out as a parallelogram, 6 miles north to south by 2½ miles east to west. In this parallelogram there are 26 lines running north and south and 41 lines east and west, many of which are double track. From this central parallelogram eight double-track lines run out to the city limits, a distance in three cases of eight miles. In the course of the next few years all the existing horse traction lines will have been converted to electricity, as those companies whose lines are not actually undergoing conversion have obtained the necessary municipal concession to make the change, the plans having been already approved in some cases.

General Conditions.

The overhead trolley system has been adopted exclusively, the trolley arm being provided with a fixed trolley wheel fork. The swivel trolley fork was in use by one company, La Capital, but after several months' trial it was abandoned.

All trolley wire used is of circular section, figure 8 and other sections not having as yet been tried.

Span wires are of stranded cable, with the exception of the overhead construction of the Anglo Argentino company, which uses solid galvanized iron wire.

In the narrow streets of the central part of the city the span wire is supported from cast iron rosettes fixed to the walls of the houses by bolts set in portland cement, rubber bushings and washers being used to absorb the vibrations caused by the impact of the trolley wheel with the ear of the hanger. Householders are not obliged by law to permit the street car companies to fix these rosettes, but in only a very few cases has the necessary permission been refused; in such cases a tubular iron pole is placed against the wall.

Municipal regulations oblige the companies to protect their trolley wires from falling telephone and telegraph wires by some device. With the exception of the Anglo Argentino all the companies, in fulfillment of this ordinance, have adopted a bare guard wire, placed about 14 in. above the trolley wire; this is insulated from earth.

The Anglo Argentino company uses a continuous strip of creosoted wood in lengths of about 20 ft., joined by a vulcanized rubber sleeve and clamped to the trolley wire by brass clips which almost encircle it; these clips are placed about 5 ft. apart, with an extra one at the end of each length of wood strip. Upon reaching a hanger the wood strips are cut about 3 in. short on either side of the hanger and two insulated wires bridge over it. An objection to this system is a most annoying click, which the trolley wheel makes on passing each clip.

Section insulators are freely used and are bridged by a switch placed in a box on the wall or post, as the case may be, the motormen being provided with keys to enable them to open the boxes and disconnect a faulty section while awaiting the arrival of the emergency tower and repair crew.

The usual magnetic blow-out lightning arresters are in general use.

In those cases where two companies use the same track, parallel trolley wires are strung, fed from their respective power stations, but supported by a common span wire. This arrangement leads to some interesting overhead construction at right angle crossings of, perhaps, a third company, and at curves.

Tubular wrought iron poles with cast iron bases are almost exclusively used, one company only, La Capital, using octagonal wooden poles on its line when well out of the thickly populated part of the city.

The feeder system of the Buenos Aires street car lines is most complete and up to date, being in two cases—those of the Buenos Aires and the Buenos Aires & Belgrano electric companies—underground in their whole extent, The total length of underground feeders used by the street car companies is 39½ miles.

Four distinct systems of cable laying are in use, namely: Vitrified clay conduit with drawn in, lead covered cables; steel armored cables laid in loose sand and bricks; creosoted wood conduit, and cast iron pipes with lead joints.

The Buenos Aires & Belgrano company has also a complete telephone system, with a call station in each feeder pillar. Negative feeders in connection with negative boosters are also employed.

The Anglo Argentino company uses a heavy trolley wire strung parallel to the trolley wire proper as a feeder, taps being taken at intervals. This system is only used in the comparatively sparsely populated districts. In the central section of the city subterranean feeders alone are used. A solid copper conductor used as a feeder is a great deal less unsightly than a thick, insulated, heavy cable hanging in festoons from pole to pole.

Track.

Groove rails are used exclusively, municipal regulations not permitting the use of rails of the Vignoles section. The most usual track construction is that of a continuous concrete beam upon which the rails rest, a perfect bearing being made by grouting with portland cement. The usual fish plates are generally used, but a considerable extent of the track of the Buenos Aires & Belgrano company is cast welded. None of the patent joints have so far been used. Track laid on "quebracho colorado" sleepers has given excellent results.

"Quebracho colorado" is a tree belonging to the order "anarcardicæ" and is to be found in large quanties in several districts of the Republic. Of its several excellent qualities that of its perfect preservation from decay when placed under ground is the most salient. This is principally due to the high percentage of tannin it contains, the core or heart ranging from 19 to 22 per cent. Its weight per cubic meter varies from 1,282 to 1,392 kilograms. Track laid with this wood has been in use for 15 years under heavy traffic, and then only some sleepers have had to be renewed, owing to there being no room to bore holes for new dog spikes, the sleepers on removal from the track being in first-class condition as far as preservation is concerned.

Extra long lengths of rail are not in use, due to the difficulty of trans-Atlantic transportation. Joints are in some cases staggered.

The Anglo Argentino company uses exclusively double tongue switches, and the results are being watched with interest, as accumulation of mud and street refuse in the tongue rod connection box requires constant removal. Electrically operated switches are not used.

All special work and crossings are either made in the workshops of the companies or by local firms.

Rolling Stock.

Several types of cars are in daily use in the streets, mounted on single trucks, bogie and maximum traction types, the wheel base having to be very short on the single trucks to enable them to take the sharp curves which the narrow streets of the central section of the city render unavoidable.

The car bodies are of the latest types of American manufacture, of the convertible, double-deck type known as "Imperial"; open cars, closed cars, and several parlor cars most handsomely equipped. Trail cars are permitted during the hours of heavy traffic.

All cars are provided with controllers at both ends. The electromagnetic brake, in addition to the usual hand brake, is in general use by all the companies, with one exception, La Capital, its cars being fitted with an efficient ratchet brake only. Pneumatic brakes have not been introduced. All trail cars are fitted with electromagnetic brakes, operated from the motor car.

One type of ticket is in use on the cars of all the companies, namely, the "Providence," it having obtained the approval of the municipal authorities. The street cars are operated on the English system; that is, they "run on the left," and stops are only permitted on the far side of street crossings.

Special workmen's cars are run morning and evening, the fare being one-half the usual rate. Fare registers have not been introduced, a ticket being issued by the conductor to each passenger upon payment of his fare. The tickets are printed on rolls and are contained in aluminum ticket machines.

International Electric Congress.

The preliminary program for Section B (that on General Applications) of the International Electrical Congress of St. Louis, provides for the following papers:

Prof. E. Arnold, "Direct-Current Commutation."

Dr. O. S. Bragstad, "Compensated Alternators."

Col. R. E. Crompton, "Standardization of Dynamo-Electric Machinery and Apparatus."

M. Andre Blondel, "Calcul des Alternateurs."

Profs. Drs. Elster and Geitel, "Uber die Natürliche Radioactivität der Atmosphare und des Erdbodens."

Herr. C. Feldmann, "The Distribution of Voltage and Current in Closed Conducting Networks."

M. A. Heyland, "Self-Regulating and Compounded Synchronous Machines."

W. M. Mordey. To be announced.

A. Nodon, "Rectifiers."

Sir W. Preece, "Electricity in Ancient Egypt."

Prof. C. A. Adams, "Magnetic Leakage in Alternating-Current Machinery."

Mr. C. Day, "Electric Motors in Shop Service."

Mr. J. W. Esterline, "Carrying Capacity of Cables and Conductors."

Mr. H. W. Fisher, "Sparking Distances Corresponding to Different Voltages."

Prof. H. J. Ryan, "The Design of Insulators."

Mr. D. B. Rushmore, "The Regulation of Alternators."

Prof. E. B. Rosa, "The Influence of Wave Shape Upon Alternating-Current Meter Indications."

Dr. Clayton H. Sharp, "The Equipment of a Commercial Testing Laboratory."

Prof. H. B. Smith, "Very High Voltage Transformers."

Prof. C. P. Steinmetz is chairman of Section B and the secretary is Prof. Samuel Sheldon. The program for Section A (on "Theory") was published in the "Review" for April.

Single Deck Cars in Newcastle, Eng.

M. A. E. Le Rossignol, general manager and engineer of the Newcastle Corporation Tramways, in a paper before the Association of Municipal and County Engineers, gives his experience with single deck cars as follows:

There are several types of cars in use; single-deck cars having to be adopted at first because of the existence of several bridges which prevented double-deck cars being used. The height under these bridges has now been increased, to admit double-deck cars, by lowering the road; but the single-deck bogie cars, of which sixty were originally ordered, are in very great favor with the traveling public, who find them convenient to get into and easy in riding. These all have an open portion at each end, in which smoking is permitted; the only drawback being, from the smokers' point of view, that ladies frequently occupy these seats in the summer-time to the exclusion of the smokers. These bogie cars are 40 ft. in length, with 15-ft. bogie centers, each bogie having equal-sized wheels of 31-in. diameter. And there are, in addition, twenty-two bogie cars of the same length, which have been built by the department with double decks, and carry 102 passengers, these cars being principally used for meeting heavy rush traffic at any time.

The single-deck bogie cars have two motors of 30 horse-power each, and the double-deck bogie cars four motors of smaller size. The remainder of the rolling stock consists of four-wheel cars, a few of these being single deck, and over eighty being double deck, of the standard type, driven by two motors. The department is now building its own cars, at the car works, at Byker.

Electric Traction by Monophase Current.

BY ENRICO BIGNAMI

It is recognized that none of the systems for substituting electricity as the motive power on steam railroads has been generally accepted. One of the reasons is that any such substitutions must be made gradually without deranging the existing traffic. Any plans to be accepted must preserve the structure of the road, the organization of the service and the rolling stock, excepting the locomotive, to such a degree that both steam and electricity may be used during the transition period. The most difficult point in all systems of electric traction is considered to be the means of supplying

FIG. 1 400-H. P. LOCOMOTIVE

current to the train. The system developed by the Maschinenfabrik, of Oerlikon, near Zurich, Switzerland, has been designed to meet the conditions mentioned, and it is believed will facilitate the adoption of electricity on steam roads.

This system contemplates the use of monophase current at a high potential. The installation consists of two principal parts; first, the equipment placed upon the locomotive or car by means of which monophase current at a high potential is first transformed to continuous current and utilized for driving motors, and second, the mechanism for taking current from overhead lines and the return

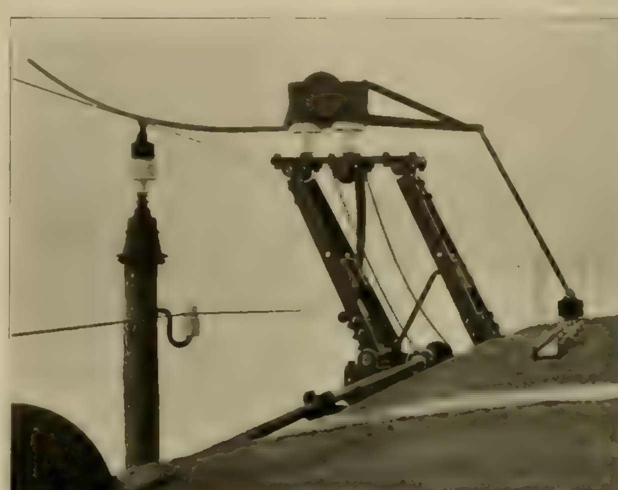


FIG. 2.

conduit. The system of taking the current from the line to the car may of course be applied independent of the type of car equipment.

The locomotive described here is an experimental one, to show the applicability of the system; that is, the employment of high potential monophase current supplied by an overhead conductor. The locomotive shown in Fig. 1 has four axles and is equipped with two motors. In the middle of the platform is a motor-generator unit.

The high potential trolley is mounted on one side of the car and the low potential trolley for use in stations, in streets, or elsewhere where the high potential current is prohibited, may be placed where most convenient. The locomotive is of 400 h. p. capacity and designed for a speed of 60 kilometers per hour. The arrangement of the mechanism and cab are such as to permit two locomotives to be coupled together, and the controlling apparatus is designed

FIG. 3.

to permit operations from the cab of either locomotive by one man only.

The motor generator consists of a monophase induction motor mounted upon the same shaft with a continuous current generator. The motors for driving the car are of the four-pole type, driving the axles through gearing. For speeds above 60 kilometers per hour a design dispensing with gearing has been brought out.

The current supply is through a single wire or several wires, not insulated, except from the ground. It is, therefore, easy to employ potentials as great as 15,000 volts without having to consider the problem of insulating nearby circuits, as is the case with three-phase work. This permits of cheap construction and diminishes losses.

The contact portion trolley, which is the design of Herr Herzog, consists of a convex rod, the convexity being towards the conductor.

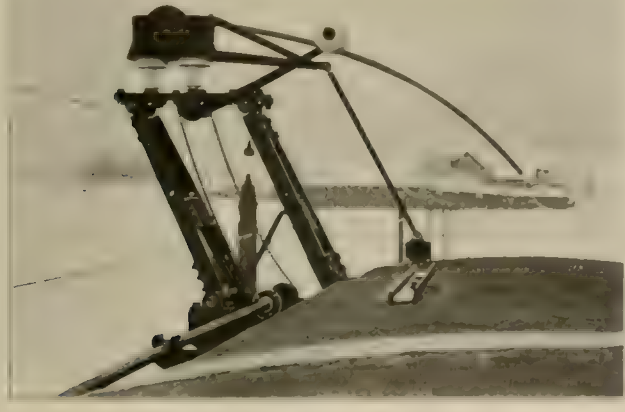


FIG. 4—TROLLEY OUT OF SERVICE.

This rod is pivoted so that it is free to turn in a plane normal to the direction of the car, the supporting axles being mounted in the insulated bearings. The position of this point, about which this contact rod turns, may be varied laterally or vertically by means of the mechanism shown, which mechanism may be operated by hand or mechanically. The illustrations show several views of this trolley, from which the construction and principle of operation are readily apparent. Fig. 2 shows the position of the trolley in contact with the upper surface of the conductor, such as would be the ordinary construction of the line. Fig. 3 illustrates the position taking current from the under side of the trolley wire. Fig. 4 shows the trolley out of service.

An examination of the design shows that it is practically impossible for this device to leave the wire, as after any derangement it again automatically adjusts itself. It is adapted to any form of line construction desired, being equally applicable for use with the conductor supported over the center of the car or at the side. The flexibility of the support and the small mass make negligible the effect of shocks on the line construction. The car may be run in either direction without changing the trolley adjustment. The locomotive is furnished with two trolleys fixed some meters apart.

The disposition of the line at the side of the track and its single polarity permit the installation of two wires over a single track. One of these would serve for the normal service and the other would act as a reserve or could be used as a return circuit in case both returns were damaged at the same time.

The insulation of the line wires is designed for 30,000 volts. The line is placed about 16 ft. above the rail. As already described, the trolley permits such disposition of the overhead line as is necessary to meet the conditions found in tunnels, bridges, crossings, etc., where it is impracticable to place the lines at the side of the road.

On double track roads a single wire would be placed over each track, and either of these would supply current to the cars on both tracks in case of emergency. The return circuit is transmitted by a copper wire which is placed under the upper flange of one of the rails on the inner side.

Mansfield Railway, Light & Power Co.

The Mansfield Railway, Light & Power Co., of Mansfield, O., owns and operates the local electric light and street railway system, and also the electric interurban to Shelby and Shelby Junction, about 12 miles distant. The street railway system comprises 9 miles and serves the principal streets of this enterprising little city. Mansfield is the seat of Richmond County, and both it and Shelby are manufacturing centers.

Mansfield was founded in 1812 and has had a continuous growth. It is served by the main lines of the Pittsburgh, Fort Wayne & Chicago, the Erie and the Baltimore & Ohio railroads, and also the Toledo Walhounding branch of the Pennsylvania Lines. The principal articles extensively manufactured are boilers, pumps, electrical machinery and agricultural implements. The Ohio Brass Co. is among the leading factories. The city has handsome residences, substantial business blocks, 22 miles of paved streets, has good sewerage and has a water supply. Shelby and Shelby Junction are served by the Baltimore & Ohio and Big Four Railroads. They are well laid out with paved streets, sewers, city water and electric light. The principal industries are the manufacture of steel tubing, incandescent lamps, furniture, automobiles and stoves.

The total population now served by the railway is safely estimated at over 27,000. The present company is a consolidation of smaller interests. Since the consolidation, Messrs. H. M. Byllesby & Co., of Chicago, have been in charge of the property as consulting and managing engineers and extensive improvements were started as soon as they had taken hold of the situation.

The rolling stock first received attention and ten new cars were purchased. These have 28-ft. bodies with 5-ft. platforms on each end, measuring 38 ft. over bumpers. They are double vestibuled, of Brill manufacture with Brill trucks, and equipped with four No. 49 Westinghouse motors.

This new equipment has filled a long felt want and the road can now take care of the traffic during the rush hours without difficulty. Besides these cars, the company operates 10 open summer cars and 6 closed single truck cars. The interurban cars including that used for express and freight car are equipped with Christensen air brakes.

The tracks, wherever laid with rails of light section, are being rebuilt with heavier rails. So far the Park Ave. line has been relaid with 70-lb. T rails laid on 6 x 8 x 80-in. white oak ties spaced 2 ft. from center to center. The ballast used is crushed macadam of which 8 in. has been placed under the ties. New Atlas rail joints and Ohio Brass Co's. protected bonds have been used in connec-

tion with this work. Besides this part of the system, several other sections have been rebuilt in the same manner and further improvements will be made this summer. Amongst these figures prominently the rebuilding and double tracking of Main St. over which all the three city and interurban lines jointly run, and which forms the main artery of travel in Mansfield.

By means of three diamond turnouts and well arranged schedules the travel is handled over this stretch of track, but it necessitates the periodical accumulation of cars at the transfer point, which being located in the middle of an 8 per cent grade, puts a very fluctuating demand on the power station. For this reason the double tracking is considered the only way of remedying this trouble.

The new management also intends to rebuild all crossings over waterways on the Shelby interurban with substantial steel and concrete structures and to raise the grade of this division at various points above high water mark. This interurban brings the city of Mansfield in touch with the main line of the Big Four at Shelby and the company derives a very handsome income from the travel between the two towns.

The power station contains at present three engines, one 20 x 36-in. Allis-Corliss, one 16 and 36 x 42 tandem Cooper-Corliss and one 20 and 40 x 48 Bates cross compound corliss engine. The generator equipment consists of three 300-kw. 600-volt Card generators and one 100-kw. Card railway booster, two 250-kw. Warren alternators and one 225-kw. Westinghouse 2 phase generator for the

NEW PASSENGER CAR.
COOLING TOWER AND NEW OIL AND MOTOR HOUSE.
INTERURBAN CAR.

FREIGHT AND EXPRESS CAR.
VIEW ON PARK AVE.
OLD CITY CAR.

lighting load, and a separate machine for the company's 500 volt power circuit.

The boiler plant, which is located on the west side of the engine room on a B. & O. siding, contains one 500-h. p. and four 250-h. p. Aultman-Taylor boilers. They are at present operated at a pressure of 150 lb. per sq. in., and are, during the summer months, fired with natural gas.

A Stilwell-Bierce surface condenser with 4,000 sq. ft. of surface is installed. Condensing water is taken from a nearby creek and cooled with a Stilwell-Bierce cooling tower which has been erected outside of the power station. Most of the piping had to be changed while the plant was kept in operation. It is the intention of the engineers to remodel the installation of the entire plant and bring it to the highest standard in engineering practice. The company has recently secured the city lighting contract, for which a series arc system has been installed, and which will be put in operation July 1st.

The directors of the company are: H. M. Byllesby, president; Arthur S. Huey, vice-president; W. D. Breed, of Cincinnati, secretary and treasurer, and Leopold and Rudolph Kleybolte, of Cincinnati. F. W. Raber is local general manager of the property, and Emil C. Braun, engineer in charge for H. M. Byllesby & Co.

The accompanying illustrations show the new equipment in comparison with the old, also one of the Shelby interurban cars, and some views of the newly erected cooling house.

The Three-Phase Tramway from Schwyz to Seewen.

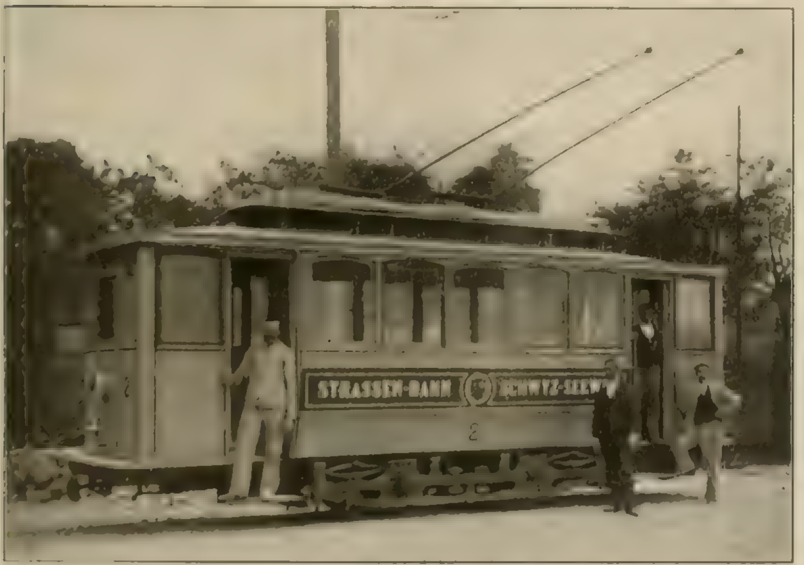
BY E. GUARINI.

This recently constructed line is of special interest not only because it is the second of the Swiss railways which is operated directly by three-phase current without previous transformation to continuous current, but also because of the numerous technical problems hitherto unsolved which have here received a solution, perhaps not final but certainly original and satisfactory. The line is 1,875 km. long and there is a difference in level of the two terminal stations of 57½ m. The current is supplied from a hydraulic central station situated at Schwyz, which furnishes current to a dozen neighboring localities. This central station is equipped with four electrical units comprising a Girard turbine with a horizontal shaft, furnished by T. Bells & Co., coupled to an alternating three-phase generator built by Brown, Boveri & Co. The turbines develop 600 h. p. each at 400 r. p. m. The water power is supplied from a branch of the Muota, where there is a fall of 70 m. with a delivery of 3½ cu. m. of water per second. The total available power is 3,000 h. p.

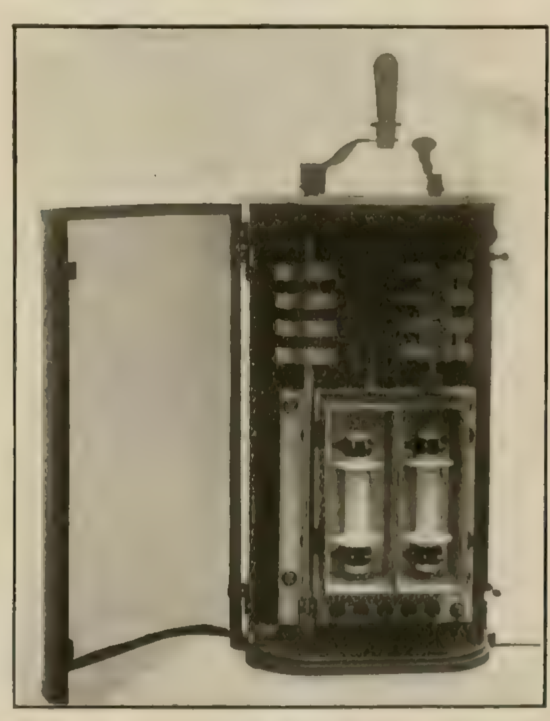
The turbines are coupled directly to the alternators and the latter generates 40 amperes at 8,000 volts with a frequency of 40 periods per second. They are of the revolving pole type with stationary armature. The winding of the armature is designed so that the triphase alternator can also operate as a monophase alternator at full load. The monophase current is employed for lighting and the triphase current for power. The peripheral speed of the 12-pole rotating element is 40 m. per second.

The exciters are coupled directly to the generators. They absorb 2 per cent of the power of the turbines and furnish a maximum current of 200 amperes at 40 volts. The high tension current is reduced to the working tension in a sub-station situated close to the center of the line. This sub-station is divided into two stories. The upper story is used for the introduction and wiring of the high tension circuit and for the outgoing wires of the low tension circuit. The lower story contains four alternating current transformers of 20 kw. capacity. Their ratio of transformation is from 7,600 to 550 volts. One of these transformers is held for a reserve. The elevation of temperature for a continuous run does not exceed 40° C. As the track is used for the return circuit one phase of the secondary is connected to the rails. The overhead trolley circuit consists of two copper wires insulated from each other and generally suspended from flexible brackets. On curves and crossings these lines are suspended from span wires by flexible attachments. The poles are mostly of wood and are spaced 30 m. apart. An interesting novelty in the construction of the overhead trolley wire is the arrangement for switching. Up to the present time there has always been serious difficulty presented in providing switching arrangements for an overhead two-pole line. The new system consists practically of two single phase overhead switches mounted side by side, carefully insulated from each other.

For bonding, the surfaces of contact of the rail and of the bonds were thoroughly cleaned and covered with a metallic paste of good conductivity. By the tightening of the bolts a good metallic union is obtained between the joints. From the many experiments made with this system it appears to be at least equally as good as bonds of copper wire. For making the two rails act equally as conductors for the return circuit cross bonds have been placed 60 m. apart, these bonds being of copper wire 8 mm. diameter, bolted to the rail.



MOTOR CAR, SCHWYZ-SEEWEN RY.



CONTROLLER

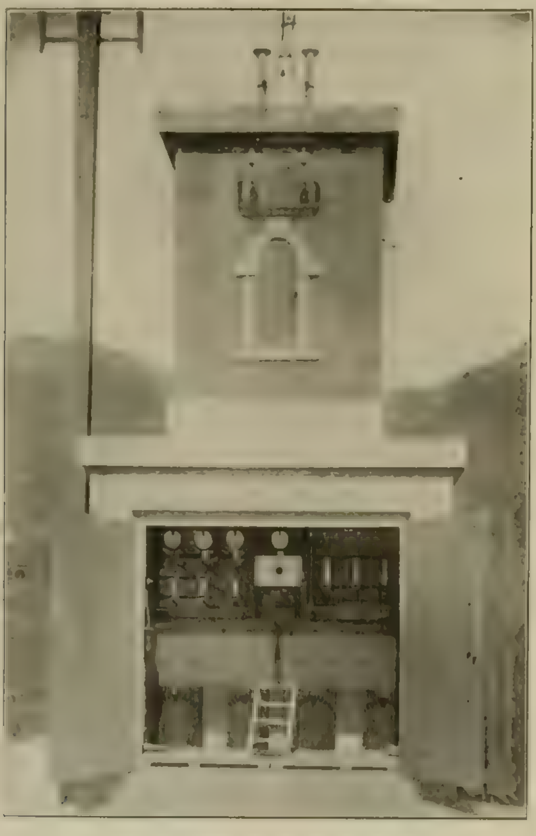
Each car is equipped with two triphase motors which develop from 20 to 25 h. p. at 400 r. p. m. with a current of 500 volts and 40 periods per second. The diameter of the bore of the 12 poles is 452.5 mm. and that of the rotor 450 mm., giving an air gap of 2.5

mm. The voltage of the stator is 500 and that of the rotor 110 volts. The total weight of each motor is 840 kg. The motors are constructed in such a manner that the motor cars can mount the maximum grades at normal voltage without any increase in the voltage of the current, while carrying a full complement of passengers. Tests were made on a car which made a run of 83 km. with about 2-3 full load to determine the rise in temperature of the motors. The temperature at the interior of one motor was

CAR RESISTANCE

46° and of the other 40°, the temperature of the atmosphere being 22°. The diameter of the wheels is 800 mm.

For lighting each car is provided with a transformer which reduces the tension of the 500-volt current to 100 volts. The lamps are in parallel. The starting resistances are placed under the car and are operated from the controller by means of a chain gear. There are two controllers on each car which resemble in exterior appearance those of continuous current equipments. Fuses are



TRANSFORMER SUB-STATION

placed so as to be easily accessible and there is a circuit breaker mounted alongside of the controller.

The rolling stock comprises three motor cars of which, however, but one at a time is generally in service. The cars seat 16 passengers and there is standing room for 18. Their length over all is 7.39 m. The weight of the cars is 6.3 tons each, and that of the electrical equipment 3.2 tons, giving a total weight of 9.5 tons. It has been found that in making the up-grade trip the speed is 16 km. and on the down-grade trip 17.5 km. per hour.

Chicago Union Traction.

May 28th Judge Grosscup and Judge Jenkins, sitting in the United States Circuit Court, rendered their decision as to the validity and scope of the so-called 99-year act. The following paragraph from the court's opinion summarizes the findings:

"To sum up our conclusions in one paragraph, we hold, that as such ordinances as were passed by the city council prior to the counting of the vote at the charter election in 1875 [May 3, 1875], and accepted and acted upon by the railway companies, there exists, between the companies and the city, a contract relation, terminable by neither party without the consent of the other, until the period named in the legislative act expires, but that as to streets occupied under ordinances passed after that date, the contract relation is to be looked for solely in the ordinances themselves. Upon those legal predicates, the status of the particular streets affected is easily ascertainable."

There is now in preparation the formal decree, which will specify the various ordinances affected by the 99-year act. As soon as this is entered, the city will take an appeal to the United States Supreme Court, and a hearing is expected at the October term.

The controversy between the Union Traction and the underlying companies growing out of the application of revenue under the modified leases, is before the court on petition. A hearing will be had June 27th.

The United States Circuit Court of Appeals having ruled that the injunction restraining stockholders from suing in the state courts was erroneously issued, two cases have been brought in the state courts. Of these, the Miller case is set for July 12th and the Townsend case for June 27th.

Practically no progress has been made in the franchise negotiations with the city.

The court has under advisement a petition for the purchase of 100 new cars by the North and West Chicago companies.

Incorporate for East River (N. Y.) Tunnel.

S. Pearson & Son, Incorporated, of New York City, filed certificate of incorporation June 18th to build a tunnel between the boroughs of Manhattan and Queens under the East River. The capital is $1,000,000, and the directors are: E. W. Moir, London, Eng.; George W. Wyckersham, Henry W. Taft, John F. Charlton, Arthur C. Patterson, New York City. Mr. Moir subscribed for 960 of the 10,000 shares.

Again, About the Big Bill.

"The conductor cannot reasonably be expected to carry with him an excessive weight of small change. On the other hand we do not expect passengers to be provided always with the exact change. But we do expect that passengers will tender the conductor something smaller than a $5 bill. How many $5 bills on one trip would exhaust the change that one conductor can carry, do you suppose? Beside that he is too busy a man to make change in large amounts and attend to the demands of his passengers. We ask that this observation be taken to heart in the kindly spirit it is intended."—Extract from Detroit United Weekly, Issued by Detroit United Ry.

Chicago Elevated Traffic.

The South Side Elevated Railroad Co. reported a daily average traffic for May of 83,342, an increase of 458, or .51 per cent. The daily average of the Metropolitan West Side Elevated Railroad Co. for May was 114,372, an increase of 5,042, or 4.61 per cent. The Northwestern Elevated Railroad Co's. daily average was 69,232, an increase of 2,242, or 3.35 per cent. The daily average of the Chicago & Oak Park Elevated Railroad Co. was 41,379 on the main line, a decrease of 1,187, or 2.79 per cent; with transfers the daily average was 42,833, a decrease of 1,183, or 2.68 per cent.

The Birmingham Railway, Light & Power Co. has adopted a sliding scale of wages for conductors and motormen which provides for an increase of from one to five cents per hour, according to length of service.

Inspection and Care of Car Wheels.

BY R. B. STEARNS, SUPERINTENDENT, NORTHWESTERN ELEVATED R. R., CHICAGO.

For nearly four years after the Northwestern Elevated was opened the general policy pursued regarding the care of wheels was to operate them as long as possible before sending them to the shop to have the tires turned down. The road was opened May 31, 1900. At this time the company had 154 cars with 628 pairs of wheels. Later on, from time to time more cars were bought, increasing the number of wheels to 876 pairs. Of these, up to March, 1904, only [illegible] pairs were sent to the shop to be turned.

Investigation of the shop records and examination of the wheels thus turned down led to the conclusion that the policy of waiting until the wheel had become so worn as to fail to pass inspection, before sending it to the shop to be turned down was, in the end, not an economical one. Wheels which have reached the limit of wear allowed for flanges or treads often get into that condition by reason of some cause which might be easily corrected, and the rate of wear reduced. Thus intelligent inspection permits the taking of the "stitch in time" which saves nine. A wheel sent to the shop with a thin flange usually has the flange so thin at the base that in order to get the proper section, not only the edges of the flange but also a portion of the tread must be turned off in the lathe. This, of course, is a waste of the material in the tread, and is a useless waste, because when the cause of abnormal wear is discovered and removed, the wheel when again put in service will wear more evenly.

The inspection system now followed on this road has for its object determination of the condition of the wheels and the location of causes of abnormal wear, and the maintenance of an intelligent and economical system of inspection and records showing the exact conditions as they exist. It is the intention to never let a wheel run so long that it will be necessary to turn down the tread, excepting as may be required occasionally to make the wheel round or remove a flat spot. Wheels on the Northwestern Elevated average for all about 30,000 miles per year. The wheels used under motor cars have cast steel 10-spoke centers 28 in. in diameter with 3-in. "Standard" steel tires of M. C. B. section, made by the Standard Steel Works, Philadelphia. The allowable wear is to 1 in. in thickness, or a total reduction in diameter of 4 in. The motor wheels are put on the axles with 60 tons pressure, and have a ½ x 1 in. key. The axle bearings on the motor trucks are 4¼ x 8 in., the wheel and gear fit being 5½ in. in diameter.

The wheels of the trailer trucks have 25-in., 10-spoke cast steel centers with 3-in. "Standard" steel tires, giving a wheel 31 in. in diameter. These are put on the axles with 30 tons pressure. Axle bearings are 3¼ x 6 in., the wheel fit being 4 in. in diameter.

The sizes given, 34 in. for motor wheels and 31 in. for coach wheels, are the company's present standard. The earlier equipment had smaller motor wheels, 33 in. in diameter and coach wheels [illegible] in. diameter.

A pair of 33-in. motor wheels (driving wheels), taken to the shop on account of a flat spot, after running [illegible] miles, showed a [illegible] in diameter of [illegible] in. after the wheel was turned which equals about 22,600 miles per eighth-inch wear on the tread, or 271,200 miles for the total life of the tire.

A pair of coach wheels put in service June 1, 1900, and taken out Feb. 19, 1904, after having made 105,600 miles, showed a reduction in diameter of 11-16 in. after the tire was turned to the proper section. These wheels had 2½-in. tire, so, assuming a no more rapid wear, the total life of the tire would be 460,800 miles.

Until last year the Northwestern Elevated had no repair shops of its own, the work being done in the shops of the Lake Street Elevated, and the management was desirous of sending out as little work as possible; this was the reason for the practice before mentioned, of operating wheels as long as was practicable before having the tires turned down. Now the company has its own shops and can do repair work more economically, and an entire change in the method of handling wheels has been adopted.

As soon as the company could do the repair work itself a careful investigation of the subject of wheels was made and a system of records and instructions to inspectors formulated. In designing the blanks the idea was to cover only those points which are important and essential to make the records complete and to have the inspection intelligent and yet reasonably inexpensive.

For a running record of wheels and axles a book about 9 in. wide by 14 in. long, containing some 200 pages, was printed, with the column headings as shown in Fig. 1.

NORTHWESTERN ELEVATED RAILROAD CO.

Running Record of Wheels and Axles In and Out of Service.

Car No.	Position of Axle.	Date Out—In.	AXLE. Our No.	AXLE. Condition.	WHEELS. Our No.	WHEELS. Dia.	WHEELS. Thickness Flange.	WHEELS. Tread Wear.	WHEELS. Maker. Name.	WHEELS. Maker. No.	WHEELS. Condition.	REMARKS.
		Out—In.*										

*One of these words stricken out according as the axle is taken out or put in.

FIG. 1.—COLUMN HEADINGS (SIZE OF PAGE 9x14 IN. ABOUT).

Form No. 30

NORTHWESTERN ELEVATED RAILROAD.

WHEELS OUT AND IN.

Car ____ Date ____

	POSITION	OUR AXLE NUMBER	OUR WHEEL NUMBER	CONDITION	REMARKS
REMOVED					
APPLIED					

Signed, ____

FIG. 2. FORM NO. 30.

This record contains a great deal more information regarding the condition of the wheels and axles than was ever before available and yet it is not so elaborate that it will be a burden to keep up.

For reporting the wheels and axles that are taken out and put in, a blank known as Form No. 30, which is 4¼ x 5½ in. is used.

This is reproduced herewith as Fig. 2. These forms are printed on yellow paper and made up in gummed pads of about 50 sheets each. The foreman in charge of the shop turns in daily reports showing just what wheels have been removed, and why. The data are at once copied into the running record book (Fig. 1) and the original report is then filed.

For keeping a record of the condition of the wheels and axles before and after repairs are made, Form No. 31, reproduced here as Fig. 3, is used. This blank is $7\frac{5}{8} \times 4\frac{1}{8}$ in., and is printed on blue paper. After the wheels have been taken out of a car because of some defect, before and after that defect is corrected by turning the tires, or other repairs, the exact dimensions and condition of the wheels and axles, together with our number, the maker's name and number, and other necessary remarks, are entered upon Form 31 (Fig. 3) and turned into the office. The data from these reports are entered in the running record book (Fig. 1) and the original slips filed in regular order. These three forms give all the information required for the complete running record.

Form 32, used for reporting the regular inspection of cars in detail, is shown here as Fig. 4. This report is $8\frac{1}{4} \times 4\frac{3}{8}$ in. with a stub $1\frac{1}{2}$ in. long. This form is bound in books of about 50 pages, the report when filled in being detached on the perforated line and thus leaving the stub in the book as a memorandum for the inspector.

It was originally the intention to inspect cars in this detailed manner at intervals of 30 days until it should be demonstrated that this interval is shorter than necessary. It was very soon found that once in 60 days is sufficiently often for this inspection, and that is the company's present practice.

The following is a copy of a bulletin which embodies the instruction to the mechanical department of the Northwestern Elevated R. R. for the inspection and care of wheels:

The following general rules with special reference to instructions to car inspectors in determining the actual conditions of the steel tired motor and coach truck wheels must be rigidly followed. All employes whose duty brings them in contact with this class of work must supply themselves with the various forms, together with a copy of these instructions and drawings referring to the subject matter below:

1. The Hedley motor truck will be known as truck class "A".
2. The Hedley coach truck will be known as truck class "B".
3. The M. C. B. coach truck will be known as truck class "C".
4. The new M. C. B. motor-trailer truck will be known as truck class "D".
5. On all motor cars the truck at the opposite end from the pump and at the same end as the triple valve shall be known as the No. 1 truck.

The truck at the other end, or same end of the car as the pump, shall be known as the No. 2 truck.

6. On coaches or plain trailer cars the truck at the same end of the car as the triple valve shall be known as the No. 1 truck and the truck at the opposite end of the car shall be known as the No. 2 truck.

CONDITION OF WHEELS AND AXLES BEFORE AND AFTER REPAIRS.

NORTHWESTERN ELEVATED RAILROAD.

Date

	AXLE		WHEELS								REMARKS.
	Our Number	CONDITION	Our Number	Diam.	Thickness Flange	Height Flange	Tread Wear	MAKER Name	MAKER Number	CONDITION	
BEFORE REPAIRS											
AFTER REPAIRS											

SIGNED

FIG. 3—FORM 31 (SIZE OF ORIGINAL $7\frac{1}{2}$X4 IN.)

NORTHWESTERN ELEVATED R. R.

CAR INSPECTOR'S CONDITION REPORT

Car

Date

Inspected by

Form No. 32

NORTHWESTERN ELEVATED R. R.—Car Inspector's Condition Report of Car ________ Date ________

AXLE					WHEELS AND DIMENSIONS						REMARKS
LOCATION	OUR NUMBER	CONDITION	REMARKS Note Wheel and Journal FIT	Diam Journal	Our Number	CONDITION	Diam	Height Flange	Thickness Flange	Tread Wear	

Car

Date

Inspected by

SIGNED

Shop Foreman

CONDITION OF	TRUCK No. 1-CLASS	TRUCK No. 2-CLASS
Truck Frame		
Swing Bolsters and Links		
Center and Side Bearings		
Miscellaneous Remarks		
Air-Brake Apparatus		
General Condition of Car Body		
Miscellaneous Remarks		

FIG. 4—FORM 32.

7. On combination motor-trailer cars the truck at the opposite end of the car from the pump and at the same end as the triple valve shall be known as the No. 1 truck.

The truck at the other end, or the same end of the car as the pump, shall be known as the No. 2 truck.

8. The position of the axle and pair of wheels shall be determined as follows:

The No. 1 position shall be the forward or outside pair of wheels and axle of No. 1 truck.

No. 2 position shall be the rear or inside pair of wheels and axle of No. 1 truck.

No. 3 position shall be the rear or inside pair of wheels and axle of No. 2 truck.

No. 4 position shall be the forward or outside pair of wheels and axle of No. 2 truck.

Every wheel must have its number clearly stamped on the outside of the tire between the limit ot wear and the wheel center fit and immediately below the maker's name and number.

Every axle must have the number clearly stamped on each end, the number to be in line with the number of the wheel located on the end of the axle between the axle center and the number of the wheel, the figure not to be inverted.

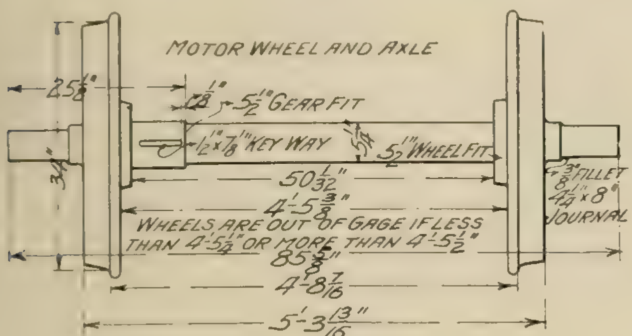


FIG. 5.

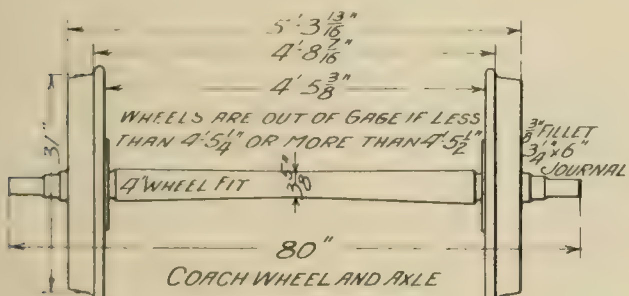


FIG. 6.

The wheel number must be stamped in line and parallel with the circumference.

On Fig. 5 are shown the important dimensions of the motor wheels and axles when new. Fig. 6 shows important dimensions of coach wheels and axles when new.

The distance between backs of tires on all wheels fit for service 4 ft. 5⅜ in. and if this distance is less than 4 ft. 5¼ in. or more than 4 ft. 5½ in. the pair of wheels and axles must not be allowed to go into service.

Fig. 7 shows standard tire for all wheels when new and also gage to determine the thick flange and the application of the gage. Any wheel flange found to measure more than 1 7-16 in. at the completion of the fillet arch should be removed.

Fig. 8 shows the standard tire for all wheels worn to the maximum limit of wear allowable which is ¼ in. outside of groove cut in the side of the tire. When the tire becomes worn to a thickness of 1 in. from the center of the wheel fit to the steel tread it must be removed and condemned.

Should a crack or seam be found in a tire, word must be sent to the foreman's office at once and the car taken out of service.

Fig. 9 shows a Northwestern Elevated Railroad standard gage

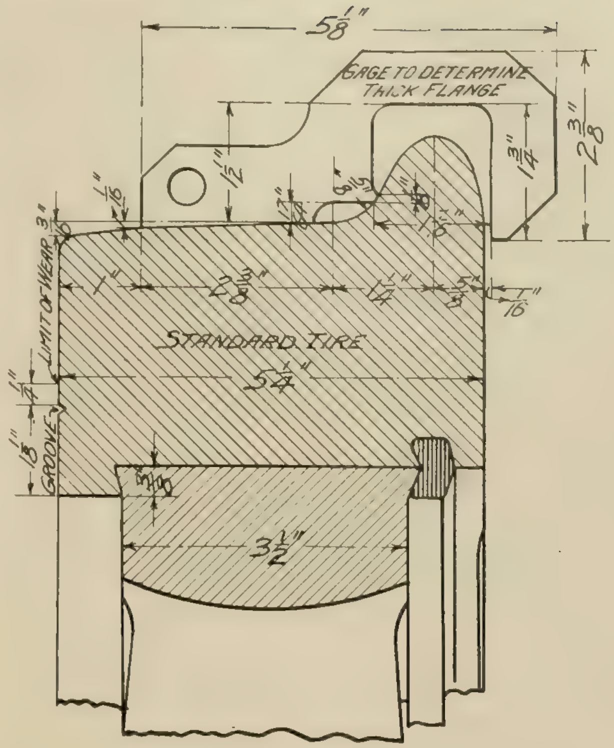


FIG. 7.

to determine flat spots, worn (or thin) flanges, or hollow tread, and is used as shown in Fig. 10 to determine the length of a flat spot which must not exceed 1⅛ in. Fig. 11 shows the application of the gage to determine worn and thin flanges. A straight flange

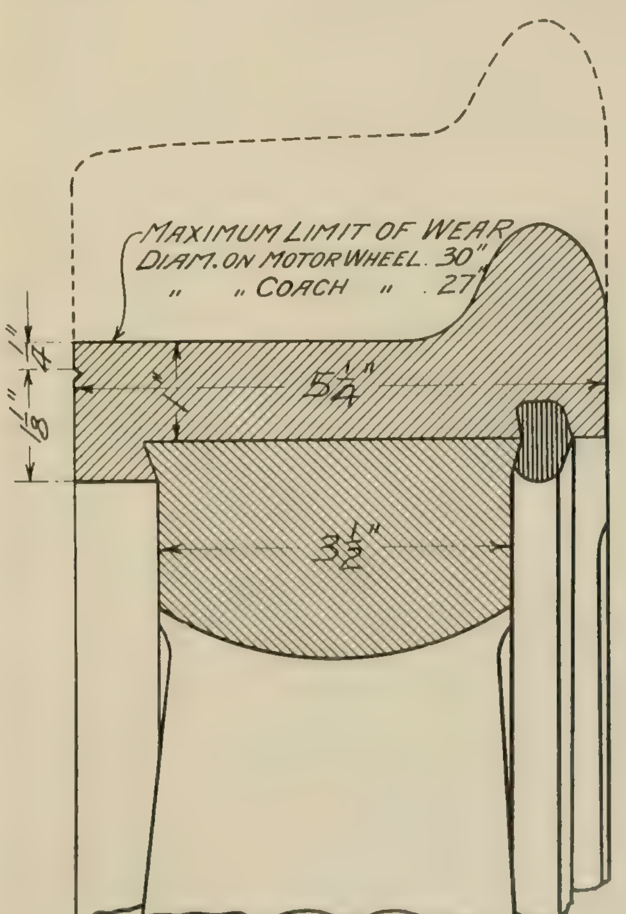


FIG. 8.

of 1 in. or more is sufficient cause to condemn a wheel, which must be removed. Fig. 12 shows the application of the gage to determine a thin flange. When a flange of a wheel wears to 1 in. in thickness it must be condemned and the wheel removed. Fig. 13 shows the application of the gage to determine a hollow worn tread; ¼ in. wear of a tread should be the limit of the tire and it must then be turned if it exceeds this amount.

The dimensions of a motor journal are 4¼ in. diameter by 8 in. long, not including the ⅜ in. fillet at the back.

Motor journals must not be allowed to wear tapered, and when

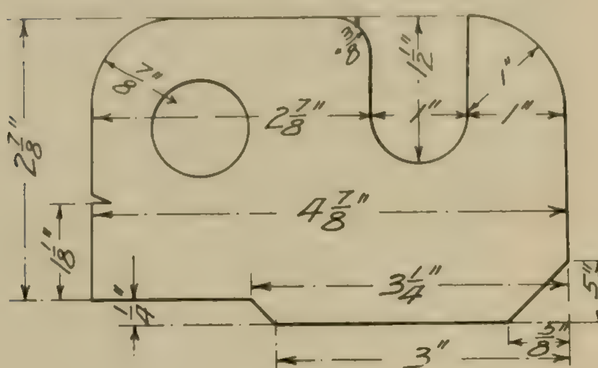


FIG. 9.

the journal is worn to a diameter of 3¾ in. it should be removed and a new axle applied.

The dimensions of a coach journal are 3¼ in. diameter by 6 in. long not including the ⅜ in. fillet at the back.

Coach journals must not be allowed to wear tapered and when a journal is worn to a diameter of 2¾ in. it should be removed and a new axle applied.

If a defect of any kind, whether in running gear, braking apparatus, outside car body or interior of car that would be liable

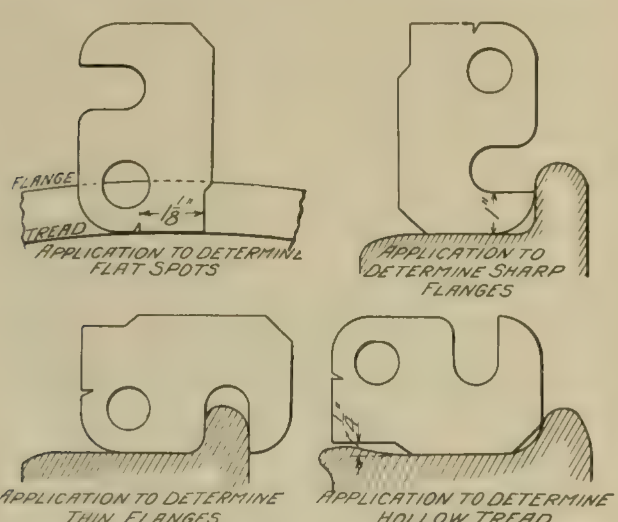


FIG. 10. FIG. 11.
FIG. 12. FIG. 13.

to cause a delay to traffic and possible injury to passengers or employes exists the car must not be allowed to go into service.

Form 30 must be filled out properly and signed when wheels and axles are removed or applied. This form must be turned in on the same day.

Form 31 must be filled out properly and signed before and after repairs on all wheels and axles. This form must be turned in on the same day.

Form 32 must be used for the regular inspection of all cars and all the space arranged on the form must be properly filled out from actual measurements and data and properly signed.

The running record will be kept in a printed book showing the record of all wheels and axles in and out from data taken from Forms 30 and 31.

The following data regarding the wear of wheels and the relative efficiency of two kinds of coach brake shoes will be of interest in this connection.

BRAKE SHOE DATA.

	A shoe.	B shoe.
Weight of coach shoe, av.	22.2 lb.	26.2 lb.
Weight of scrap, av.	9.4 lb.	9.4 lb.
Wear of shoe, av.	12.8 lb.	16.8 lb.
Car-miles per shoe	6,307	12,056
Car-miles per lb. wear	493	717
Trailer car-miles per day	10,386	10,386
Weight coach shoes per day	211 lb.	145 lb.
Number of coach shoes per month	285	166

TIRE WEAR.

	A shoe.			B shoe.	
Car miles (5 cars)	12,370	11,055	12,500	15,605	16,185
Tire wear per wheel per shoe, in.	.0664	0703	0703	0781	.1015
Av. tire wear per 1,000 car-miles, in.	.0054	.0059	.0056	.0049	0062
Av. car-miles per year	29,200	29,200	29,200	29,200	29,200
Av. wear per tire per year, inches	1577	1723	1723	.1431	.1810
Av. life of tire for 2 in. loss in diam., brake shoe wear only, years	12.7	11.6	11.6	13.9	11.1
Av. life of tire for 3 in. loss in diam., years	19.0	17.4	17.4	20.9	16.7
Av. car-mile for life of 3-in. tire (brake-shoe wear only)	554,800	508,080	508,080	610,280	487,640

Care of Interurban Cars.

BY H. J. LAKE, MASTER MECHANIC, MUNCIE, HARTFORD & FT. WAYNE RAILWAY CO.

The care of cars used in interurban service is something that is too often overlooked by electric railway managers. They quite often think that a car should never get out of order. As I once heard a general manager, who had formerly been a steam railroad superintendent, say, "An engine will blow out a cylinder head or burst a flue, but a car, that ought not to get out of order." In speaking thus he overlooked the fact that an electric car was both the locomotive and the coach, and should be treated as such. No railroad manager would think of running an engine more than the length of one division, about 150 miles, before it is sent into the shop to be cleaned, oiled and given a general inspection, but on a great many of our electric roads cars are run from 350 to 400 miles every day in the month with but three or four hours' rest out of each 24. What kind of care can be given a car that is in service that length of time and is released only at night?

In the cool weather my cars are in service on alternate days, making from 350 to 400 miles in 21 hours. In this way each car is given a rest of 27 hours in 48, unless in case of emergency it has to go out as an extra. This enables each car to be thoroughly inspected, cleaned and oiled, each alternate day.

During very hot weather I change the cars in the middle of the day, that is, give each crew a fresh car. By this method the motors have a better opportunity to cool and get better care than they could possibly receive in three or four hours at night. I also find that the motors give better results if the commutators are dressed when the cars are not in service. Sanding the commutator while the motor is working causes particles of sand and copper to pass under the brush, roughening it, when it might otherwise have a full, smooth surface. When we sand our commutator we always raise the brushes and cut the motor out of circuit.

The cars are thoroughly cleaned inside and out after each day's run. I use compressed air for blowing out motors and compressors, for cleaning the seat backs, cushions, and on all other parts of the car where a pressure of air is required to start the dust.

The Why and How of Interurban Railways.*

BY GUY MORRISON WALKER.

It should hardly be necessary at this late day to make any extended argument to prove the advantages and necessities of interurban railways. The convenience of their frequent service and its extreme cheapness have wrought such a change in farm life that wherever these interurban roads have been built there can hardly be said to be any country at all, but that the whole region has become transformed into a great though scattering city.

The farmer along the line of one of these roads enjoys at the cost of 15 or 20 minutes in time and a few cents in fare almost every convenience of the dweller in the city. He can go to town for business or pleasure at any hour of the day. His crates of fruit, barrels of vegetables and cans of milk are picked up at his door and landed in the city market within an hour or two of the time that they are taken, fresh. It is easy for his wife to go to town after her morning work is done and like the city housewife return from her marketing and shopping in time to get dinner, and it is no more inconvenient for the farmer and his family to attend the theatre or the opera than it is to any other dweller in the city's suburbs.

In addition to this they place it within the power of the farmer to take advantage of every fluctuation in the price of his farm products and to place those products in the market without delay in time to dispose of them to the best advantage. To the city dwellers these interurban roads make possible the dream of years and they flee from the crowded cities to settle on two, three, or five-acre tracts along the line of these roads, there to enjoy in the midst of their gardens the pure air, the quiet and the healthful conditions of country life.

In thickly populated communities these interurban roads have proved profitable investments to those who have built them while they have increased enormously the value of and demand for the lands through which they have run. As a rule all lands desirably located and within reaching distance of these interurban lines have doubled in value and increases from $50 to $100 per acre in the selling price of farms along these lines is common even where the distance from the city is so great as twenty miles.

But the places where these interurban roads have been profitable have been those old established communities where the land for miles around the central cities has been cut up into small parcels, each with its substantial group of buildings, indicative of a dense and well distributed population, and so able to furnish the traffic necessary to make such an interurban railroad pay.

When interurban railways first began to be built, many such opportunities and localities were found but so rapid has been their development that the ten short years that have elapsed since the first interurban electric railway was built has sufficed to see almost every such opportunity taken and the present time finds almost every community with population and traffic enough to support an interurban railway already supplied with such a service.

Reckless promoters and unthinking investors have built many such lines in communities not yet sufficiently developed to support them and now find that they have made an investment which not only yields them no income but that the traffic in many instances does not yield enough to pay even operating expenses and they are threatened with a loss of their principal.

The advantages of these interurban railways are, however, so great and so apparent that a great many communities are clamoring for their construction through them and are unable to understand why capital does not find their particular locality an attractive place for investment by giving them the service of such a railway.

Such communities, however, usually recognize their need of transportation facilities, particularly such as is furnished by these interurban railways. They know that much of the value of their present product is consumed by their present slow and expensive methods of reaching the markets, that their farms remain large because their products must be limited to those staples which can be placed in market without deterioration and that the higher values which come from intensive farming and the cutting up of their large farms into small tracts cannot be secured until their lands can be made accessible and the products of this intensive farming be made transferable to market at a cost that shall not consume the value of the products in transportation. It is plain to be seen that intensive or higher farming and the cutting up of large tracts into small farms cannot come before the furnishing of the kind of transportation facilities that makes these things possible.

The fact that the first interurban roads were built in good territory and consequently were profitable investments, created the impression that these roads would prove good investments anywhere, but the experience of ten years of extremely careless promotion and construction has resulted in effectually effacing any such idea and many roads which have found themselves built in a territory of large farms and thin population have been forced to go into the hands of receivers and be re-organized with great loss to the original promoters and investors in them.

If therefore a group of property owners or a community desires to secure the service of an interurban railway and the attendant benefits, conveniences and profit, they must pay whatever the cost of that interurban railway service may be. If the ordinary traffic and business of their community will not at ordinary or customary rates support such an interurban railway they will find it impossible to find capital or railroad builders willing to build an electric railway through their community or to furnish them with the service which they desire. It is therefore necessary for them, in order to secure the building of a railway and the benefits of an interurban car service to insure investors and railroad builders against loss. They cannot expect capital to seek an investment by building an interurban railway through their community when it is apparent that the population is too small and the possible traffic too limited to support an interurban railway until the community has been settled up, which must take several years.

As an investment such a proposition has no attraction whatever, yet it is apparent that the community will be greatly benefited and enriched by the construction of the railway in spite of the fact that its use will be so limited as to render it a failure as an investment. In other words the community will gain by the new investment even though the investor loses. The community cannot be opened up before the building of the railway nor can it expect an inpouring of new population and an increased demand for small tracts of land for summer homes before the installation of interurban car service.

As an interurban railway in such a community will not pay as an investment until the population has come in, it is impossible to interest capital in the construction of such a railway unless provision is made to guarantee it against loss during the period of development which must follow between the time when it is built through a new country and that time when the country shall have become occupied to such an extent as to furnish a traffic which at current rates will support the road and make it pay a fit income on the cost of its construction.

A community must pay the cost of its own development and if it has reached the position where an interurban car service is necessary for its further development it must pay the cost of such a service. If this service is such as to require one thousand users at the ordinary rate of fare to make it pay, and the community has at present only five hundred such users there is no possible way by which the company furnishing such service can do so at ordinary rates except at a loss. The consequence is that if the community of five hundred users are to have this service they must pay for it the sum equal to the normal charge from one thousand users. This would necessitate a charge equal to double the normal rate which by making the fares high and the freight rates excessive would defeat the very purpose which they have in view, namely, to induce emigration into their community by furnishing it with transportation facilities at low cost.

To accomplish their purpose then the rates must remain as low as possible and not be above normal, so that in order to pay the cost of service and yet induce the building up of their community by furnishing that service at current rates, the property owners of

a community must make up the difference between the actual cost of the service and the current rate of charge for such service until such time as the use of the service shall have reached normal proportions in their community and the road shall have been placed upon a paying basis. In this respect they have much to learn from the development of steam railroads in the United States.

In 1850 the whole railroad mileage of the United States was about 9,100 miles, hardly a mile of which extended beyond the crest of the Alleghany Mountains. In the valley between the mountains and the Mississippi River an already large population dependent upon national roads and canals was struggling to secure better transportation facilities for the increasing products of their farms and their growing manufactures, and railroads were being projected everywhere.

In the state of Ohio private rights of way were offered to the railroad companies and cities and towns vied with each other in their efforts to secure the construction of railroads to or through them. The competition was fierce, bonds were voted, private subscriptions raised, lands donated and terminal facilities granted in order to secure the coveted railroad or to prevent some rival town from securing it. The result was a construction of railroad mileage far in excess of the actual needs of the state at the time, and in instances, in places where there was little or no traffic to support a railroad.

In some cases the donations and grants to the railroads enabled them to run until their territory filled up with population and a traffic was developed sufficient to support them, but in most instances it was followed by the failure of the railroad companies, a long period of receiverships and a reorganization which involved in many cases a heavy loss to the original investors in the roads. But although many of the roads failed to pay and involved their builders in ruin, the state at large was enormously benefited by their construction, and so many times repaid for the gifts and donations made to secure their construction. This is shown by the following facts. In 1850 the state already had a population of 1,880,000, yet at that time its wealth only amounted to $500,000,000, and the value of its manufactures was less than $63,000,000. With the building of railroads the wealth of the state grew rapidly and the value of its manufactures multiplied.

The following table shows this increase by decades:

Year.	Miles of Road.	Population.	Value of Manufactures.	Wealth.
1850	575	1,980,329	$62,002,279	$500,000,000
1860	3,946	2,339,511	121,000,000	1,000,000,000
1870	3,538	3,665,260	269,000,000	2,000,000,000
1880	5,798	3,198,062	348,000,000	2,720,000,000
1890	7,980	3,672,316	500,000,000	4,000,000,000
1900	8,768	4,157,545	605,763,566	5,800,000,000

From this it can be seen that by reason of the magnificent system of railroads whose building was induced by gifts of right of way and substantial subsidies and donations besides, that the wealth of the state during this period grew enormously. In other words, while the increase of population in the state from 1850 to 1900 amounted to 110 per cent, the increase in the product of that population was 900 per cent, while the increase in wealth was 1,160 per cent, or, in other words, while in 1850 the average wealth of each individual in Ohio was only $250, it had grown by 1900 to the sum of $1,400 per capita.

The same process was going on in the adjacent states of Indiana, Michigan and Illinois with the resultant increase in wealth, manufacture and income. At the same time that this process of supplying transportation facilities to the already populous central states which was resulting in their enrichment, the government was undertaking the problem of opening up its great national domain lying west of the Mississippi which at that time, in 1850, held a total population of only 1,481,000, or about that of the single state of Kansas today. There were magnificent stretches of rich land, great areas of fine forest and rich treasures of mineral wealth which were valueless because of their inaccessibility. It was impossible to reach them on account of the lack of transportation facilities and impossible to take their products to market for lack of cheap transportation rates. Before the building of railroads it took six weeks for a wagon train to travel from the Missouri River to Colorado and the charge for hauling freight ranged from 15 to 25 cents per pound according to season. The fare was $300 per passenger, with extra charges for meals.

Under such conditions it was impossible to attract labor or induce emigration into this great public domain because the returns of labor were dependent upon transportation facilities and rates, and in such inaccessible places these returns were meagre and poor compared to those obtained even under the most trying conditions where transportation facilities were present.

It was difficult and expensive for the government to police this vast territory and private capital engaged in building railroads in the states where there was already population and traffic was not attracted to the public domain, rich and desirable though it was in natural resources and advantages, because it held no population to create business and traffic and railroad construction therein would consequently not only be unprofitable but be attended by actual and severe loss, and because this public domain was the property of the government in which private capital and the people generally had no direct or personal interest. The result was that the government, recognizing the fact that this great public domain must pay for its own improvement and opening up, sought to interest private capital by giving to it a large proportion of this public domain in consideration of the construction by private capital of the railroads necessary to open up this great territory.

In order to do this the government granted to railroad companies about 200,000,000 acres of land, or almost one-sixth of the entire public domain lying west of the Mississippi River. This grant, however, of 200,000,000 acres was really a much larger proportion of the desirable part of the public domain, being really one-fourth of all that it was possible to use after eliminating desert spots and mountain tops. This enormous grant to secure the construction of railroads was not, however, sufficient to secure the speedy opening up of the public domain, so in addition to these grants of land the government gave cash subsidies amounting to approximately $100,000,000. The result has been that in consideration of the grant of $100,000,000 in cash and 200,000,000 acres of land, the government has secured the construction in this territory west of the Mississippi River of 98,000 miles of railroad, or nearly one-half of the railroad mileage of the United States, while the population of this same region has increased from 1,481,000 in 1850 to 22,500,000 in 1904.

The subsidies granted by the government, however, were not the only grants made to secure the construction of these railroads. The state of Missouri alone granted $25,000,000 in subsidies for the building of railroads within its borders and the other grants by states, counties, cities, towns and individuals to secure the construction of railroads far exceeded even those granted by the federal government itself.

With the increase of our transportation facilities, our commerce, manufactures and wealth have grown steadily, as the following table shows:

Year.	Population.	Miles of Road.	Value of Manufactures.	Internal Commerce.	Wealth.
1850	23,191,876	9,021	$1,019,106,616	$2,000,000,000	$7,135,780,000
1860	31,443,321	30,626	1,885,861,676	3,500,000,000	16,159,616,068
1870	38,558,371	52,922	4,232,325,442	6,250,000,000	30,068,518,507
1880	50,155,783	93,262	5,369,579,191	7,750,000,000	43,642,000,000
1890	62,622,250	166,703	9,373,437,283	12,000,000,000	65,037,091,197
1900	76,903,387	193,345	13,014,287,498	18,000,000,000	94,300,000,000
1903	81,000,000	203,131	14,288,935,072	21,000,000,000	100,000,000,000

From this it will be seen that in a little over 50 years since the construction of railroad mileage under the inducement of public and private grants and subsidies really began, and during which period our railroad mileage has increased by reason of these subsidies or grants from 9,000 miles to 203,000 miles, or more than 2,200 per cent, our manufactures increased from $1,019,106,616 to $14,288,935,072, or 1,400 per cent, our internal commerce grew from $2,000,000,000 to $21,000,000,000, or an increase of 950 per cent, and our wealth increased from $7,000,000,000 to over $100,000,000,000 or more than 1,400 per cent, and this, too, while the population only increased about 240 per cent from 23,000,000 to 81,000,000.

If the government had received no return whatever from its grants made to secure the construction of these railroads, it would have been amply repaid by the enormous growth in commerce, manufactures and wealth just shown, but it has received directly

much more than it ever paid for it as shown in the prosperity that has come to the people by the construction of these railroads. The public lands which it held and still holds have increased enormously in value; the $100,000,000 of cash bonus given to the railroads has every dollar of it been repaid and the railroads whose construction was induced by these grants or subsidies are now contributing to the support of the government sums that approximate $50,000,000 a year, while the indirect returns resultant from the building up of the country and the increased taxes and revenue from the increased population are almost too great to be estimated.

We have reached the stage in our national life where further development requires the construction of interurban electric railways to supplement the splendid service rendered by our steam railroads. It is not economical for a locomotive built to haul a train of cars to waste its power in moving a single car, while the system of electric traction is arranged to move single cars whether passenger or freight with the greatest economy and dispatch. It is this which makes it possible for them to make the numerous stops and furnish the frequent service which are impossible to the steam railroad and which indicate that the province of the interurban electric railway is to relieve the steam railroads from their local or short haul passenger traffic and to gather at convenient transfer points carload lots of freight for their further transportation in trains.

But while the character of the traffic of these two classes of roads is different, the relative conditions of developing them are the same and the process which secured for the country its splendid systems of steam railroads must be pursued to secure the construction of the interurban electric railways that are now necessary to supplement the service of the steam roads and insure the continued growth of our country in produce and wealth.

The idea seems to be widespread that electric lines are cheaper to build than steam railroads, but nothing could be farther from the truth. The right of way, grading, ties and rails cost just as much for one as for the other, but at this point of the investment a steam railroad is ready to operate, while the electric line must invest a sum half again greater than the cost of all this to erect a pole line with overhead trolley and feed wires, while its power houses are far more expensive than locomotives and every electric car equipped with high power motors costs as much as an ordinary locomotive. This greater original cost of an electric line over the cost of a steam railroad is one of the things that makes it particularly necessary for the communities desiring them to contribute to the cost of their construction.

In those localities where population and traffic are already sufficient to support these interurban railways they have been built. But those other localities without the necessary population and traffic must, in order to secure the construction of these interurban railways which are so necessary to their further development and prosperity, do as the government did in the case of the steam railroads; offer inducements to private capital to secure their construction and these inducements or subsidies must be sufficient to reduce the cost of the road to the investors furnishing the funds to pay for its construction to a figure which the expected traffic will carry or to insure the operation of the road without loss until such time as it can build up a population and traffic sufficient to support it.

A subsidy is in fact nothing but an insurance to the capital invested in an enterprise against loss by being so invested, given by those who expect to receive the collateral benefits to be derived from the investment. The purpose of those giving subsidies being to secure for themselves the benefits of facilities the entire cost of which they are either unable or unwilling to advance; their proposition to the investor is that if he will make the investment necessary to furnish them with the facilities which they desire, they will insure the investor against loss, either by reducing the cost of his investment to a figure upon which the net earnings of the proposition will pay a reasonable return or by creating a fund out of which to pay to the investor a reasonable interest on his investment while the use of the facility is being developed to the point where its net earnings will pay such interest on its cost.

The investors to whom they look to furnish them with the transportation facilities which they desire, having no holdings in the locality and so having no share in the collateral benefits to be secured by the construction of the road, can only be interested in the proposition of building it when their investment is reasonably insured against loss of principal and the undue delay in income returns. The community is forced to recognize the just necessity of paying for its own development and enrichment and the people desiring a service which on account of the small use which they are able to make of it must be furnished at an abnormally large cost, are under the necessity of paying the actual cost of the service whatever it may be, and yet in order to create traffic and induce emigration into their community they must see that the charge for the service is normal or small.

The position of the property owners or communities offering subsidies to secure such a service as that rendered by an interurban electric railway is that they will be benefited by the service and will profit by the construction of the road, even though the road as an investment may be a failure, and the subsidy which they offer is that proportion of the benefit which they expect to receive in the better facilities given them for reaching their markets or of their saving in the cost of reaching that market, and that part of the increased value of their land resulting from its being made more available and therefore being in better demand, which they are willing to contribute in order to secure for themselves those increased values and benefits. In other words, they are willing to share the prosperity and wealth that will come to them from the building of such a road with those who will build it for them.

This they can do in several ways, the easiest and most usual method being the raising of a cash sum by popular subscription or voluntary assessment in a community, the property owners all joining to pay in proportion to their holdings to raise a sum to be given to the builders of the proposed railway, which sum is approximately large enough to reduce the cost of the road to those building it to a figure upon which the traffic of the community as it stands will at the ordinary or nominal charge for transportation pay a reasonable return upon the investment. It is usual, in such cases, to deposit the sum so raised with a bank or trust company and provide for its payment to the railroad company upon engineer's estimates as the work progresses, in such proportions as the work done shall bear to the estimated cost of the completed road.

When a community undertakes voluntarily to raise a subsidy by popular subscription there are usually some property owners who refuse to subscribe thereto. The mutual jealousies between large and small land holders make each afraid that he might give an undue proportion of the sum necessary to secure the desired road, though frequently there are those imbued with real public spirit who are willing to give their proportion or more, regardless of what their neighbors are willing to give. It is, however, plainly unfair that such men should be compelled to pay to secure a service which enures to the benefit of the entire community and that those who are unwilling to contribute their share of this charge upon the community should be permitted to escape paying any part of the sum necessary to secure a service which they are only too willing to enjoy and whose benefits they greedily appropriate to themselves.

It is eminently just and fair that such sums as may be necessary to secure such a service as an interurban railway, that benefits an entire community and which adds to the value of all the community's holdings proportionately, and which being built will in the future contribute by its own taxes very largely to the support of the public service of the community, should be raised by taxation in such a manner as to compel every one in the community sharing in the benefits of such a road to pay their proportion of the charge to secure the road. The laws generally provide for the voting of bonds or the borrowing of money for such purposes and wherever it is possible, particularly if any considerable number of property owners should refuse to join in a voluntary popular subscription, this plan should be followed and the funds necessary to secure such a benefit should be raised by general taxation upon all property holdings in proportion to their value.

In many communities, however, the raising of cash subscriptions is difficult and the property owners are anxious to substitute land instead. The very first thing that a community seeking the construction of the interurban road should do is to secure the donation of a private right of way not less than sixty feet in width, for while many of the earlier roads have been built on narrower strips, the modern road built for fast service cannot be built upon any narrower strip than that just mentioned. The donation of right of way to an electric railway is the very least thing that a com-

[illegible] property owners can do to secure such a public benefit for their community [illegible] through [illegible] that make many such projects a failure where they might have been successes had they been welcomed and assisted.

In almost every community there is a right place and a wrong place for the construction of such a road and many property owners seriously embarrass a proposition by attempting to make their subscription and offering dependent upon the construction of the road in some location other than that which is plainly the best, ignoring the fact that the greatest benefit to themselves as well as to the community is to be derived in having a road of good alignment and grades built to furnish the best possible service rather than that the road should by many curves and grades attempt to run past the door of every one who contributes to securing it.

In most cases the donation of lands in lieu of cash are acceptable, but a railroad cannot be built with land nor can interest coupons be redeemed with it, and while a railroad company may accept lands in lieu of cash to insure itself against bankruptcy and loss, the property owners must realize the fact that it will take a larger sum measured in lands to protect the railroad company from insolvency than it will in cash, as lands are not a quick asset. In other words, lands as a bonus to a railroad are only worth what can be borrowed upon them or what they will bring under the hammer. If, however, the investors who build such a road are financially able to carry the lands as an investment and furnish the road with the cash funds which it needs to support it until the traffic along it has been developed, they are enabled to secure a larger profit from the construction of the road than they would if they accepted a cash donation in the first place for the acceptance of the land gives them a share in the collateral benefits that come with the construction of the road, and they are so enabled to share to a reasonable extent in the benefits secured by other property owners.

The method of guaranteeing the interest on the bonds of a public service company, as was done by the United States in guaranteeing the bonds of several of the transcontinental roads, need not be discussed here for the reason that it is impossible for individuals to furnish a satisfactory guaranty, and it is no longer practicable for cities or states to do so, municipal corporations almost universally preferring to pay a definite cash sum at once than to assume any continuing obligation such as paying interest on an issue of bonds for a long term of years. This method, however, still remains the best method to be followed by governments and has just been adopted by the Canadian government in its effort to secure the construction of the Grand Trunk Pacific and is now being offered by our own government to secure the construction of railroads in the Philippines.

Another method of securing new investments for the public benefit, but one usually used in addition to one of the methods already described, is the relief of public service companies from certain fixed charges such as taxes and street and road improvements. There is great wisdom in a community granting relief from such charges to such a company for the reason that if they are charged against the company furnishing the public service the company must itself collect their equivalent from the community by adding it on to the service charge plus a sum for the collection thereof.

It is useless for property owners to complain that they are unable to interest capital in the construction of an electric railway through their particular community, for if their community was sufficiently developed and already had population and traffic enough to support such a road, capital ever seeking a profitable investment would have found the spot and furnished the service desired, and the fact that capital has not done so warrants the inference that their community is not sufficiently developed and that such an investment would be of doubtful value and uncertain returns. If they desire the service they can always get it by being willing to pay for it, which is what they will have to do in any event, however much they may attempt to deceive themselves in the process, and as they have to pay for it in the end they might as well pay for it in the beginning, and have the service early and secure for themselves the benefits and profits of such a service.

The way is not difficult. A line must be surveyed through their community giving the best possible location for alignment and grade so that the railway when built may be easily maintained and furnish the best possible service at the least possible cost. They should donate the right of way, in doing which they are in most cases fully protected by the laws of their state for the land cannot be stolen or run away, and if not used for railroad purposes will within a few months or years revert to the original donors. If the laws do not so provide, it is very easy to incorporate in the deeds granting such free right of way a provision that unless the right of way shall be used within a specified period the title shall revert to the grantor.

If the donation of right of way is not sufficient to secure for them the service which they desire they can raise an additional cash sum either by popular subscription or by voting and sale of municipal bonds and these cash sums they can expend in grading the right of way which they have already donated. By doing the grading it is in many cases possible for the property owners to contribute labor and teams in lieu of cash. In most cases the donation of a right of way and of sums sufficient to grade it ready for the laying of ties and rails will be sufficient to find investors ready to raise the balance necessary to complete the road, but should in any particular case this prove insufficient the property owners can continue their payments for the service which they seek by making and laying the ties upon the right of way as has been done in many cases.

Through all this process the property owners are in no danger of losing anything that they have given or offered to give, to secure the new service; for the money expended for grading is expended in their own community and it is impossible to remove either the grade or the right of way from their midst. Every dollar of work expended on or cash given to the new project adds to the wealth of the community and hastens the day when it will secure the benefits and profits of the new service.

It is no doubt difficult for some to understand how moneys gathered by general donation or public subscription can be granted as bounties to private enterprises in such a way as to produce a compensatory return to the community or persons giving the bounty, but regardless of theories the fact remains that by the magnificent system of grants both of lands and of cash, our government induced the building of the greatest railway system that the world has ever seen, and this great railroad mileage has opened up lands that otherwise would have remained unopened for decades, covered them with a great population that is still growing, multiplied the value of farm products many fold, added to the taxables of the country property now paying annually in taxes sums far exceeding the original subsidies granted and built up a manufacturing industry so great that even the tremendous increase in population has been unable to keep down wages which in the United States have reached the highest standard of which there is any record in history.

States, counties and cities have contributed to secure and pay for these transportation facilities without which their agriculture would wither and their manufactures perish. Distances are measured not in miles but in hours and minutes and almost every city of our country has seen the development of suburbs miles distant from the heart of the city while broad acres much nearer have remained unoccupied because their owners would not contribute to pay for a transportation service to them.

The same conditions are true of many rural communities which have been standing still for years, making little or no growth and progress. What they have lacked is that great vitalizer of every community, better means and facilities for transportation and communication. The age of interurban electric railways is at hand, the service is theirs if they are but willing to pay for it and share in the prosperity and wealth that is spreading all over our land.

The Milford, Attleboro & Woonsocket Railway Co., of Milford, Mass., the Woonsocket Street Railway Co., of Woonsocket, R. I., and the Columbia Street Railway Co., of Pascoag, R. I., all owned by the same interests, have increased the wages of motormen and conductors from 20 to 22½ cents per hour.

It is announced that the Interborough Rapid Transit Co., of New York City, has bought control of the New York & Putnam R. R. from the New York Central & Hudson River Railroad Co., and will install the third-rail system thereon. This adds 58 miles to the system, and when the electric system is installed trains will be run from the Battery to Yonkers.

Club Rooms for Topeka Ry. Employes.

At midnight Saturday, May 28th, the new club rooms of the Topeka Railway Benefit Association were dedicated, and the rooms formally delivered to the trustees of the association by the officials of the railway company. The new rooms occupy the entire second floor of the new office building of the Topeka Railway Co., at the corner of 12th and Jackson streets. The rooms were fitted up by the company and presented to the men furnished complete and free from incumbrance. There are two apartments, the smaller being the bath room, which is equipped with two shower baths and all modern appliances. The members pay 5 cents for the use of the bath and employes who are not members are charged 10 cents for the privilege.

The rest of the second floor has been thrown into a large recreation room and the furnishings include billiard and pool tables, card and other game tables, reading table, chairs, couches and writing desks. A portion of the room is reserved for a well-equipped gymnasium and at one end are cigar and bootblack stands. The charge for billiards and pool is 20 cents an hour for members and 40 cents for employes who are non-members. The expense of each game is proportioned among the players, gambling in any form not being allowed. Other privileges, such as cigars and shines, are cheaper to members than to non-members. The expense of maintaining the rooms will be met by the receipts from the privileges. If, however, there should be a deficiency, the company will pay it. A feature of the rooms which the men appreciate are 50 steel lockers, the use of which is free, members paying 50 cents for a key, the money to be refunded when the key is given up. The rooms are in charge of Mr. M. N. Crandall, secretary of the association.

The Topeka Railway Benefit Association held its first meeting five years ago in a car on a siding. Now it has a membership of 108 out of the 126 employes of the company and it is expected that all the employes will become members before long. It costs nothing to join. The company has endowed the association with $500, and when that has been drawn upon the members are assessed 50 per cent of the amount withdrawn and the company contributes 50 per cent, also. The sick benefit is $7 per week and in case of injury by accident the benefit is $10 per week.

The officers of the association are: President, C. V. Wolf; vice-president, John Engle; secretary, M. N. Crandall; treasurer, Howard Patten. The trustees of the association are John Engle, L. E. Myers, A. M. Patten, E. B. Snyder, J. H. Tincher, William Young, H. W. Naylor, A. G. Bennett and C. W. Hixon.

The idea of presenting the club rooms to the association was conceived and its realization made possible by Mr. L. E. Myers, of Chicago, who presided at the dedication of the rooms. The formal presentation was made by Mr. B. E. Sunny, chairman of the executive committee of the company, and the rooms were accepted on behalf of the association by Mr. E. B. Snyder. Visitors, who also made addresses, included Governor Bailey, Congressman Charles Curtis, Mayor Bergundthal, and members of the Topeka city council.

The new office building in which the club rooms are situated has just been completed. It is built of concrete blocks, composed of three parts sand and one part portland cement, and is 45 x 70 ft., and two stories high. In the facade is a concrete tablet which bears the company's monogram. The first floor is occupied by the offices, which include the president and directors' room; offices of the cashier, auditor and superintendent, and three toilets rooms for ladies, men and shopmen. Entrance to the shopmen's toilet is from the yard in the rear and a brick wall between it and the other rooms prevents the occupants of the offices from being annoyed. The superintendent's office at the rear of the building commands a view of the entire yard, so that the superintendent is cognizant of everything that is going on within the inclosure.

The interior finish of the building is quartered oak, with hardwood floors. All the electric wiring is placed in conduit. The plumbing is sanitary, and everything else is up-to-date. A branch telephone exchange connects with every desk and with every department in all the buildings.

The other buildings located on the company's land at 12th and Jackson Sts. are the car barn, 105 x 280 ft.; machine shop, 60 x 130 ft.; carpenter and paint shop, [illegible] ft.; emergency station, 20 x 50 ft., and the boiler house. All the buildings except the machine shop are new throughout and are just being completed. They are all built of concrete blocks and have steel truss roofs and steel rolling doors. The concrete for the buildings was made in molds and is very strong. The machine shop is also used for special work, the company making all work of that character which is used on the system.

The company's property is located a short distance from the state capitol, in the heart of the city, and presents a very attractive appearance. Since the reorganization a great deal of money has been expended on rolling stock, as well as buildings and reconstruction work, and the officials feel that Topeka's street railway system is second to none in the country.

New Publications.

BRIDGE AND STRUCTURAL INDEX. By H. G. Tyrrell, C. E., author of "Mill Building Construction", etc. This publication contains condensed information relating to the principal bridges and steel structures in Europe and America built in 15 years from 1885 to 1890. The descriptions are accompanied by outline sketches giving the form and general dimensions of the structures. The book includes draw-bridges, simple spans, viaducts, cantilevers, suspension bridges, steel and masonry arches and concrete steel construction. Also data relating to train sheds, exhibition halls, office buildings, warehouses, power houses, armories, mill buildings and a great variety of other steel structures. Issued in blue-print form, size 6 x 9 in., 400 pages. Price complete $50.00. For sale only by the author, H. G. Tyrrell, chief engineer the Brackett Bridge Co., Cincinnati, O.

MILL BUILDING CONSTRUCTION. By H. G. Tyrrell, chief enginer of the Brackett Bridge Co. An idea of the character of this work is best conveyed by the following brief summary of the contents: Chapter 1 deals with "Loads", including roof, floor, crane, snow and wind loads and miscellaneous loads, together with a summary and methods of calculation. Chapter 2 treats of "General Design", including walls, trusses, rafters, unit stresses, lighting and ventilating, etc. Chapter 3 is devoted to "Design of Structural Details" and covers comprehensively everything pertaining to structural work, including also asphalt and concrete floors, floors for car sheds, slow-burning wood floors, roof coverings, comparative cost of roofing, miscellaneous structural details and other considerations. Cloth, 6 x 9 in., 42 pages. Illustrated. Price $1.00. For sale by the Engineering News Publishing Co., 220 Broadway, N. Y.

A TREATISE ON FRICTION AND LOST WORK IN MACHINERY AND MILL WORK. By Robert H. Thurston, M. A., LL. D., director of Sibley College, Cornell University. Seventh edition, first thousand. It is announced in the preface that this book contains the results of an attempt to exhibit the facts and laws involved in the waste of energy by friction in machinery and mill work, and the study of the methods and magnitudes of friction losses, it being the author's idea that the laws governing their production is, next to the theory of pure mechanism, the most important study in relation to the transmission of energy by machinery. The investigations of the author revealed new facts and established the impracticability of the usually received values of the coefficients of friction to much of the most familiar work of the engineer, and the author devised new apparatus and new methods of experiment, which led to the accumulation of a large mass of new and practically applicable data, the most important of which is published in this work. An attempt has been made to exhibit as concisely as possible the principles involved in the transmission of power and the performance of work, and in the waste of power by friction. It has also been attempted to show what are the methods of reducing such wastes, how to determine the purity and the intrinsic values of the unguents, and finally to ascertain how and to what extent variations of the magnitudes of these wastes are produced by variations of the conditions affecting the machinery exhibiting them. 8vo, + 430 pages, 77 figures. Cloth, $3.00. Published by John Wiley & Sons, New York; London, Chapman & Hall, Limited.

The Ft. Wayne & Wabash Valley Traction Co. is fitting up club rooms for the employes in the new car barns being erected at Logansport, Ind. An instruction car is to be equipped, also.

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SUMMARY OF CONTENTS.

THE ST. LOUIS EXPOSITION.

The Louisiana Purchase Exposition, which was formally opened on April 30th, was not entirely complete on the opening day, but in this respect it compared very favorably with other expositions of similar scope, and the record made by it is a particularly good one in view of the physical magnitude of this undertaking, the area of the ground and the area covered by buildings at the St. Louis Fair both being almost exactly twice the corresponding areas at the largest of former expositions.

This number of the "Review" is devoted largely to those features of the Louisiana Purchase Exposition which will be of most interest to our readers. By far the greatest number of exhibits of street and electric railway equipment and material is in the three palaces—Electricity, Transportation and Machinery—while a smaller number will be found in the Varied Industries, Manufactures and Liberal Art Buildings. Some interesting exhibits are also located in the foreign buildings. The display of apparatus for the power house is largely in the Machinery Building and its annex, known as the Steam, Gas and Fuels Building, where engines, turbines and generators from the principal makers are in operation supplying power for the Intramural Railway and for general service and lighting.

A very striking feature of the St. Louis Fair, which distinguishes it from former expositions, is that the exhibits represent present practice rather than novelties of doubtful value. Exhibitors have shown their standard products instead of presenting a costly exhibit piece which, while of interest, is of but little use except for exposition purposes.

It is perhaps disappointing that the Intramural Railway could not have exemplified some of the new traction systems involving the use of alternating current. The choice of the overhead trolley for operating this road is, however, a distinct tribute to the reliability of the trolley system, the necessity of handling traffic on the Fair Grounds being a very important consideration.

Under the auspices of the committee having in charge electric railway tests new systems of traction will be investigated and the possibilities of the most modern equipment determined, this being a most important part of the Exposition's contribution to science.

There is much that might have been contained in this number of the "Review" which is not mentioned because we have already presented it to our readers. Thus, a complete description of the Intramural Railway, and a discussion of the controlling conditions and the original plans were published in the "Review" for August, 1903, while in this issue we give the drawings of the station plans as adopted and the description of the equipment.

Aside from the Exposition and the exhibits we publish several articles on the arrangements made by local traction companies for handling the World's Fair traffic. In connection with the article on the St. Louis Transit Co's. World's Fair plans reference should be had to the plans of the terminals shown in the "Review" for May.

Chief among those upon whom has rested the burden of bringing the exposition to successful completion are: David R. Francis, president of the Exposition Company; Frederick J. V. Skiff, director of exhibits; Isaac S. Taylor, director of works; Mark Bennitt, chief of press and publicity. Those who have had charge of mechanical and electrical matters in which electrical transportation exhibitors are interested are: W. E. Goldsborough, chief of the department of electricity; Thomas M. Moore, chief of the department of machinery; W. A. Smith, chief of the department of transportation; Henry Rustin, chief electrical and mechanical engineer; R. H. Phillips, chief civil engineer

SPRINKLING STREETS AS A SOURCE OF REVENUE.

The experience of a number of electric railway companies indicates that there is an opportunity for many roads to not only relieve themselves of the cost of such sprinkling of their tracks as may be required by municipal ordinances, but to turn this work into a source of profit by taking the contract for sprinkling the entire street, the company doing all this work instead of the track only. The perfection of the pneumatic sprinklers which are now on the market makes it possible to distribute water over the entire surface of the street from a car operated over the street railway tracks. No argument is required to demonstrate the economy of such a method over the only others available; that is, by means of carts drawn by animal power or by the abutting property owners from their lawn sprinklers.

The compensation which the street railway company can secure for street sprinkling is a variable quantity and probably no two contracts for this work are identical. One railway receives 75 cents per mile of street per day; another receives $1.00 per mile of street per day, and in a third city the city pays the railway company $211 per mile per year for sprinkling the streets from curb to curb on which the railway company operates cars. At New Brighton, Staten Island, New York, the traction company receives 60 cents per mile for each trip of the sprinkling car, which should make the earnings from this source from $1.80 to $2.40 per mile of street per day during the dry season. In this particular case the company has 60 miles of track and is able to care for all by means of one 4,000-gallon pneumatic sprinkler. It is necessary, however, to operate this car almost continuously night and day in the dry season.

The amount of water required depends upon the character of the street, a depth of 1-64 in. being sufficient for a hard pavement, while macadam would require two or three times as much. On the basis of 1-64 in. in depth 1,000 gallons of water should cover 11,400 sq. yd. on asphalt or hard brick pavement.

In the case of one company operating in a city where it was required to sprinkle its track and the owners of abutting property were required to sprinkle the rest of the street, the railway company offered to do the whole of the sprinkling and charge abutting owners only one-half what they had theretofore been paying. Even at this price, the contract was found to be a profitable one for the company.

ELECTRIC RAILWAY SUBSIDIES.

In this issue we publish an article by Mr. Guy Morrison Walker, entitled "The Why and How of Interurban Railways," which is a comprehensive review of the development of interurban electric lines in this country, with an analysis of the conditions which make for their success or failure, and a discussion of the obligations which the communities benefited by the building of such lines owe to the transportation companies. The author discusses the subject in a straightforward manner, presenting pertinent facts in a way that can scarcely fail to be convincing.

Readers of the "Review" are familiar with the effect of the interurban electric railway in developing the territory through which it runs. All recall the opposition on the part of the smaller towns along proposed lines which had to be overcome. The fear was that the larger towns would profit at the expense of the smaller ones by reason of the interurban lines. This was perhaps a natural fear, but those who expressed it overlooked the fact that what a given town might lose in this way was sure to be more than replaced by business from the rural district, which was created because of the small town being made more accessible to the rural residents than it was before. No extended argument should be necessary to convince a man or a community of the advantages of improved transportation facilities, but the other side of the question as to who shall pay for these advantages is too often not considered at all, or, if considered, is viewed from the wrong standpoint and a policy adopted that is narrow and in the end must prove hurtful to the community.

We have the established fact that improved transportation facilities benefit a community and insure its ultimate development, increasing the population of the territory and increasing the value of property in that territory. Also, it is recognized that a district without good means of transportation cannot in the beginning furnish the business necessary to make a transportation company financially successful, and until the developments due to the railway are effected, the railway is a losing venture. Some one must suffer the loss. Inasmuch as it is the inhabitants of the territory and the owners of the property there, especially merchants and the owners of real estate, who are benefited, it is they and not the railroad company who should suffer the loss.

As Mr. Walker aptly says: "A subsidy is nothing but an insurance to capital against loss in an investment, given by those who expect to receive the collateral benefits to be derived from that investment." There is no community in the country, outside of a few of our largest cities, but would gladly donate a site and a cash bonus to secure the erection of a manufacturing plant, yet when the same proposition is placed before it by a railroad company there is too often an outcry against the grasping corporation. This difference in the attitude of the public towards enterprises of these two classes is due in large measure to the campaign waged by demagogues against the so-called public utilities. A railroad is certain to be of more benefit to a community than the largest manufacturing establishment, and is more deserving of a bonus.

By the proper presentation of the principles which underlie the granting of a subsidy, much can be done to eliminate the opposition towards such grants that now exist, and then there immediately become possible developments that otherwise would have to wait for a generation.

RULES FOR THE TRANSACTION OF CONVENTION BUSINESS.

One of the points in which many technical societies are particularly weak is the method of handling business brought before their annual conventions. This is, doubtless, due to the fact that meetings are held at long intervals, in most cases but once a year, and that the presiding officer is in general not well versed in parliamentary law. In consequence, when a report is presented for consideration, the discussion is extremely apt to be of a desultory and irrelevant nature. The ideas presented by one speaker suggest to the next one points which have no connection with the paper, so that the time which the association has at its disposal is exhausted before the subject before the meeting has received such consideration as should be had before final action. Then, the most natural course is to refer the matter again to the same committee or another one, and it is thus allowed to drag from year to year, unless the new committee, as is too often the case, allows the whole thing to drop.

A great improvement could be effected by the adoption of a few simple rules as to the manner in which the reports are presented and then adhering to these during the convention. The American Railway Engineering and Maintenance of Way Association has adopted the following rules for the consideration of reports, which commend themselves: (1) Reading before the convention is by title only, the papers having been published in advance, and the presumption being that all present are familiar with their contents. (2) Each conclusion is read, discussed, and acted upon separately. (3) Votes are taken on each item, clauses not objected to when read being considered as voted upon and adopted.

After the discussion is closed the action is one of the following: (1) The report is received as information. (2) It is received as a report of progress and referred back to the committee. (3) A portion is adopted and the remainder referred back to the committee. (4) The whole is adopted as amended. (5) The whole is adopted as submitted.

An adherence to rules such as these would conserve much time at conventions and secure an expression of opinion on those matters which are the most important, presumably, since they were assigned to the various committees. The record would be kept in good order, so that the report of the proceedings when printed would be far more readily available for reference than when matter interesting of itself, but not relevant to the subject, is received in discussion.

THE STATUS OF INTERURBAN ROADS IN HIGHWAYS.

The latest reported case affecting the rights of interurban electric railways is one decided by the Supreme Court of Wisconsin in February last. The earlier decisions of this court established the principles in that state; first, that an electric street railway within a city is not an additional burden on the fee for which abutting owners are entitled to compensation; second, that an interurban railway on the highway is an additional burden for which abutting land owners are entitled to compensation. Now the court goes a step further and holds that the operation of an interurban car through a city over the tracks of a local company is an additional burden.

Wisconsin was one of the first states in which the question of the rights of interurban railways in country highways was passed upon, the decision that such roads are an additional burden on the fee having been rendered in 1898. In this case the court assigned as the reason for placing interurban lines on a less favorable footing than street railways in cities, that the interurban cars carried many long distance passengers who would otherwise have patronized steam railways, saying: "The operation of this newly-developed street railway (so-called) upon the country road is precisely opposite to the operation of the urban railway upon the city street. It burdens the

road with traffic that would otherwise not be there, instead of relieving it by the substitution of one vehicle for many."

There are two very weak points in this argument; first, it properly involves a distinction between those electric interurban lines which compete with steam railroads, and those electric lines that do not so compete; second, the proportion of through traffic does not warrant the classification of the interurban as a non-local transportation line. Recent statistics on interurban railways, operating lines 50 miles or more in length, show that approximately one-fourth of all passengers pay only a 5-cent fare and that the average haul is from 10 to 15 miles, indicating that the interurban is eminently a local convenience, although incidentally a long distance line.

In New Jersey the courts have taken an entirely opposite view of this question, although four years ago (June 1900) the New Jersey courts said that the right to build an electric railway in the highways outside of the corporate limits of cities and towns was unsettled; a few months later (November, 1900) it was held that a trolley road on a country highway is not an additional servitude. The court failed to perceive any difference between the easement that the public has in the city streets and the one that it has in a country road and was unable to find any test for the distinction between these two classes of highways. The question was asked, If the density of population along the highway is to be the criterion, how closely must the houses stand? And also, if the highways are to be divided according as they lie within or without the limits of a town it is asked by the court, What is the substantial basis of difference? It was further pointed out that to grant a right of damages to an abutting owner in a rural community, when a year's time might see this right taken away because neighbors had built in his vicinity or because a town had extended its corporate limits is quite illogical and absurd.

In Kentucky this question was raised by the Ashland & Catlettsburg road and in 1898 the Supreme Court of that state held that an electric railway in a country highway was a proper use, although a new and improved use, of the highway, identical in principle with the corresponding use of city streets by street railways. This case was even stronger because of the rails being laid with their tops two or three inches above the surface of the highway and thus different in construction of roadbed from what would be permitted in the city.

In 1901 it was decided in Louisiana that legislative authority for an interurban railway in a highway is required and that even with such authority abutting owners must be compensated for the servitude imposed on their lands. In Massachusetts the legislature, by an act passed in 1895, authorized the location of railways on and at the side of a highway, and in 1903 the Supreme Court held that this act imposed no additional burdens on abutting property. In Maine it has been decided that the legislature has authority to enlarge the easement which the public has in highways and may authorize interurban lines to be built in these roads. Virginia holds (1902) that legislative authority is necessary for electric railways to occupy country highways. Michigan has taken the position (1903) that abutting owners are not entitled to compensation.

The Wisconsin decision that abutting owners are entitled to compensation for the operation of interurban cars over the lines of urban street railways is of peculiar interest to Indiana electric railways as that point has been raised in two recent cases, one of which is now pending before the Indiana Supreme Court.

Canadian Notes.

Grand Trunk Ry. interests, by the purchase of 1,035 shares of stock, have secured control of the Hamilton, Grimsby & Beamsville Electric Ry., and thus practically have a monopoly of fruit shipping in the Niagara peninsula. Messrs. Ramsay and Bauer, the largest stockholders in the electric road, sold the controlling interest, receiving therefor $200 per share. The company recently increased its capital from $200,000 to $300,000. A change has been made in the directorate: Messrs. A. H. Myles, Homan Myles and Robert Ramsay have retired and in their places are Messrs. J. W. Nesbitt, K. C., John G. Gauld and James Dickson, of the law firm of Nesbitt, Gauld & Dickson, of Hamilton. Mr. C. J. Myles is still president and Mr. W. J. Harris, vice-president, while Mr. Nesbitt has been elected treasurer.

The South Western Traction Co. has elected officers as follows: President, F. G. Rumball, London; vice-president, Lieutenant-Colonel McEwen, Byron; managing director, A. Welch. The directors are T. H. Luscombe, Dr. A. Mackay, Captain Robson, H. M. Rumball, Joseph Howlett and William Detoe. The grading between London and St. Thomas is well along and the rails have been ordered. It is expected to reach St. Thomas by August 1st. The company will adopt a different system from that in use in St. Thomas and will not operate over the tracks of the St. Thomas Street Ry., as at first proposed.

As preliminary to acquiring the suburban lines the Toronto Railway Co. has obtained permission to invest in the stock of other railways and a special meeting of the stockholders was called for June 20th to ratify the acquisition of the Toronto & Mimico Railway Co., the Toronto & Scarboro Electric Railway, Light, Heat & Power Co., Ltd., the Metropolitan Railway Co., the Schomberg & Aurora Railway Co., and the Toronto & York Radial Railway Co.

The Toronto Railway Co. is installing an additional unit which will bring the total capacity of its power plant up to 10,000 h. p., and it will also install a 3,000-h. p. reserve storage battery. The company has secured an additional 200 h. p. from the old Metropolitan power house at Eglington, a suburban line just acquired. The city recently promulgated a new time-table which called for the construction of 120 new cars by the company, it being stipulated that the cars must be built in Toronto. The company complains that it has not been given sufficient time to comply.

The Niagara, St. Catharines & Toronto Railway Co. has been given permission to intersect the Grand Trunk Ry. at Stamford and the company now has a direct line from Niagara Falls to Port Dalhousie, and thence by its own steamers to Toronto. During the fruit season four trains are run daily.

The Montreal Street Railway Co. has been granted a 30-year franchise in Westmount. The company has a 50-year franchise in St. Cunegonde, which expires in 1942; a 50-year franchise in St. Henri, expiring in 1942, and a franchise in Maisonneuve which expires in 1925. The city franchise expires in 1922.

The Winnipeg Street Railway Co. is building a car shed to hold 14 cars, a car shop at Fort Rouge, an extension to its Main St. shed, and three large buildings at the gas works. It will also erect a shop building on Pembina St. All the company's cars are to be built in Winnipeg hereafter. A new belt line will be opened on the completion of the Main St. subway.

The British Columbia Electrical Railway Co's. new sub-station at New Westminster will be 60 x 33 ft. It will have a concrete foundation 9 ft. deep, resting on 128 piles, and above this a floor of steel rails 2 ft. apart and a 6-in. layer of cement. The walls will be brick and the roof asbestos.

The Toronto & Hamilton Railway Co. has applied for permission to extend its line from Hamilton to a point on the international boundary near Grand Island or Niagara Falls. Mr. Allan Royce, Toronto, is the solicitor.

The Strathroy & Western Counties Electric Railway Co. has been granted power to extend its line from St. Thomas to Port Stanley.

Ten writs, each for $200, have been issued by the city of Toronto against the Toronto Railway Co., for alleged non-fulfillment of the contract in regard to Sunday service.

The Grand Valley Radial Co. has inaugurated a Sunday service between Brantford and Paris. The Lord's Day Alliance will seek restrictive legislation.

The Canadian Traction & Power Co. has been incorporated to build an electric railway from Montreal to Ottawa and to acquire and develop water powers. Incorporators: Hon. R. Dandurand, Hon. W. A. Weir, A. Brunet, J. P. Mullarkey and others, of Montreal.

Messrs. Greenshields, Greenshields, Henekler & Mitchell, of Montreal, are solicitors for the Charlemagne Traction & Power Co., which will construct an electric railway in Terrebonne, Montcalm, L'Assomption and Berthier counties.

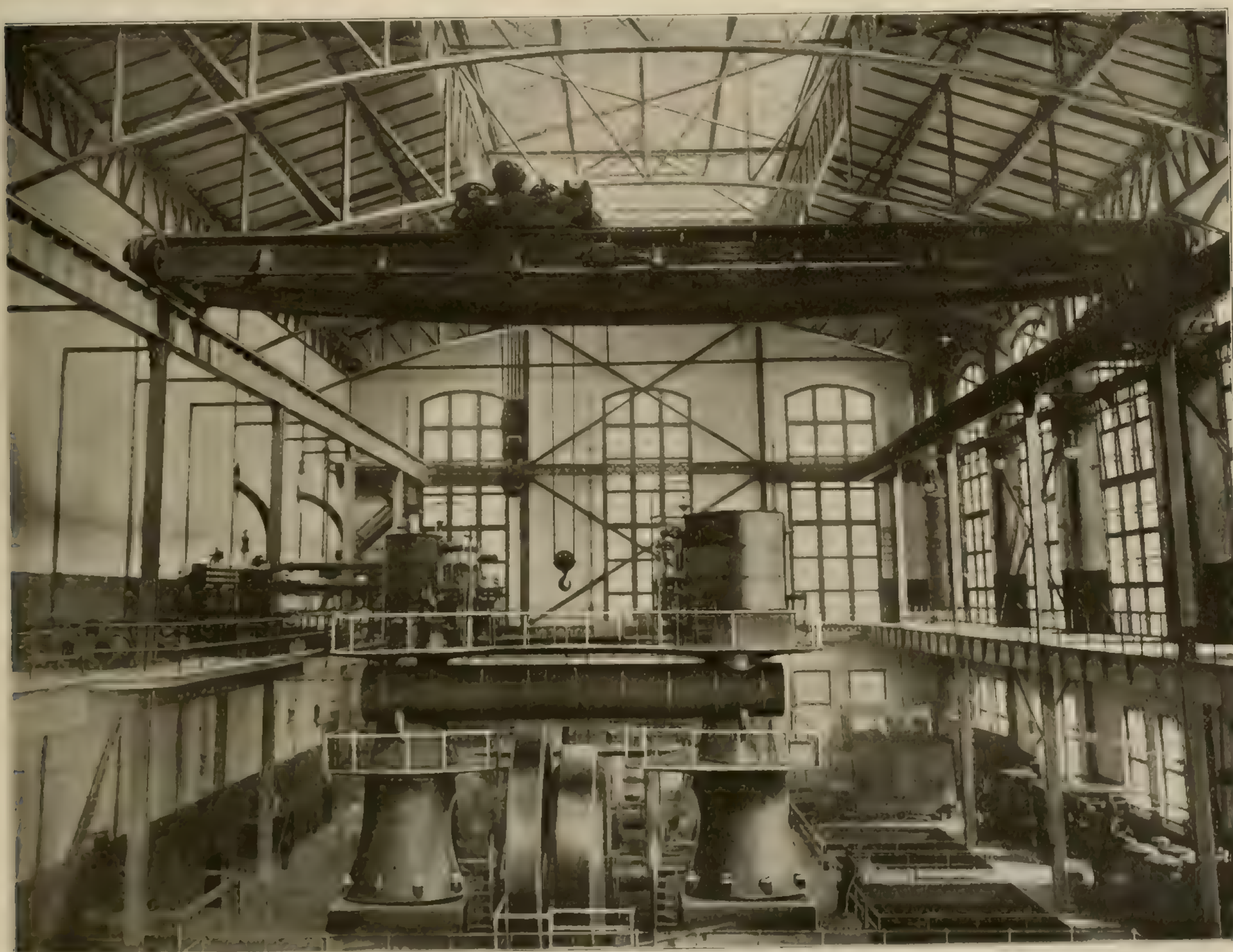
MR. G. C. KUHLMAN, president of the G. C. Kuhlman Car Co., of Collinwood, O., tendered his resignation as president of that company, June 18th, to take effect immediately. He will take a long-needed rest for several months, and will make an extended trip with his family, probably to the Pacific Coast. On his return Mr. Kuhlman expects to enter upon a new business, the nature of which he has not yet announced.

The Missouri River Power Station of the Metropolitan Street Railway Company of Kansas City, Mo.

BY HOWARD PRESCOTT QUICK, DESIGNING AND MECHANICAL ENGINEER, WITH FORD, BACON & DAVIS.

Power Situation in Kansas City.

The principal and most expensive piece of work which forms part of the undertaking of Ford, Bacon & Davis, engineers, to reconstruct the Kansas City street railway system, is the new Missouri River Power Station, a plant of about 40,000 kw. ultimate capacity. The present installation is to be 10,500 kw., of which a portion has been in operation since February 6th of this year.



INTERIOR OF MISSOURI RIVER POWER STATON FIRST UNIT IN OPERATION

This is designed to provide current for both lighting and railway service for the whole city for many years, but is principally for railway service, as in conjunction with it is to be used the new lighting plant on the Kaw River, erected in 1902-3, by Ford, Bacon & Davis, having a capacity of 1,500 kw. and an installation of [illegible] kw. These two plants and four or five sub-stations are connected by an underground conduit high tension system shown in the diagram Fig. 1. The voltage of these lines of transmission is 6,600, and this is carried entirely underground in lead cables laid in 3½-in. tile ducts embedded in concrete.

The sub-stations will each be arranged with both lighting and railway apparatus to care for the districts of which they form the centers. The construction of these sub-stations is now in progress, and some are equipped and operating with either permanent apparatus or temporary expedients. There is also much temporary auxiliary power generation and transmission carried on at the old and new power, lighting and cable stations to care for the increasing electric load, but as the new station is nearing completion, they will soon be put out of use and midsummer or early fall will see the new sub-station system in complete working order as now contemplated.

The two new generating stations will continue to be supplemented by the old Kaw River plant of 5,000 kw. capacity, which will care for the demand from Kansas City, Kan., and the West Bottoms, and by the old Blue River station of 650 kw. capacity, which will care for the distant Independence City line, making a total of 19,150 kw. present capacity.

This will be made more clear by stating that the needs of the city were anticipated early by the companies which later combined

their interests both lighting and railway, and in the year 1901 engines and boilers of sufficient capacity were ordered for both purposes. Their delivery was planned for early in 1902, but reorganization and changing of engineers and delay in getting a site postponed this to late in 1902 or early in 1903.

The problem presented to the new engineer was to design a power plant for a future population of 500,000 people, and to furnish all light and power for it, because of the desirability of the ultimate abandonment of all existing plants and changing of all cable lines to electric, as was to be required by an agreement between the Metropolitan Street Railway Co. and the city. To therefore provide for the growth of the city to a possible 10-mile distance from the central source of power and for lighting conveniences an alternating three-phase system with sub-stations was adopted, with a pressure of 6,600 volts and 25 cycles per second periodicity. Heavy high-powered cars were deemed necessary for the steep grades, and the use of electric light was expected to increase very rapidly.

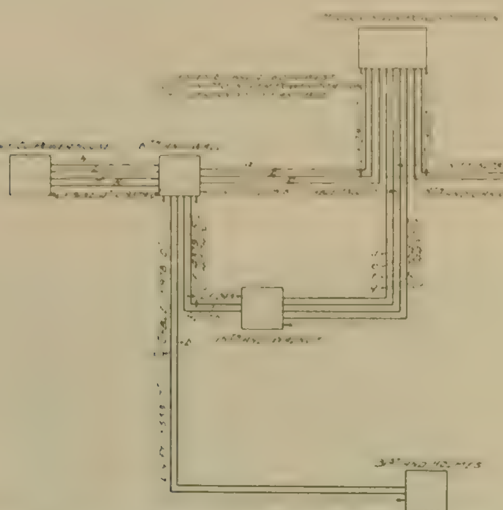


FIG 1—ARRANGEMENT OF POWER PLANT AND SUB-STATIONS.

The completion of the new lighting plant at the Kaw in the winter of 1902-3 provided assistance sorely needed for both railway and lighting load increase, and while it is considered a temporary plant it is bound to be required for a number of years and may always be retained in service with addition to its equipment of another unit as space exists therefor. The flood of May 30, 1903, overwhelmed this plant as well as the main direct-current railway plant on the opposite side of the river and some smaller ones, but they were repaired and put in service and are doing their usual work at the present time.

With the general situation thus explained we may properly take up the main features of the plant.

Selection of Site and Apparatus.

To make clear the general design it will be stated again that the selection of a portion of the engines, generators, boilers and stokers antedated some 12 or 15 months the selection of site by the present company. In the meantime changes in management took place and the steam turbine became a successful competitor with the steam engine of the reciprocating type ordered, and its possible future use made it prudent to design the system with this in view. These considerations as to turbines formed the key of the situation in regard to the general design and arrangement of the station on the lot, and to some extent of the exterior and determined especially the electrical controlling scheme.

The Missouri River plant has three 4,600-h. p. Allis-Chalmers vertical cross compound condensing engines and 18 Babcock & Wilcox 578-h. p. double deck boilers with Green chain grates. This is only a portion of the present boiler capacity of about 24,000 b. h. p. If the rest of the power is to be taken from 5,000-kw. turbines, two of which have been ordered, and if turbines only are used hereafter, then it is designed that six units shall occupy the west half of the station, the east half being given over to the three engine units, and considered fixed for the present, but to supply all these turbines another boiler house must be built to the south of the station, as shown by Fig. 2. This is so far in the future that it is difficult to predict what will be done or required. At any rate the installation of the next three units will require the completion of the north half of the boiler room with two tiers of boilers, stack, conveyor, etc.

The Missouri River power station was located, as shown by the plans Figs. 2 and 3, between two railroads and about 1,000 ft. from the river, thus insuring provision for coal and condensing water. This was as near to the river as it could be located, for after a year's endeavor no other site was found suitable or available, surprising as it may seem in view of the extensive river front, but this is explained by the fact that the steam railroads have all the available bottom land, and one side of the Missouri River is not accessible for industries of any kind.

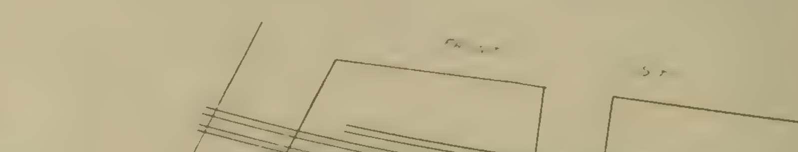


FIG 2 PLAN OF MISSOURI RIVER STATION.

The station site was a bluff, and many old buildings, with earth to a depth of from 25 to 50 ft., were removed, and the earth deposited on the river bank hydraulically. A city sewer formed a convenient channel for this earth as it lay on the bed rock which formed the basement level of the station. This rock was reached in November, 1902, after two or three months' work, the starting of plans dating from July, 1902.

The relative elevation of the river water levels, high and low, and location of the building site, tracks, etc., are shown in Fig. 3, and it will be seen that a plane 25 ft. below the lowest street level was chosen as the basement floor level, for the location of pumps, condensers and piping determined this elevation as the proper one for the engine room basement and in the boiler room a greater depth was not necessary, except for pumps and hot wells.

General Design and Arrangement.

Much of the station detail had to be determined very early in a general way, for the preliminary contract for the structural steel in bulk, entered into some time previous to the starting of plans, necessitated an early completion of the steel designs, and these depended wholly on the mechanical requirements. This detailing was all done in the special offices of Ford, Bacon & Davis at Kansas City, established for the purpose. Some 3,500 tons of steel were

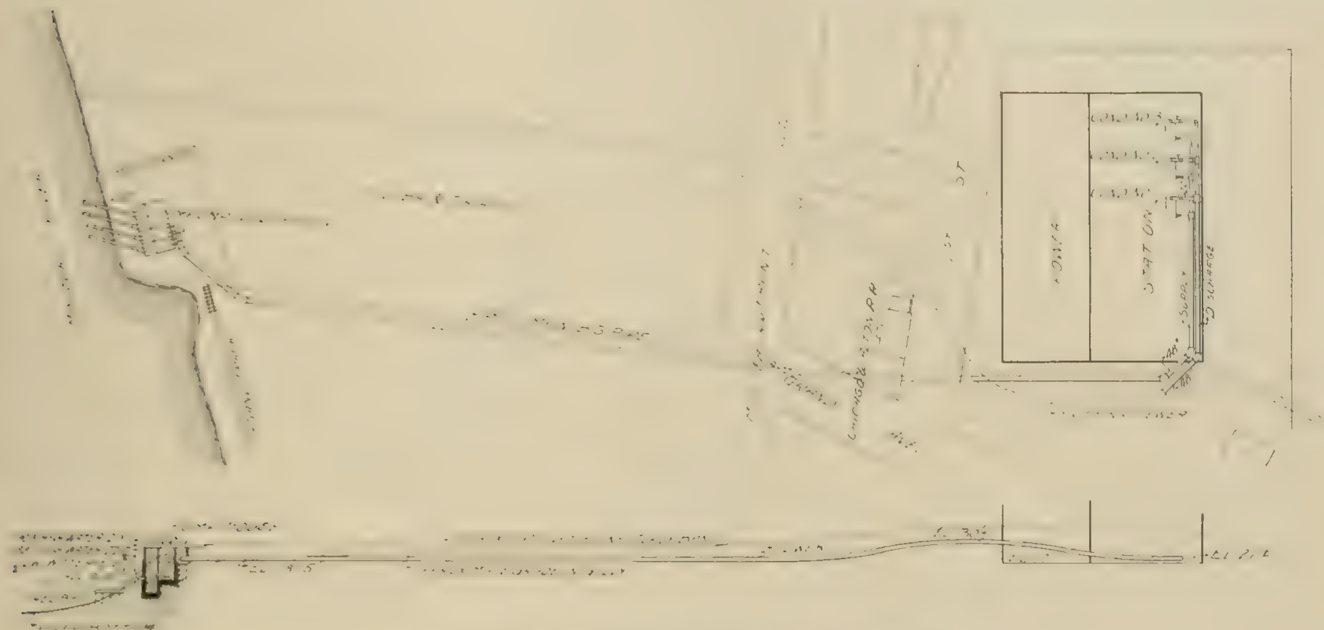


FIG. 3. CONDENSING WATER PIPING SYSTEM.

thus designed and prepared by the Illinois Steel Co. at South Chicago. Erection began in March, 1903, upon concrete foundations prepared by the company's engineers, and a local contractor, from rock taken from and crushed on the site, sand from the Kaw and Missouri Rivers, and cement furnished by the Atlas Portland Cement Co. of New York. Steel erection was completed in two months and the erection of the superstructure walls proceeded immediately, the firm of Taylor & Winn of Kansas City, having the masonry; the Weis Cornice Co. of Kansas City, copper, sheet metal work and skylights; the St. Louis Expanded Metal Fireproofing Co., flooring, roofing and plastering; the F. P. Smith Wire & Iron Works, Chicago, and the American Bridge Co., miscellaneous interior iron work, stairs, railings, partitions and platforms; J. C. McFarland & Co., of Chicago, galvanized

FIG. 4—PUMP HOUSE AND RIVER.

[illegible] and Alpena Cement [illegible] Construction Co., of Chicago, [illegible] and [illegible]

The problem of [illegible] water supply [illegible] A [illegible] on the river bank [illegible] Fig. [illegible] finally decided upon, and plans were made to put in a cellular [illegible] extreme variations in water levels which prevails here, the lowest level occurring in midwinter, and the highest in midsummer.

The work on this station was begun in the spring of 1903, and after various delays the structure has emerged from the sand as shown by the engraving Fig. 4, and is now in operation.

As shown by Figs. 5 and 6, the station proper covers a space 266 ft. x 196 ft., and has a height of 125 ft. from basement to top of roof. Near the center is a chimney 265 ft. high above basement, having a 16-ft. flue, circular in shape, with four flue openings. A fire-brick lining extends to a point above the upper flue opening. The general features of the chimney are the octagonal common brick base and the circular tapered shaft of radial brick, having a bulging head with segmental cast iron cap and copper lightning rods.

There is also a 43-ft. extension of the building foundation on the east or Locust St. end of the building, designed in part for a future condensing water pumping chamber, but allowing for the installation of the coal handling plant over it. This consists of two branch steam railroad coal tracks for cars of 50 tons' capacity; two 100-ton platform scales and coal tower where coal and ashes are to be interchanged between cars, conveyors, bins and crushers, as shown by Figs. 2 and 7.

The building proper has a skeleton steel frame which carries the floors, coal pockets, boilers, engine room crane and roof, takes the wind strains and stiffens the walls, which, being so stiffened, are of medium thickness, although they are borne entirely by the concrete foundation walls, Fig. 8.

The design of the exterior is on classic lines, but devoid of ornamentation. It is massive in its proportions, and the elevation is uniform as to height and design throughout. The base has a batter on the outside and is heavy, with groups of two small, deep-set, flat

arched windows. The base is capped by a stone belt and forms a support for the pilasters which mark the main window spaces. The pilasters are joined by segmental arches over the 16-ft. and 14 ft. x 45 ft. recessed arched windows. Above these is the main cornice of copper surmounted by the attic story with triple window groups in line with the main windows below. All lines extend around the building. There are no temporary walls. The building is faced with a brown face brick, which with the plain lines and massive design gives the exterior a very satisfactory appearance. The brick in the chimney is a somewhat lighter brown and unusually uniform in color. An ornamental cut stone entrance on the west end and special doorways on the east end of the base are the only breaks in the regularity of the lower windows.

Boiler Room.

The interior, see Fig. 6, has the usual arrangement for stations of this character containing vertical engine units of large size. A party wall divides the two rooms, boiler and engine. The boiler room has a basement floor where are located feed pumps, tank or heater pumps, hot well pit, sump pit, ash and coal machinery, also a freight or coal elevator and space for economizers and flue connections, if ever installed. The next two floors are boiler floors, on the first of which are also the auxiliary heaters. A passenger elevator starts from this floor, and with a stairway reaches all floors and the roof. At the east end are located the firemen's wash and locker rooms. Above the second floor are the two coal storage bins of concrete and steel, from which chutes extend to the coal receiving, weighing and distributing apparatus. A monitor with ventilators and windows, and a skylight illuminates the central well between chimneys and coal bins which extends to the basement, openings in each floor being provided for the purpose.

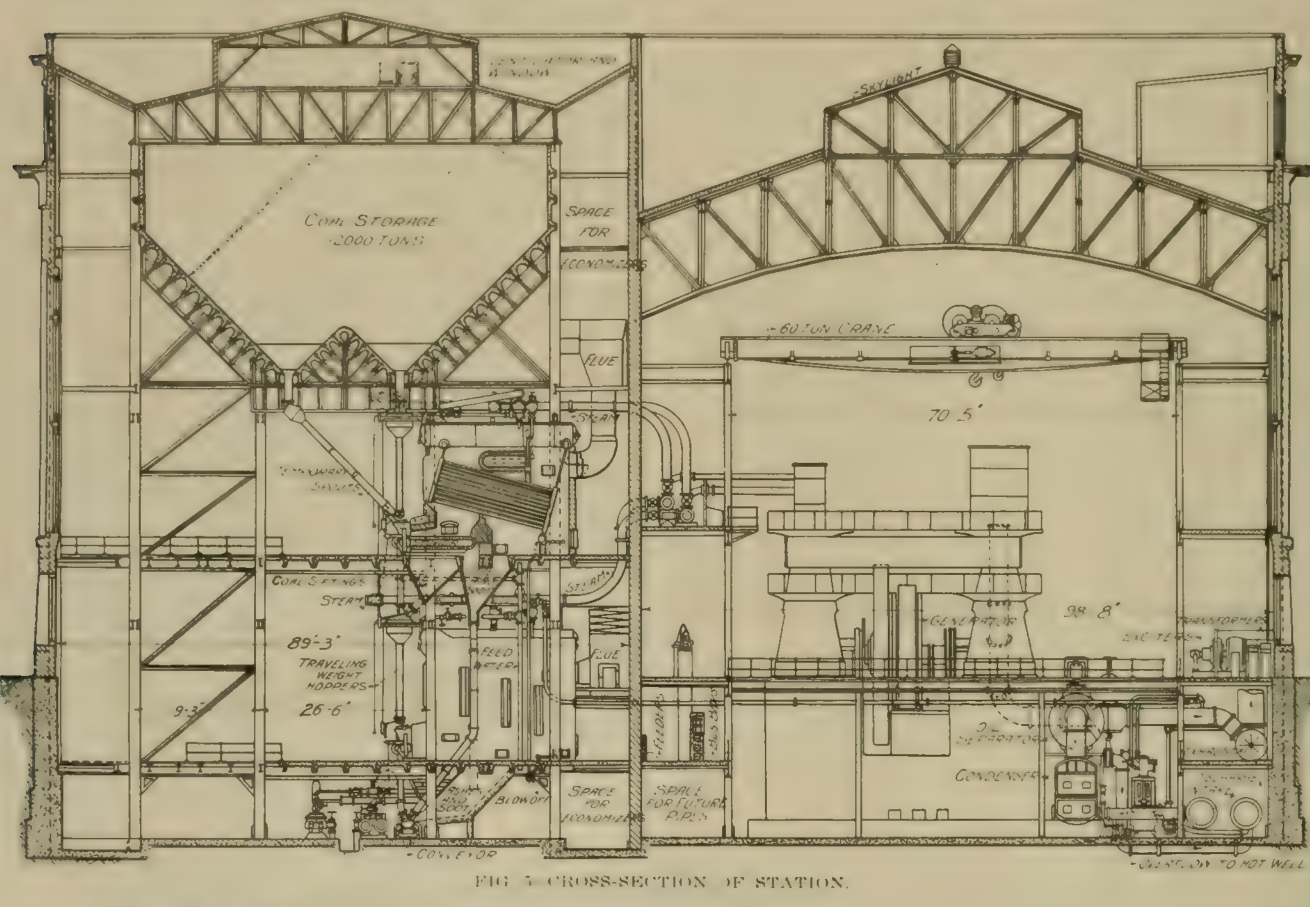


FIG. 5. CROSS-SECTION OF STATION.

Engine Room.

The engine room basement is on a level with that of the boiler room basement. On the north and south side under the galleries are spaces for intake and discharge pipes, the south side only being in use at present. At the east end are the storage battery, oil and store rooms. In the center at one end are the three engine foundations, the condensers, air pumps and connections; at the other end is space for turbines.

The first gallery on the north side contains bus bar and switch compartments and the high tension cable ducts. On the east gallery are rooms for the operating forces. On the south gallery are the main exhaust pipes, and space for future bus bar compartments is left on either side in the west half. At the main engine room floor level the three engines occupy the east half of the room. They are 37 ft. on centers, which spacing is the unit throughout the building, for both columns and machinery.

On the north side of the engines are the oil switches; on the east, the chief engineer's and electrician's offices; on the south are the exciters, transformers, and exciter and battery switchboards. On the main floor wings in the west half of the engine room are spaces for the future oil switches for turbine units.

The engine room has another gallery running around it, above the main floor. The north portion of this gallery is occupied by the main steam headers, valves and branch connections, and in the center is the electrical controlling board on a balcony overlooking the whole room and on a level with the upper engine platforms. All the floor space excepting in the galleries is commanded by a 60-ton traveling crane running on a span of 70 ft., 5 in. which is that of the interior gallery columns. This crane was built by Pawling & Harnischfeger, Milwaukee. Outside at the east end 10-ton auxiliary beam hoists enter both the engine and boiler room walls for handling small machinery.

In the engine room, as in the boiler room, a stairway runs the full height of the building, communicating with all levels. A skylight surmounts the engine room, being a special provision of value if the second boiler room is ever added, when the south windows would be closed up.

Engines.

The engine room contains three 4,600-h. p. Allis-Chalmers vertical cross-compound condensing engines, having cylinders 46 in. and 94 in. x 60 in. and running at 75 r. p. m. The three engines will use superheated steam, but have ordinary cylindrical corliss valves. There are governors on both the high and low pressure cylinders

and the usual devices for safety and control, the electric motor speed control for synchronizing being on the low pressure cylinder and of the sliding motor type and the automatic stop valve on the high pressure cylinder next to the starting valve. There is a 6-in. by-pass from the starting valve to the intermediate receiver for [illegible] starting or in running high pressure. [illegible] of the starting valve [illegible] which is connected by a [illegible] pipe from the main steam header. There is no separate [illegible] of the high pressure cylinder. The main exhaust is

34 in. The cylinders have copper expansion pipes on their distribution pipes. The valve casings are cast separately from the cylinder barrels. The exhaust pipe from the cylinder to condenser is cast iron. Bridges or galleries connect all three engines at both

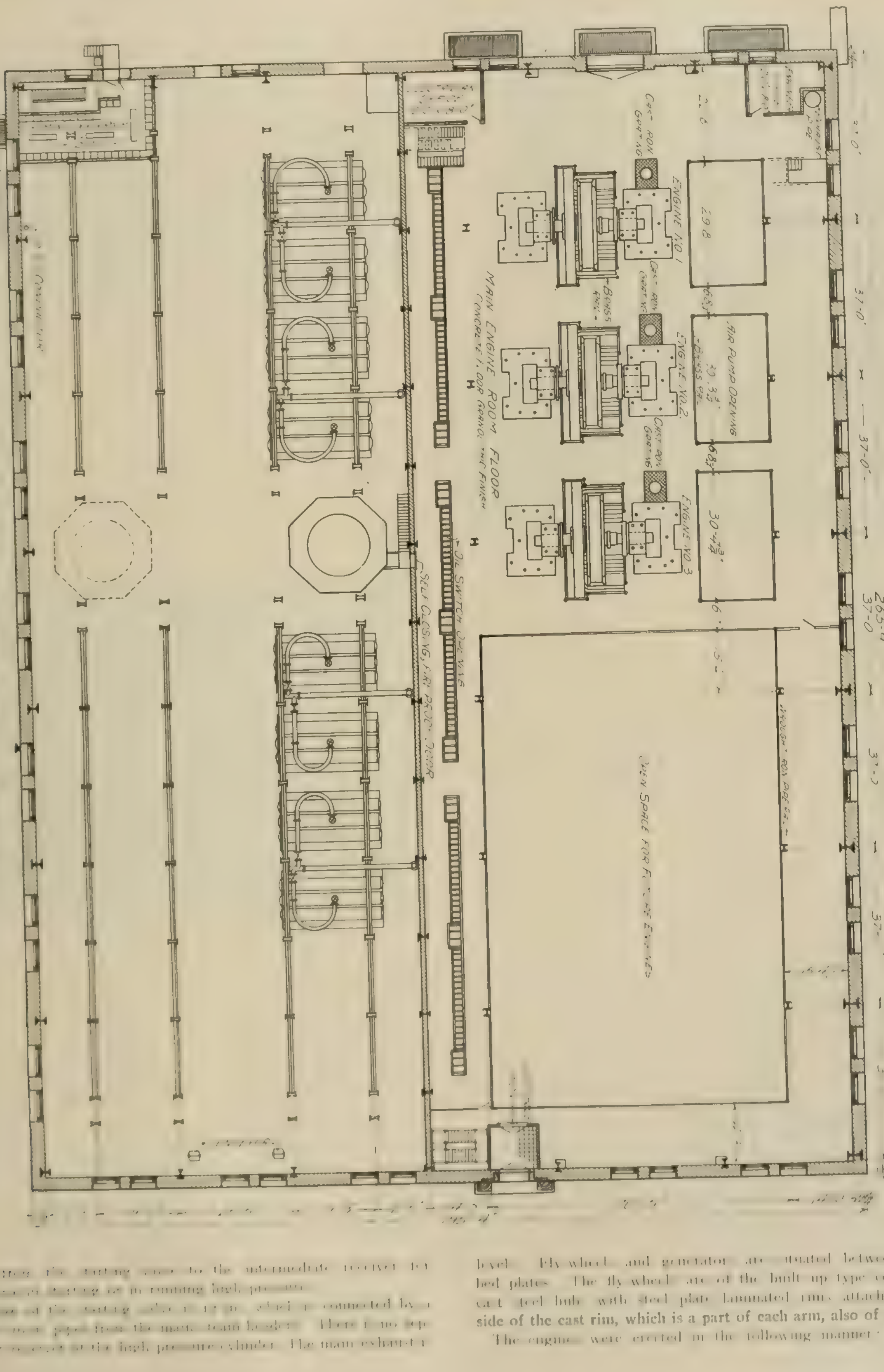


FIG. 6. PLAN OF MAIN ENGINE ROOM FLOOR AND BOILER ROOM.

level. Fly wheels and generators are situated between the two bed plates. The fly wheels are of the built up type consisting of cast steel hub with steel plate laminated rims attached to each side of the cast rim, which is a part of each arm, also of cast steel.

The engines were erected in the following manner: First, the

[illegible]

[illegible] spokes with their segments were set up and the latter joined by shrinking keys into slots. The erection of plates then proceeded. Each plate segment of the rim being identical with the others and [illegible] a very simple

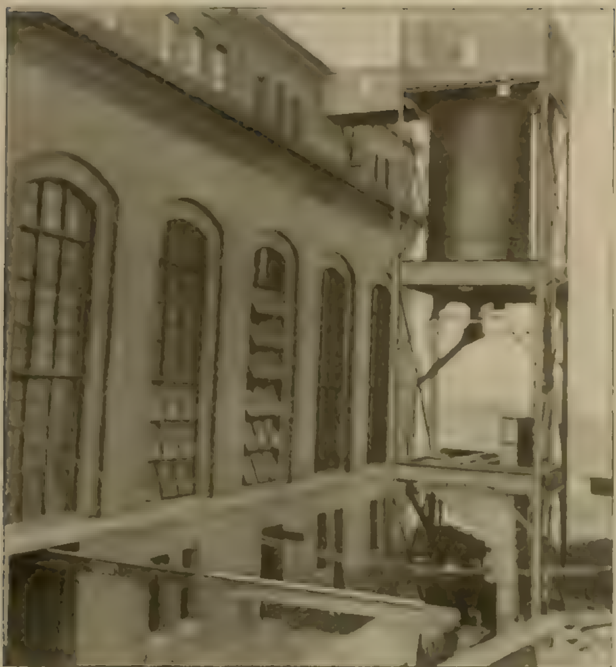


FIG. 7 COAL AND ASH TOWER

FIG. 8 STEEL SUPERSTRUCTURE

matter. The outer and inner circumference of each plate was left rough and extended beyond the face of the cast rim segments, which were merely rough turned. The last layer of plates was provided with countersunk and counter bored holes, designed to receive the expanded rivet heads. Bolts with nuts and washers were used to erect the plates, and these were replaced by rivets hydraulically driven, but to properly prepare the holes for rivets it was necessary to ream out all holes with a special machine after

the shaft erection proceeded. By means of a branch track extending diagonally into the engine room, and by a 60-ton crane, all parts were handled with ease direct from cars into place on the foundations. The hollow forged shafts were shipped naked except for the fly-wheel hubs, which were put in place at the factory. After arrival they were jacked up at one side or put in place over the bearings; then the generator field hubs were pressed on and keyed. These were followed by the crank disks, each of which was pressed on by a force approximately 300 tons created by a nut and sleeve arrangement on a bolt extending through the hollow shaft, the nut being turned by a wrench, the end of which was hitched to the

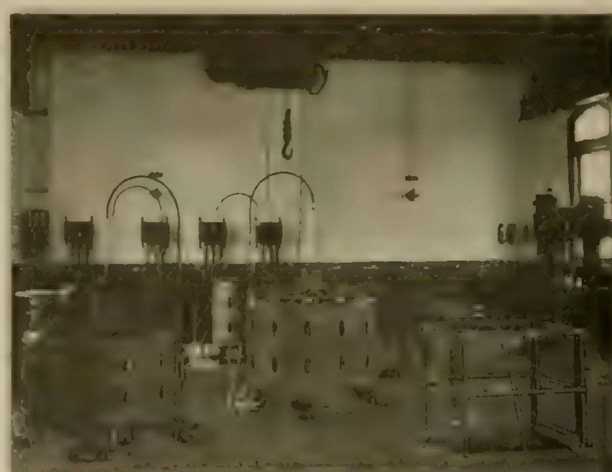


FIG. 10 PUMP ROOM

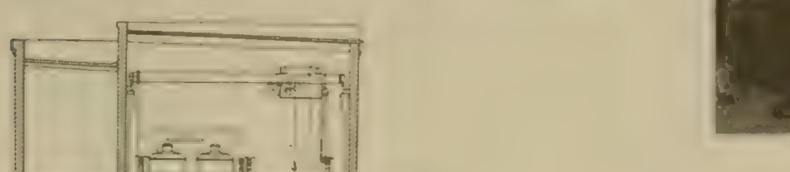


FIG. 9 SECTION OF PUMP HOUSE

main hoisting hook of the 60-ton crane. The shaft being ready, it was rolled or lowered into place in the bearings. The eccentrics were then attached and the erection of the A frames and cylinders

the plates were in place; this was furnished for the purpose and erected in position to do this on the job. After riveting all heads were trimmed off by cutting tools held by the boring machinery, while a motor spur geared to an inside gear attached to the wheel arms turned the wheel on its shaft. The same cutting tools were then used to face off both sides and perimeter of the rim until its surface was true and smooth and presented a perfectly homogeneous appearance. The erection of the revolving field rim and rim magnets and setting of the armature coils attached to the upper half of frame was carried on without any difficulty during the fly-wheel erection, and the A frame and cylinder erection proceeded also while this was going on.

Exhaust and Condensing System.

The engines exhaust into Wheeler surface condensers of 5,000 h. p. capacity through Cochrane 48-in. cast iron circular oil separators, a 34-in. x 48-in. tapered pipe being used for this purpose between each separator and the 34-in. shut-off valve, which cuts out the condenser line from the atmospheric line.

The condensers have a single passage for condensing water. This enters at one end at the bottom by a 20-in. pipe and passes through 1,680 copper tubes 1½ in. in diameter, and out at the other end at the top through a 20-in. pipe. The latter pipe dips and rises in U shape to the main overflow pipe, forming thereby a water seal which, as soon as a continuous column of water is formed by the action of the circulating pumps in filling pipes and condensers, then acts as a siphon and cuts down the lift required to get water to the condenser outlet level. Both inlet and outlet pipes have valves close to the condensers, and on the outlet is an air valve for breaking the siphon vacuum. The oil separators have Sorge drainage traps and tanks with chronometer steam valves.

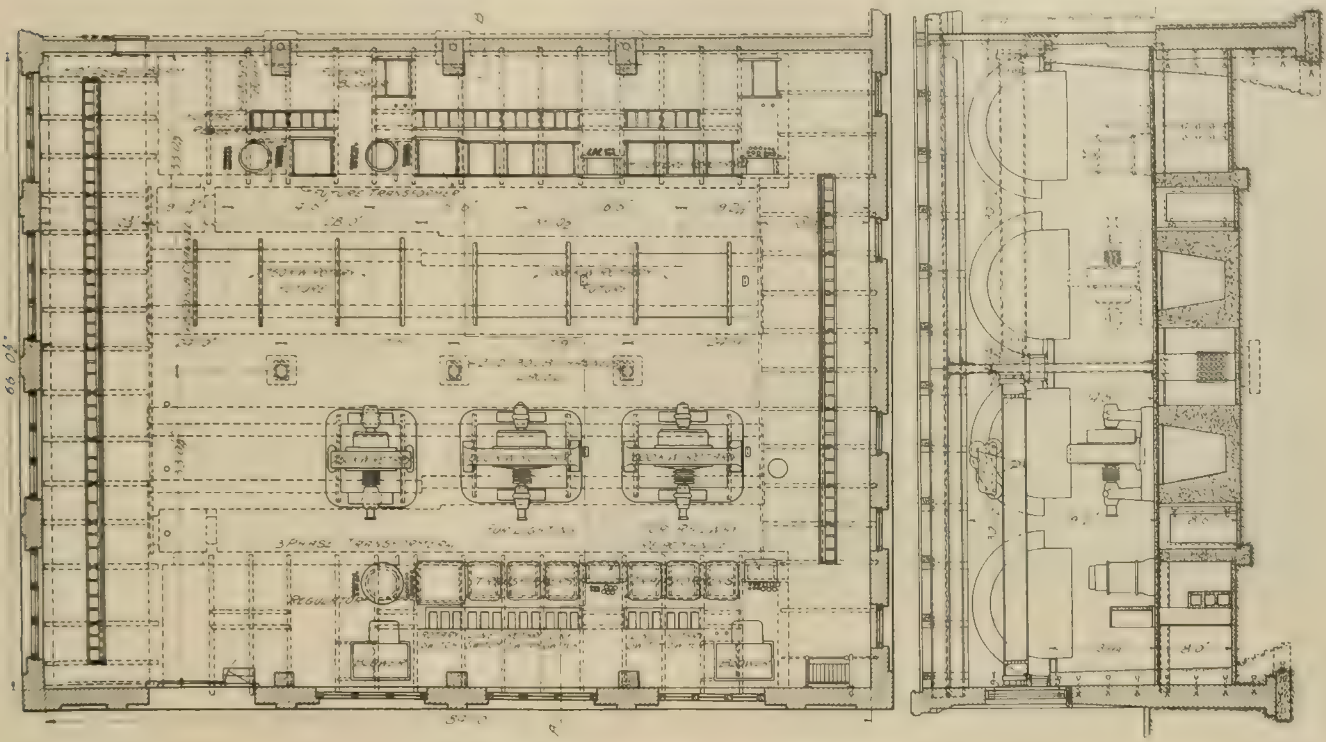


FIG. 12 SUB-STATION 15TH AND WALNUT STS

The atmospheric exhaust is through a 30-in. Blake globe type automatic relief valve. Each valve has separate control by hydraulic cylinder attached to it and connected to the city water system. This is for the extreme positions of open and shut, the four-way valve used being set at by-pass when the vacuum system is working so that the valve spindle is free to rise or fall. The 34-in. shutoff valve in the vacuum line is operated by direct-current, 220-volt motor geared to the spindle. This insures quick shutting of a large valve in case of emergency to prevent steam filling condenser and pipes under atmospheric pressure. All atmospheric exhausts are connected to a 48-in. steel riveted header terminating in one exhaust head on the roof.

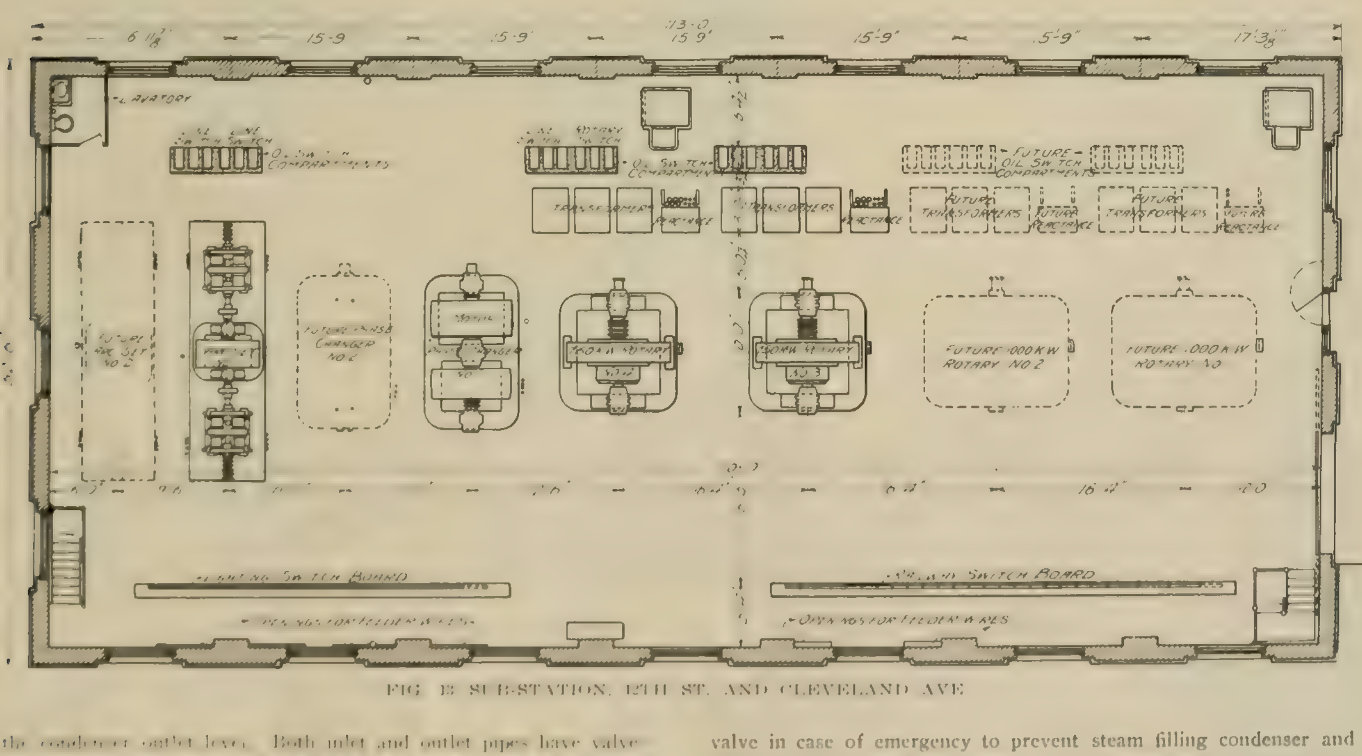


FIG. 13 SUB-STATION, 12TH ST. AND CLEVELAND AVE.

Blake vertical duplex beam air pumps, size 14 x 38 x 21 in., take care of the water of condensation. The suction nozzle is several feet below the condenser outlet and the pump overflow is several feet above the floor, giving a sufficient head to carry the water of

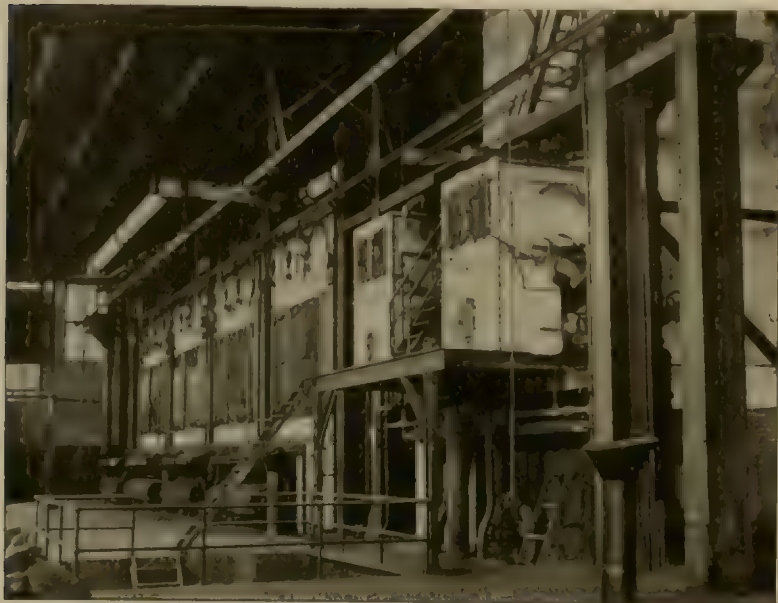


FIG. 14—BOILERS—LOWER FLOOR.

condensation by gravity to the hot well in the boiler room basement.

Pumping Station.

Circulating water for the condensers is pumped to the main station from a pumping station at the river through a 48-in. cast-iron bell and spigot pipe line, and the discharge is carried away by a similar line emptying into a 6-ft. brick sewer passing near the station.

At the pumping station the main features are the rectangular pump and screen wells and the motor room above them in the superstructure. The whole structure has a height of 63 ft. from bottom of wells to roof and covers a space of 30 ft. by 54 ft. in plan. The equipment consists of three 6,000-gallon per minute and one 3,000-gallon per minute Morris high lift centrifugal pumps with 18-in. and 12-in. top suction pipes and 15-in. and 10-in. horizontal discharge pipes expanding to 18 and 12 in., which connect with the 48-in. pipe outside. The pump guarantee is 70 per cent efficiency and the maximum working head is 40 ft.

The pump suction pipes lead through the concrete walls of the pump wells into screen wells divided by screens on the opposite side of which 30-in. intake siphon pipes drop. The screens are made of No. 6 galvanized iron wire with 1-in. mesh set in angle iron frames. These screens are 4 x 6 ft. in size and set in pairs in the form of a double partition each side of a center post, which carries some of the guides, and there are six tiers of these screens, one above the other, each having handles which can be engaged by a screen hook for lifting or lowering. There are no screens on the ends of the four siphons. These are inclined down stream, and it is considered that the swift current at this point in the river, which is one of the narrowest parts of its channel, will scour away any accumulation of debris or mud at the end of the pipes. Small stuff that may float into the pipes will be taken care of in the screen wells. On the 30-in. siphon elbows just inside of the screen chambers are taps for vacuum pump connections. This pump, a Blake 9 x 7-in. vertical duplex motor-driven geared machine, is located on the main floor above the screen wells, and is connected to all siphons and suctions. The siphons have a gate valve on the vertical pipe in each well, and this has a special self-oiling set of bevel gears completely encased in iron, for they will be under water most of the time, and it is important that the gearing should always be ready for service. These valves, of course, serve the purpose of sealing one end of each siphon when the vacuum pump is working, and of keeping out the inflow in case a well is being cleaned. Under these valves are extensions of the siphons for reaching the extreme low water stage of the river, and these pipes go below the level of the river ends, for there will be a difference in the elevation of the water in the river and wells, due to the draft on the well supply and friction in the pipes. The elevation of the bottom of the wells is —11 ft., and extreme low water may be —6 ft., so that with 3 ft. under the pipes there may be only 2 ft. of water above their ends to draw on under extreme conditions.

In the partitions between each pair of screen wells and on the river side of screens are 20-in. sluice gates of the Coldwell-Wilcox pattern for use in establishing inter-connections between wells in case of trouble with any siphon entering a well from which the pumps are drawing their supply. On the opposite side of the screens the siphon-shaped pump suctions which lead through the walls into the top of all pumps are provided with foot valves to prevent reversal of flow when pumps are suddenly stopped at low water stages. They are provided with gate valves and vacuum connections on the pump well side. The suction elbows on the pumps form a support for the thrust bearing of the shafts. The pull of the water column on the suction side will relieve the pump shafts of any friction on bearings while running, especially at high lifts.

The pump wells were made water tight by waterproofing the walls, and thus the pumps can be got at easily for repairs. The elevation of the center of pumps is zero or 11 ft. above the bottom

FIG. 15. BOILERS ON SECOND FLOOR.

of screen wells. This is not so high but that the lift even at extreme low water, —6 ft., is within the capabilities of such pumps, and generally, except for two or three months, the water will average as high as the pumps, while for a portion of the year the water level will be way above the pumps. It may even go as high as the elevation of the condenser outlets at the main station,

for this was the flood elevation of May 31, 1903, and in this case the pumps will simply have to work against the friction head due to the length of pipe and passage through condensers in keeping up a circulation. All pump discharge pipes have easy bends as they leave the pumps and at the tees on the main discharge. At the top of each pipe near the tees are gate valves, which not only serve the purpose of shutting off each pump from the main line, but of holding the main supply pipe full or primed during a complete shut-down of the pumping station, or the cutting out of any pump or other valve for repairs.

Midway up the pump chamber is a platform with iron floor gratings, and the beams of this floor carry also the intermediate shaft

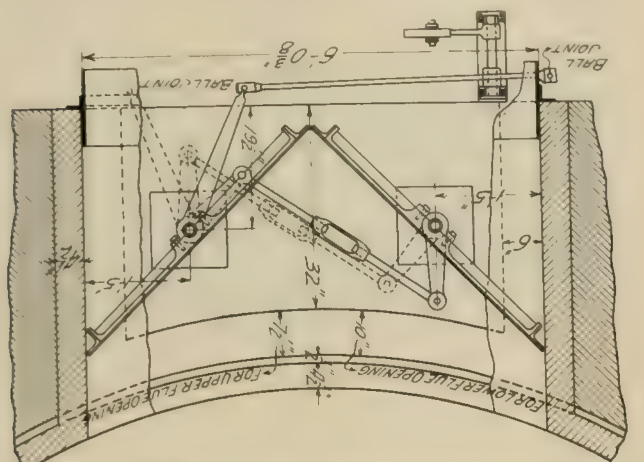


FIG. 16—DAMPER MECHANISM (FLUE OPENING 6 x 10 FT.)

bearings which occur near the intermediate couplings. All pump chamber partition walls have doorways at this level which allow easy access for the operators without use of ladders. Just under the main floor General Electric flexible shaft couplings are used, supported by bearings both below and on the motor. At the top of each motor frame are thrust bearings, which are automatically oiled from an oil pan on lower frame by centrifugal force. The motors are of the G. E. induction type K, three-phase, 25 cycle, 440 volts, and of two sizes, 125 and 75 kw., both running at 375 r. p. m. The motor feet and shoes under them are provided with set screws to facilitate perfect alignment of motor and pump shafts, both vertically and horizontally. The compensators and switches are located at the west end of the station in a recess provided therefor, under which is a wire connection chamber entirely separate from all water chambers. In this the cable conduit runs from the main station, carrying 440-volt transformed current from the transformer on the main engine room floor. Lighting is done by the same circuit and voltage, and the heat from the motors is sufficient for warming the station under ordinary conditions. The main floor of the pumping station consists of steel beams with concrete and expanded metal slabs. Cast iron plates cover the pump and screen openings, and there are ladder openings with railings in various places. All valves are controlled from this floor and gages are used to give the height of the water in all wells, on both sides of the screens.

Fig. 9 shows a section of the pump house and Fig. 10 a view of the motor room.

On the south side of the station is an extension combining an entrance vestibule with two rooms, one for the operators' desk and records, and the other for a lavatory and store room. A screen cleaning balcony is provided on the river side at the main floor level reached by a small door. At the east end is a large machinery door, through which all machinery is handled. The whole layout is covered by a crane which was made by the Cleveland Crane & Car Co. This crane is hand operated except for raising and lowering its load. For this operation the trolley is equipped with an induction motor of the G. E. type M, and is operated at 440 volts. The controller and resistances are mounted on the trolley. It will be used for hoisting screens after the installation is complete and the system running. The building itself is of brick, with concrete roof and metal lath and plaster partitions are used in the extensions. It is situated about in the center of a lot of 10,000 sq. ft., occupying a corner of the holding of the Union Depot Bridge & Terminal Railway Co., and has about 100 ft. frontage on the river, which will be riprapped to prevent injury from floods.

The station has telephonic communication with the main station at the switchboard, where the pump motor transformer current is handled. The operation of the whole pumping plant is as smooth and noiseless as it is possible to make machinery run, and it requires very little attention. It is found that one 6,000-gallon pump will supply ample water for two condensers and that throttling the injection at the condensers to cut down the supply cuts down the current required to operate the pump in the same ratio as the throttling, although the pump maintains a constant speed.

The total maximum head pumped against will be 36 ft., but the normal head will be 26 ft. The friction in the long 48-in. intake, etc., is offset by the siphon effect of the water from the condensers to the sewer. This will about balance when the full capacity of the 48-in. pipe and station, which is 40,000 gallons per minute, is reached.

Generators and Electrical Apparatus.

The generators are of the General Electric type, three-phase, 25 cycle, 6,600 volt, with revolving fields. The rating is 3,000 kw. normal load. There are two 125-volt continuous current exciters, driven by 200-h. p. induction motors from current furnished by transformers having 6,600 volts on the primary and giving 350 on the secondary coils. A 78-cell storage battery of the Electric Storage Battery Co's. type H having 60-kw. capacity, located in the basement, will furnish current for excitation when the induction motors cannot be operated, also for lighting, switch operating and testing current when no other is available. It is kept floating on the line being cut in between the exciters and switchboard on the positive and negative busses. The transformers for the exciters as well as for the pumping station motors are of the General Electric self-cooled type, arranged in delta. The 125-volt current is used for the switchboard controlling devices and for oil switch and battery and cell switch motors. Connecting all these auxiliary and operating devices is an intricate system of low voltage wiring

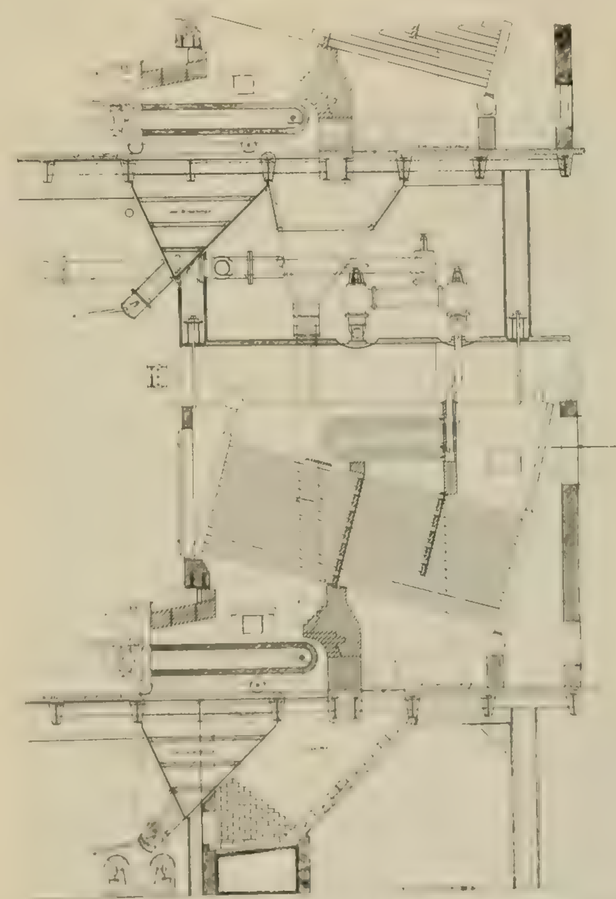


FIG. 17—SECTION OF BOILER, STOKERS AND ASH HANDLING APPARATUS

laid in [illegible] iron pipe ducts [illegible] the concrete floors and galleries where they [illegible] to current and potential transformers, [illegible] signal and control motor, exciter [illegible] switches, etc. The controlling board is a combination of table and vertical panels of black enameled slate and contains all the signaling, switching and measuring instruments required for the operation and for station record. The exciter group is shown in the general view of the engine room.

The oil switches are of the type H, of 300, 350, and 1,200 ampere capacity, set on concrete barriers or cells and slate slabs. They are arranged in a row on the north side of the engine room floor and will ultimately be grouped for each generator unit as follows: 1 generator switch, 5 feeder switches, 1 group switch, and 1 exciter switch. The present arrangement is slightly different. Directly under the switches are the concrete bus bar compartments, one for each phase, and the vertical barriers for disconnecting switches and cable connections corresponding to the oil switch phase compartments above. Here also are potential and current transformers.

The main current passes from generator to generator switch, then to bus and from bus at different points to line switches, then from line switches to outgoing ducts through static dischargers, each phase being separate and brought together only at the end bell with which each feeder terminates in the station.

The bus bars have one sectionalizing switch separating them into east and west buses. All feeders are in lead-covered cables and are laid in the ducts one above the other along the wall back of bus bars. A junction room or chamber is placed at a point in the line where it became necessary to change from a vertical single

FIG. 18. COAL POCKETS

width conduit to the square type of conduit which was used from the station to the first street manhole and from there to the various sub-stations.

In this connection reference may be made to the plan showing the conduit construction and to plans of two of the most important sub-stations, that at 15th and Walnut and at 12th and Cleveland, which are shown herewith, Figs. 12 and 13.

The matter of electrical connections, apparatus and operation is a subject large enough for another article and would be more appropriate when this part of the construction, equipment and apparatus is further advanced and has assumed its permanent form.

Boilers.

The boiler plant, see Figs. 14 and 15, consists at present of eighteen 578-h. p. Babcock & Wilcox double deck superheating boilers with Green chain grates 11 ft. 6 in. wide. The boilers are arranged

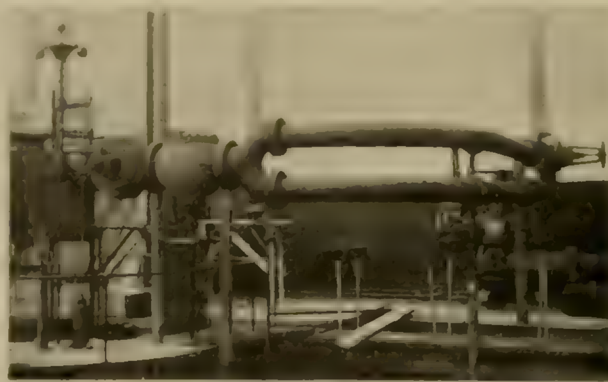


FIG. 1[illegible]. HIGH PRESSURE CYLINDER AND CONNECTIONS

singly, with access doors to furnaces on both sides of the settings.

This is an unusual feature in power plants, where they are usually coupled in pairs or batteries, partly to economize space and to save material, and partly for appearances. In the present instance the designs were influenced by the necessities of the building construction, the width of furnace and the fact that the overhead coal bins required columns close together, to leave space for which the boilers must be separated. To allow access to both sides of the fire in each boiler and to save the necessity of shutting down two boilers when one is being repaired, the single arrangement was thought very desirable. There are two boiler rooms, one over the other, and each a duplicate of the other as to boiler capacity and layout.

The stokers, which were furnished by the Green Engineering Co., Chicago, are arranged with separate driving shafts and engines for each floor, and groups of stokers of four or six, as the case may be, are driven by separate engines. Each shaft is under its group of stokers and the connecting rods are short, passing upward through the floors to the ratchet arm. All the engines are grouped near the center of each run of shafting, so that in case of necessity one engine may operate ten stokers.

Smoke flues and breechings are of steel plate covered with magnesia compound put on in plastic form. Their connections to the stack are direct and the form and position is somewhat dependent on the possible future use of economizers, provision for which has been made.

At the stack each flue is provided with a pair of swinging dampers controlled by Spencer regulators having auxiliary cylinders and mercurial pressure regulators. This mechanism is all carefully balanced and spindles have ball bearings, so that the dampers work perfectly. There are also dampers at each branch flue in the boiler wall, of the swinging type, Fig. 16.

Coal Handling Machinery.

Coal is to be delivered at the station by means of two railroad systems having branch tracks into the station yard at different elevations 30 ft. apart. The tracks run on curves of rather short radii, varying from 125 ft. to 176 ft. from the main lines running east and west to a line running north and south at the east end of the power house in a position one directly over the other and at right angles to the conveyor lines and center line of boiler house. There are sidings for loaded and empty cars on the upper track level running east and west, and it is planned to handle cars on this level by means of a car puller situated at the head of the track just beyond the unloading tower into which all cars pass. (See Fig. 2.)

The two tracks are to be equipped with 100-ton track scales of the Monarch pattern, having special recording beams. These

scales are arranged to weigh the coal cars loaded before entering the tower and empty after leaving. In the tower under each track are hoppers so located that coal may be either bottom-dumped or side shoveled into them, and the two hoppers are connected by a chute so designed that coal may stand in both to the full height of the upper track from the bottom of the crusher underneath the lower one, thus allowing cars to be emptied in spite of a temporary stoppage of the conveyor, or at least until the hoppers are full. Under the lower hopper is a McCaslin single roll crusher

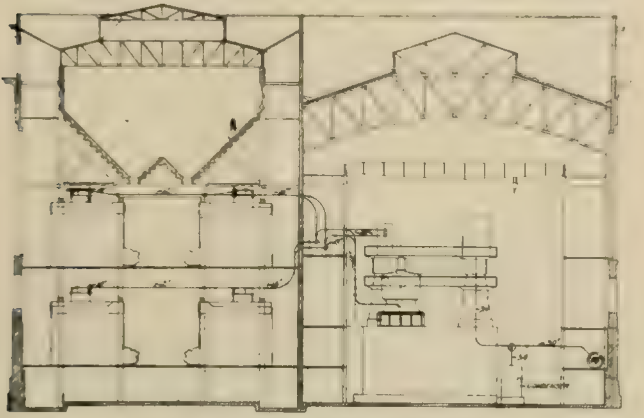


FIG. 20—ELEVATION OF PIPING.

driven by a 25-h. p. direct current motor with variable speed control. This motor is of the enclosed type with blower and fresh air connections and starting and speed regulating rheostat. Passing through the tower from bottom to top is a 24 x 24-in. malleable iron bucket McCaslin conveyor furnished by John A. Mead & Co. This conveyor passes over the ash hopper and through the attic story over the coal bunkers and down the west end of the building to the basement, thence along the latter to the tower. It is driven by a 25-h. p. motor located at the top of the tower, and its sheaves form the guide for the conveyor at this corner.

The coal storage bunkers in the boiler house are of concrete and steel construction, and two in number, extending nearly the full width and length of the house. One has about 7,000 tons maximum capacity; the other about 5,000 tons. They are so formed that there are no dead coal spaces, all surfaces sloping to the spouts at an angle of at least 40°. At the bottom of the hoppers and in two rows with a cricket between, are spouts, two to each boiler, of cast iron with duplex valves attached to every other one. The alternate ones are connected direct with spouts to the lower floor so that each floor has access to the coal bunkers. Running on tracks suspended from the floors and passing under all those spouts with valves attached are one ton traveling weigh hoppers with spouts, valves, and pendant scales of the Mead & Howe type, each equipped with sprocket chain for running same to any boiler and distributing the coal the whole length of each stoker hopper. These traveling spouts permit easy access to boiler fronts and tubes.

Coal floor spouts are arranged so that in case of fire in the main bunkers, coal may be discharged from any point and returned to the conveyor below or be dumped on the floors. Until the boilers in the other side of the house are installed temporary coal chutes will take the coal from the north side of the main bunkers and deliver it to stokers on either floor. These spouts are of steel with valve and pawl, chain and counter weight.

The conveyor in the basement has a continuous trough so that coal or ashes may be discharged at any point without the intermediate service of a filler or car. All buckets are of the malleable iron over-lapping McCaslin type, and provisions are made for leveling off the contents of the buckets before ascent and for adjustment of the chain by a tightener. The conveyor has a capacity of 72 tons per hour, running at 40 ft. or 20 buckets a minute with full buckets. There will be two conveyors for the completed boiler house, in fact a double equipment entire will be required from tower to basement. The conveyor has on the upper run two movable trippers for dumping coal, one for each bin, and one for the ash bin, the former running on a separate track and propelled by sprocket chain. There are foot walks and ladders along the whole length and both vertical runs are steel encased.

Under the stokers are steel ash and siftings hoppers, the former lined with fire brick, arranged to take all the ashes falling from the grate at bridge wall as well as all the soot from the space between the bridge wall and mud-drum wall, where the influx of air is prevented by a swinging damper controlled from outside the setting.

The siftings hoppers are arranged to catch all the unburned fine coal which drops through the chain grates in such quantities where slack coal is burned that without such a device the labor of caring for boilers is greatly increased. All hoppers are sealed from air drafts by valves and back draft of air is kept from reaching the ash pit and thence from going into furnace along face of bridge wall and through the slot between grate and wall by a drop damper hung from the grate frame in such a position as to force all air up through the bed of coal.

Coal siftings from the upper boilers are discharged into the lower hoppers and fed direct into the lower stokers, and those from the lower boilers chute directly to the conveyor.

All ashes fall direct to the conveyor through cast iron spouts from the ash storage hoppers under each boiler, which latter have a capacity sufficient for one-half day's run on the upper floor and one day's on the lower. Ashes are not allowed to collect in the spouts or to become wet. They are held back by cut-offs attached to inspection lids near the mouth of each hopper, and these cut-offs must be raised at each cleaning out time by manual effort at the

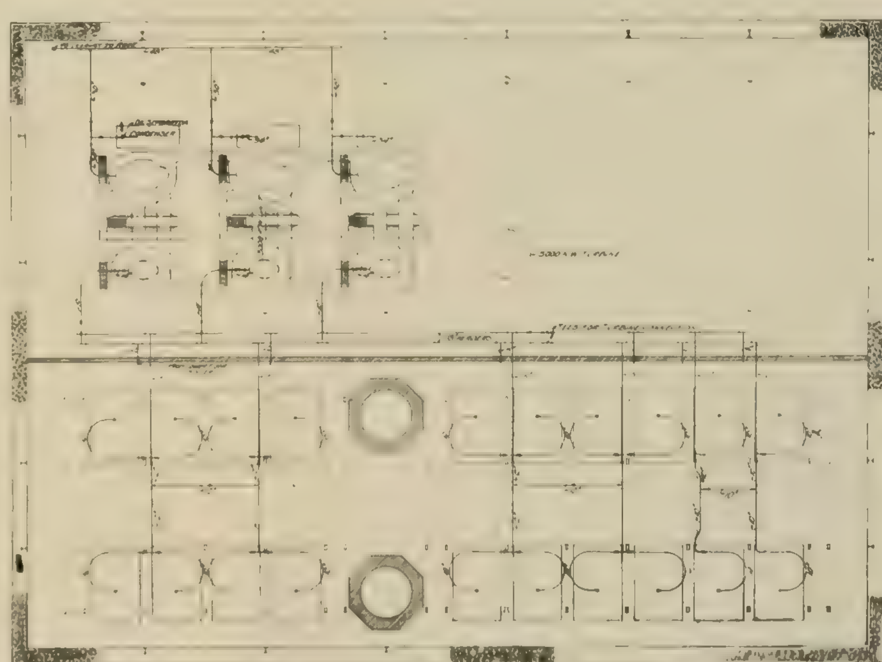


FIG. 21—PLAN OF PIPING

lid, when also the operator must assist the flow of ashes by poking if necessary, and when once in the chutes, further progress is controlled by the valve at the conveyor.

All ashes are then delivered by the conveyor to the ash storage tank in the top of the tower, which has a capacity of 130 tons, and is brick lined, having a conical hopper bottom with a spout and valve attached, and suspended from which is a hinged swinging spout in two sections, one for the upper track, and one for the lower track, enabling the operator to fill cars on either track or wagons on the lower yard level.

Boiler Feeding System

As already mentioned, the water of condensation is returned to the hot well situated in the boiler room basement floor. The loss of water is made up by a 3-in. city water connection controlled by a float operated valve. The heater pumps force this water to two 5,000-h. p. "Star" vacuum heaters, where it is raised from a temperature of 110° to about 160° to 200°, depending on the working conditions of the plant. The main feed pumps take their supply through a 12-in suction from the heaters, by-passed in the line of which is a 6-in. Worthington hot water meter for testing. These pumps are two 12 x 20 x 10 x 18 in. Blake steam feed pumps with outside packed plunger and pot valves. They are duplex, compound, non-condensing, each good for 10,000 b. h. p. against 250-lb. pressure of feed with 180-lb. steam and 100 to 125 degrees of superheat. They have Fisher pressure regulators and speed governors with balanced valves, safety valves, force pump lubricators, and are wholly automatic in action under all loads. The heater pumps are duplex piston brass fitted Blake pumps 8 x 14 x 16 in. in size.

The heaters have a vacuum line connection to the condensers, a 6-in. overflow valve, 18-in. exhaust pipe with Webster oil separator and drip, 1½-in. regulator valve on the steam inlet controlled by float 10-in. pump connection, 3-in. cleanout opening and drain. They are guaranteed to heat 150,000 lb. of water per hour from 90° Fahr. to 210° and to return 14 per cent of exhaust steam and to largely prevent scale in boilers by furnishing practically pure water. They take steam from all the auxiliary pumps and engines including air pumps.

The Webster feed water heater and separators, made by Warren Webster & Co., were furnished by their agents, the American Engineering Specialty Co., of Chicago. The feed water heater is of the vacuum type, of 5,000-h. p. capacity, specially arranged for condensing plants equipped with Webster vacuum line attachments for the removal of air. This insures the highest efficiency

FIG. 22. BUS BAR COMPARTMENTS

in purification and temperature without back pressure on the auxiliaries furnishing exhaust steam for feed water duty. The separators for live steam and exhaust are of the usual Webster type, equipped with the hook plate retaining surfaces insuring the satisfactory removal of oil and moisture from the steam.

The feed pump suction has a direct city water connection, and there is also a connection with the condensing water supply for emergencies.

A sump pump of the vertical steam bilge type 6 x 12 x 10 in. automatically takes care of the station drainage which comes from every direction to a sump well in the basement floor.

High Pressure Steam Piping.

The steam pressure carried is 185 lb. with 100° to 125° of superheat, this being the limit with the cylindrical corliss valves. There are special Babcock & Wilcox superheaters consisting of a nest

FIG. 23. EXTERIOR OF STATION

of U-shaped pipes between the boiler tubes and drum of each boiler, arranged so that the coils may be duplicated when higher superheat is required for turbine use. This will be done by inserting another nest of tubes within the present one. Piping connections are so arranged that saturated or superheated steam may be taken direct from each boiler. The superheater can be flooded at will from without the boiler according to directions furnished with each, and they are drained to the main blow-off. On top of the boiler drums are two 10-in. main steam connections controlled by two angle check valves of the Schutte type, one giving steam direct from the drums through a 3-pipe header, one for each drum, the other giving direct superheat connections. This is done by three 5-in. pipes passing from the steam space down through the drums into the superheater header, then through the coils and back to another header which in turn connects by two 5-in. and two 4-in. pipes with the main steam pipe. Both angle valves are at the ends of a header which has a tee with a 10-in. Schutte automatic angle stop check valve on it. From this valve the 10-in. U pipe connections from each two adjacent boilers run to the 15-in. cross header which conveys the steam from a group of four boilers (two not yet installed). This header enters the 20-in. main header in the engine room gallery through a 15-in. valve and tee. The cross headers for the eight boilers directly over each other in one vertical group are on opposite sides of the line of building columns between them and enter the main headers, each connecting with a different one, and the next adjacent pair of cross headers alternate with the former in their connections to the main header, so that all possible contingencies are provided for.

The engine connections are in duplicate, two 10-in. pipes being run one to each main from a Y at or near the starting valve. These pipes all have valves at the main header within each reach of the operator standing on the gallery. The main headers are likewise divided in the middle by 18-in. valves, and they are also anchored near these valves to the gallery floor. They are supported by cradles on I-beam stringers bolted to the floor. The chairs in contact with the pipes have no valves. All high pressure pipe is extra heavy lap-welded steel for 12 in. and below. Above 15 in. the pipe is ½-in. and 18-in. pipe is ½-in. with heavy cast iron fittings and screwed flanges. All joints are bolted ones. Copper gaskets are used on a raised face inside of the bolt circle, cast or turned on both flanges of each joint. Low pressure pipe is standard weight and brass pipe is seamless extra heavy, iron pipe size. Riveted steel pipe is of mild steel with flanges riveted on; galvanized iron pipe is standard weight. All high pressure

fittings were tested to 250 lb. working pressure, and were made of cast iron because steel could not be secured within time to complete the job. Low pressure cast iron fittings were made for 125 lb. working pressure.

All fittings on live steam, high pressure water, exhaust steam, and low pressure water systems are flanged.

Covering for high pressure steam pipes is 85 per cent magnesia furnished by Keasby & Mattison, 2 in. thick, molded for small sizes, and covered with canvas. Above 10 in., blocks are wired on and covered with ½ in. of cement and 8-oz. duck, all bound in place with brass bands. Flanges have removable forms. Covering is of different thickness for different systems. Besides these the auxiliary steam, auxiliary exhaust, gravity drips, Holly drips, feed water heaters, boiler drums, smoke flues are all covered, sized and painted, the covering being 1-in., 1½-in. and 2-in., according to location.

Miscellaneous Piping.

Ample provision has been made for expansion and valves are well distributed for all probable emergencies. All mains are completely dripped. Those below the main pipe gallery on high pressure work are taken care of by a Holly return drip system; those above by gravity system. All low pressure drips run to the sump pit. The boiler blow-off main is under the lower tier of boilers and connections lead to both decks, those below alternating with those above as to the side of boiler from which they emerge. Blow offs from boilers are three in number, all provided with 2½-in. Babcock & Wilcox blow-off valves. These three pipes come together and a 3-in. Cadman blow-off valve controls the connections to the main blow-off. All blow-offs enter a receiving tank from which an overflow enters the sump pit.

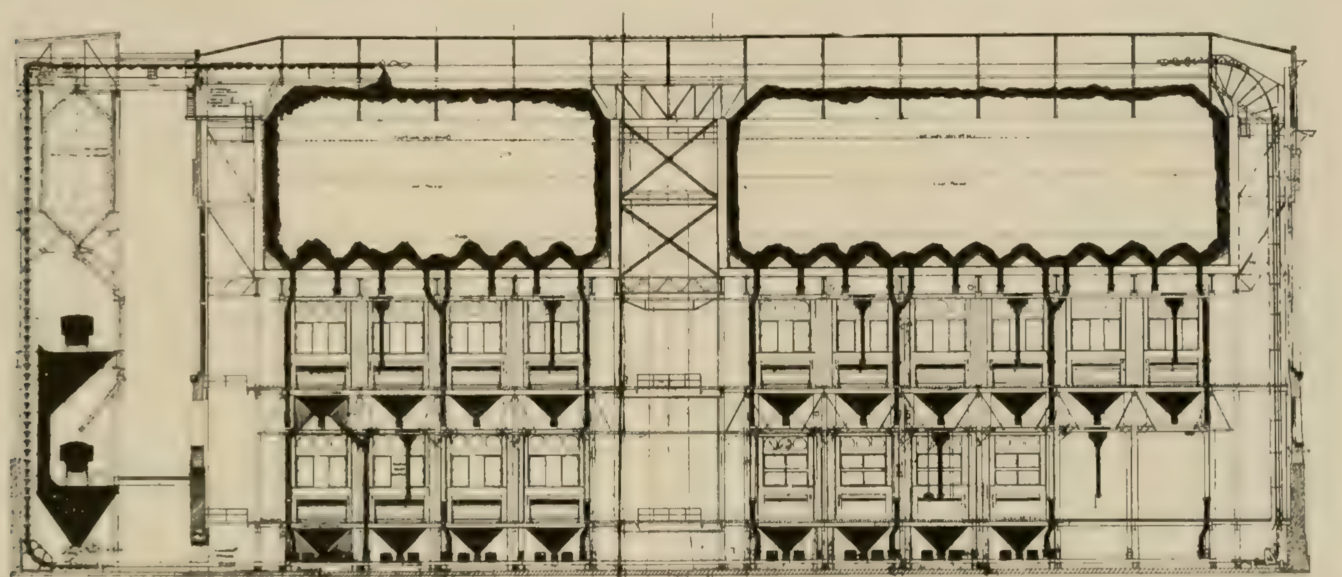


FIG. 24—SECTION SHOWING COAL HANDLING INSTALLATION.

A complete pressure oiling system is provided having two filters with a filtering capacity of 600 or more gallons per day and a storage capacity of 250 gallons each, also a 500-gallon tank for new oil, and a pressure tank and two 4½ x 2¾ x 4-in. oil pumps of the duplex piston type; also one cylinder oil tank of 150 gallons. All connections are 2½-in. brass. Pressure is furnished direct by two 4½ x 2¾ x 4-in. oil pumps to the cylinders and bearings, a different oil and pump being used for each. There is a complete compressed-air system, using Westinghouse locomotive type compressor. This is piped to coal tower and boilers and to generators with hose connections.

City water is piped to heaters, hot well, feed pump, boilers, engine room and boiler room plumbing, condensers, oil separators, engine bearings, cross-head jackets, automatic relief valves and oil filters. In the oil room is a distilling apparatus for the battery cells.

The whole design and equipment of this station and the solution of its many difficult problems reflects great credit on the firm of Ford, Bacon & Davis, Consulting Engineers, for the Metropolitan Street Railway Co. and [illegible] Co's. [illegible] Light Co., on its engineer in charge, Mr. Charles N. Black, and on the efficient corps of designing engineers, draftsmen and erection engineers upon whom has devolved the management of the details of this great undertaking for the past two years.

Fast Trip from Dayton to Columbus.

May 27th, two special cars ran over the Appleyard lines carrying parties to the United Commercial Travelers Association Convention at Zanesville, O. One of the cars left from Dayton and the other from Springfield, so as to reach Columbus at about the same time. From Columbus both of the cars ran through to Zanesville. The distance from Dayton to Columbus is 77 miles and the car making this trip covered the distance in two hours and eleven minutes, ten minutes of which was consumed in stopping for passengers, making the actual running time two hours and one minute. This running time included the necessary stops at railroad crossings, slowing down for curves, etc., and the average rate of speed outside of the cities was 46½ miles per hour. The Springfield car, which had a shorter run, made practically the same speed.

Mr. Theodore Stebbins, acting manager of these roads, states that this is probably the best record run ever made in the state of Ohio by trolley cars. The same average rate could not be maintained for the entire trip through to Zanesville for the reason that the cars had to travel around the large loop in Columbus in order to pick up other delegates to the convention. The run from Columbus to Zanesville, a distance of 68 miles, was made in two hours and 12 minutes. Mr. E. B. Gunn is general superintendent of the Appleyard roads between Dayton and Columbus.

Bronx (N. Y.) Traction Co.

The Bronx Traction Co., of New York City, was recently incorporated with a capital of $585,000, to consolidate the Suburban Traction Co., the Van Nest, West Farms & West Chester Traction Co., the Wakefield & West Chester Traction Co., the West Farms & West Chester Traction Co., and the Williamsbridge & West Chester Traction Co. These five companies held in all from 12 to 20 miles of franchises, principally in the eastern section of the Bronx, Williamsbridge, West Chester and Union Park along Long Island Sound, the franchises having been obtained before that section of the Bronx was annexed to New York City. About 10 years ago the Union Railway Co. bought these franchises from the original owners; some of the lines had tracks and others had not, but it is believed that they will be very valuable as the Bronx is developed, so it was decided to combine the franchises and organize one company to handle them. Mr. Edward A. Maher, president of the Union Railway Co., is likewise president of the Bronx Traction Co.

Ohio Interurban Railway Association.

The third meeting of the Ohio Interurban Railway Association was held at the Chittenden Hotel, Columbus, O., May 26, 1904. The meeting was called to order at 1:30 p. m. by the president, Mr. H. P. Clegg, and on motion the reading of the minutes of the previous meeting was dispensed with. The first business before the association was the report of the Transportation Committee on interchangeable mileage. This report, which was read by the secretary, stated in substance that the committee, following the instructions given them at the Cleveland meeting, had forwarded typewritten copies to 12 Ohio and 14 Indiana companies of the suggested plans for the interchange of coupon tickets, requesting the companies to forward their votes in favor of either plan. The vote as finally cast stood 11 in favor of the Dayton plan and 6 in favor of the Cleveland plan. Continuing the effort to arrive at some conclusion, the committee forwarded a circular to the various companies announcing the result of the vote and suggested that the portion of the Cleveland plan referring to the companies giving a bond be inserted in the Dayton plan. As the responses to this up to the date of the meeting had been very few the committee suggested that representatives of the companies at the meeting desiring to become parties to this agreement meet with the transportation committee after the close of the meeting and take some definite action disposing of the subject of interchangeable coupons.

The next business before the meeting was the report of the Transportation Committee on arrangements for the operation of one car over the lines of another company. The secretary read the report of this Committee which first reviewed Mr. Sloat's proposition, which in substance was as follows:

A scale of prices for the fares of individuals traveling in special cars over tracks of a foreign company will be difficult to arrive at because of the different equipments and weights of cars, seating capacity, gear ratio and motor capacity, the argument being that a heavy car with say 75-h. p. motors and high gear cost more to operate than a smaller car with 35-h. p. motors at low speed. Mr. Sloat's schedule of cost of operating various size motors based on tests produce figures ranging from 15 cents to 28 cents per car-mile. An objectionable feature of the classification of motor equipments would be that a road owning cars not equipped with standard equipment and of the same seating capacity would be just as much at sea as at present in making a rate over a foreign line, not knowing at the time the rate was made what equipment would be available on the day the car was required. The object of arriving at a standard rate for the operating of one car over the tracks of another company is to enable the company that desired to operate the car to know exactly what it will cost on a mileage basis. This would enable the company to make a rate for a party of people, as the foreign company would receive a fixed rate for the operation of a car, whether the car contains 10 or 50 people. It is the universal practice on steam roads to charge a certain rate —say 50 cents per car mile—either for one or more large or small, emigrant or Pullman, coaches in the train. For the interurban companies that are so fortunate as to maintain rates of 2 cents per car-mile for special or excursion business a charge of 30 cents per car-mile for operation over a foreign road would not be exorbitant; for the less fortunate companies whose passenger rate is from 1¼ to 1½ cents per car-mile a rate of 30 cents would bar them from ever routing a car off their own tracks. On a basis of 1 cent per mile per capita, which is the basis most of us figure upon when building on excursion business, a rate of 20 cents per car-mile would be a minimum. The Committee also recommended that the company owning the car shall not assume any responsibility of equipment, employes or passengers while the car is on a foreign line.

The next subject before the Association with the Executive Committee's report in reference to the Legislative Committee. The question at issue was the method of payment of the necessary expenses incurred by the Legislative Committee, and the president read an extract from the constitution of the Association which states that all expenditures for special purposes shall be made only by appropriations acted upon by the Association at a regular meeting. This clause robbed the Executive Committee of any power to handle the matter of expenditures and all that it could do was to recommend the importance of this work. The Committee felt that the Indiana roads which were represented in the Association certainly could not be expected to bear any part of the expense of Ohio legislation and for this reason the Executive Committee reported their full approval of the work of the Legislative Committee and recommended that each Ohio company identified with the Association bear its just proportion of the expense of such legislation, according to whatever division of such expense might be recommended by the Legislative Committee. After some discussion of the subject a motion embodying the recommendations of the Executive Committee was carried.

After the election of several new members the Association took up the discussion of the five subjects which were mentioned in the call for the meeting. The first of these was, "What arrangement can be made for the operation of the cars of one company over the tracks of another?" Mr. Merrill opened the discussion by again reviewing Mr. Sloat's proposition which in brief was that cars of a different horse power be charged for at a different rate per mile, ranging from 15 to 28 cents per car-mile. A 300-h. p. car at 23 cents per car-mile was given as an example of this plan. The Transportation Committee, after making inquiries, believed that a car mileage basis without considering the horse power would be a better plan and it recommended a rate of 20 cents per car-mile.

Mr. Stebbins, of the Appleyard system, believed that there were a good many conditions to be taken into consideration and that different prices would have to be established. He considered it worth a great deal more to give cars terminal facilities in cities than it is to run over interurban lines. Under these conditions he considered 20 cents per car-mile would be entirely insufficient as a charge. Mr. Bicknell, of the Lake Shore Electric Ry., stated that his understanding was that the rate of 20 cents per car-mile was established as being about the average rate. Twenty cents is about what all the interurbans in the state of Ohio earn per mile. Some of the companies have recently come to the conclusion that in placing an exorbitant charge upon the cars of another company on their tracks they have been standing in their own light. Some of the lines connecting with his system had an agreement whereby they charged each other $1 per car-mile for the operation of cars on each other's tracks. He believed that they were on the wrong track there and that instead of encouraging business new to the company they were driving it away by placing the rates too high. He had recently made a suggestion to a connecting company that they charge 30 cents a mile and he believed this to be more equitable than 20 cents, for the reason that the companies get a better rate for the operation of special cars than they do for regular cars. Where a party wants to return over his line after the time of shutting down the power house he adds $5 an hour for each hour that the power house was required to run overtime to accommodate them. His understanding was that the crew from the line where the business originated runs the car to its destination, a pilot being provided, and the company upon whose track the car is is responsible for the accidents.

Mr. Fravel, of the Dayton & Western, stated that his company had spent considerable money on two terminals and that he expected and invited all roads that had track connection with his to run all the cars in there that they could, but in view of the fact that his company had spent considerable money in arriving at those two points he did not expect foreign cars could reach these points at what it cost his company to operate its own cars. The conditions on which his company had always sent cars over other lines were on a basis of 40 per cent of the car earnings.

The next subject under discussion was, "What compensation should interurban companies give the newspapers for advertising privileges?" This discussion was opened by Mr. Anderson, of the Dayton & Xenia, who stated that his company made a contract with the newspapers at the beginning of the year for printing its time cards at a stipulated price per inch of space. For this printing the company agreed to furnish the newspapers a pass good for one round trip over the road or any part of it each day of the year in addition to such trip passes as the exigencies of their business rendered necessary. The annual card pass is made out in the name of one person and is not good for any other person unless accompanied by a letter signed by the owner of the pass, giving the name, date and destination of the party using the pass. With some of the country newspapers the arrangement is somewhat different. The company agreed with them as to the monthly value of the space

its time card will occupy in their publications and on the first of each month sends them as many trip passes from their place to Dayton and return as will amount at regular rates to the value of their advertising space. These trip passes are good for any time during the month and expire with the month. The most difficult part of the problem, however, comes in the matter of carrying packages of daily papers for all points along the line where boys are waiting to distribute them. This necessarily takes the time and attention of either the motorman or conductor and the newspaper managers seem to think they have rendered a fair compensation for this service by giving the motorman and conductor each a copy of the paper and perhaps one or more copies to the office force. If an agent fails to get his package of papers at the usual time the newspaper managers make a great deal of complaint and blame the men on the cars or the ticket agent for not seeing that the package was put on the proper car. There are a number of considerations to take into account in this matter. In the first place if the publishing of a time card is a benefit to the railway company it should be paid for at a fair value for the space occupied; in the second place the space occupied by the time card is not worth any more than it would be for any other business and because it is paid for in transportation the newspaper company should not expect to get its transportation at a greatly reduced rate. If the distribution of papers along the line and the consequent increase of subscribers is worth anything to the publishers they should not complain when asked to pay for such distribution. There is also the benefit that a traction company in the distribution of the daily papers from increased traffic growing out of the advertising of various events occurring in the city. There is also a benefit to the daily papers, not only in the increased number of subscribers, but in the increased value of the advertisements and consequent demands for space in their issues.

In handling this business for papers that do not publish the company's time card a charge of ½ cent per pound is made, no package to be carried for less than 5 cents. This plan is very satisfactory with the papers that are sending large packages but cannot be very well applied to a company sending a half a dozen or more small packages of one cent papers.

After some further discussion of this matter Mr. Anderson moved that the executive committee formulate a plan for handling this business which would be recommended to the association at its next meeting, the motion being seconded and carried.

The next subject for discussion was how to arrange for the transportation of track men who are hired for a few days and to whom the company does not care to give badges. The discussion was opened by Mr. Stebbins, who described the method in use on his roads. Each head of a department is supplied at the beginning of each week with trip passes which he issues to his employes. The pass shows the points between which the employe is authorized to ride and it is signed by the head of department and by the employe and is good for the week for which it is issued only. At the beginning of each week ordinarily 12 of these passes are issued to the men. Mr. Stebbins thought these passes should be dated ahead so they could be used only on the day or the following day to that which they were dated. Mr. Rounds, of the Canton-Akron line supplies his foremen with badges which they carry all the time and the extra men only travel with the foremen so that he vouches for them personally. He does not have enough extra men to render any other methods necessary. The men are required to start at the round-house in the morning and they report back there in the evening. Mr. Harrigan, of the Columbus, Newark & Zanesville, issues passes to his track foremen good during the month, and they are held responsible for the return of the passes. The track men are given badges and the foremen are held responsible for their return. Every person riding on his road on passes except regular employes is required to sign a dead-head slip absolving the company from damages in case of accident. Mr. Bicknell pointed out that according to a decision of the Supreme Court of the State of New York a passenger riding on free transportation could not collect damages from the company on account of any injury which he might receive, but it is different in the case of an employe because in this case the transportation given is not complimentary or free but is an implied part of the remuneration for his services. Mr. Anderson stated that his road required every man employed to carry a coupon book and to give up a coupon every time he rode on the cars. The employe signs a contract when he receives the book, relieving the company from all damages. Mr. Carpenter of the Western Ohio stated that his track men reported at the car houses and worked their own way on hand cars. This he believed was much better than allowing the men to crowd into the cars.

The next subject was "Benefit associations and the relation of employers to employes." Mr. Spring of the Dayton, Covington & Piqua, stated that a road formerly under his supervision had a benefit association among the men. It contained 78 members which included all the branches of the various departments of the road. The association provided a sick benefit of $5 a week and the men had meetings every month of a social and business nature which tended to keep up good relationship and good feelings among them. It overcame a great many differences that otherwise might have arisen. Mr. Bicknell stated that in his experience associations for the men had all been of very great advantage to them, the only danger he saw in such associations was that often they go from benevolent associations to union organizations, which many managers had found unprofitable and undesirable. Benevolent features of the association are certainly good and accrue to the advantage of the company for the reason that this relieves the men from embarrassment and want and they are less liable to commence action against the company. He is also a firm believer in personal association of employer and employe and it has been his custom once a month to meet with all the heads of departments and sub-heads as well as others in less responsible positions. At such meetings a half a day each month is spent in talking freely of the business of all the departments and these meetings have proved very beneficial. They are held at different places along the line with the idea of making superintendents of one section somewhat familiar with the surroundings of the other superintendents. Mr. Bicknell believes in rather close association of managers of roads with all their men, not only with the heads of departments. Mr. Clegg, of the Dayton & Troy Ry., said that he had formerly made a distribution of Christmas turkeys to his men but one year he had proposed to them instead that if they would form a benefit association he would make a contribution of considerable amount towards the necessary expenses. The proposition was bulletined but the men never acted upon it, which indicated that the idea was not a popular one with them. This was explained partly by the fact that the road employs only married men and the benefit feature did not appeal to them because they all have some savings laid away so they are not dependent on someone as soon as they quit work. At present Mr. Clegg is forming what he calls the "Get Together Club" which is composed of all the heads of departments of the road who will meet daily at lunch, and the expense of the lunch will be borne entirely by the company. It is believed that the advantage of having the men discuss matters pertaining to the operation of the road during this noon hour will be well worth the expense to the company of providing their luncheon. Mr. Rounds said that he met the superintendent and all of the men that are due at the car house at frequent intervals and a free discussion of everything connected with the operation of the road is held. The men talked without any fear of getting themselves into trouble and many of the company's rules are discussed and explained. The men have no benefit association although there is a union organization among the men. The company, however, has never approached any serious trouble and believes that it has the good will of the employes.

The last subject for discussion was "The most economical way of keeping cars clean." Mr. Spring said that on his road certain prizes were offered, one of which was for neatness and cleanliness of the cars. Mr. Rounds stated that at his car house there were two women employed to do the inside work on the cars and he found that he could get much better results on the floors, windows and cushions with women than with men; they are not apt to slight the work and they do not ask for so much money. It takes about half a day to clean one of the cars properly with two women working inside and one man working outside. The crew are not required to sweep or clean the cars during the trip but are instructed to pick up papers and other things that will not interfere with their work. The motormen wear a suit of overalls which they put on to get under the cars or do any dirty work. These overalls are worn also when the motormen are operating the car as they have the vestibule to themselves and do not come into contact with the passengers. Mr. Harrigan's experience in cleaning cars is that women are decidedly bet

... work. He hires them entirely for the ... They get under the seats and into the corners and find dirt that the men will never find. A man, however, is better for ... ing. At present his car barns at Newark have no light after the power is shut down, but arrangements are being made to light the barns, after which the cleaning will be done at night. Mr. Kelsey, of the Western Ohio company, cleans his cars by means of compressed air. He has a 7-h. p. compressor and 100 ft. tank in which 100-lb. pressure is maintained. A man opens up the windows and blows all the dust out as well as papers and cigar stubs and this puts the car in good condition to mop. The dust can also be blown out of the curtains and out of plush seats and the compressed air is also used in cleaning the motor equipments. Mr. Rounds also has provided a portable arrangement for compressed air cleaning but has found it impossible to use it in blowing out the plush cushions in the car. It gets the dirt out of the cushions but it puts it all over the car and if the car is in the house it puts it all over the house. His plan is to take the cushions out of the cars and blow the dust off out doors.

At the close of the discussion a vote of thanks was passed to Mr. Stebbins, who offered free transportation for those wearing the Association badges on the Columbus & Springfield line, the Central Market line and the Dayton, Springfield & Urbana line.

The attendance at this meeting was evidence of the rush of business which the interurban railway men have at this period of the year and indicated that during the summer season the members would not be able to meet as frequently as heretofore. It was, therefore, determined by the Executive Committee that the next meeting of the Ohio Interurban Railway Association will be held some time in October; in the meantime the Executive Committee will meet monthly as heretofore.

New Lines and Extensions Opened.

The Illinois Central Traction Co. began operating on regular schedule over its line between Springfield and Riverton, Ill., May 20th.

The Danville, Urbana & Champaign Railway Co. opened its new branch line from Homer to Ogden, Ill., May 25th.

The Lebanon & Franklin Traction Co's. line was opened to traffic May 28th. This is an 11-mile line between the cities named. Power is secured from the Cincinnati, Dayton & Toledo Traction Co. Two cars are operated on a two-hour schedule, beginning at 7 a. m. The cars are 35-ft. combination cars, with passenger and baggage compartments. There are two folding seats in the baggage compartment for the accommodation of smokers. At the Lebanon end the road connects with the Rapid Railway division of the Interurban Railway & Terminal Co., of Cincinnati.

The Ocean Electric Railway Co., of Rockaway, N. Y., controlled by the Long Island Railroad Co., opened its line between Rockaway Park and Arverne May 30th.

The Cedar Rapids, Iowa City & Southern Railway Co. has completed that section of its interurban line which lies within the city limits of Cedar Rapids, and the initial trip over the line was made on June 1st.

The Indianapolis & Northwestern Traction Co. ran a car from Lebanon to Crawfordsville, Ind., June 1st, but the overhead construction was not completed to the terminus and the road was not opened to traffic. It was expected, however, that cars would be running regularly this summer.

The Springfield & St. Louis Electric R. R., which is that part of the McKinley system between Springfield, Ill., and St. Louis, Mo., is completed south from Springfield as far as Auburn, Ill., and regular traffic was established June 9th.

The Springfield, Troy & Piqua Railway Co. formally opened its line between Springfield and Christiansburg June 8th. It was the first time a car ever entered Christiansburg and there was a celebration.

A trial trip of the new Holland palace sleeping car "Frances" was made between Indianapolis and La Fayette, Ind., May 29th, and during the five-mile run from Zionsville to the Marion County line a speed of 75 miles an hour was attained, which established a new record. Several prominent electric railway men were on the car.

New England Trolley Information Bureau.

There has been established in Boston, Mass., a trolley information bureau, the first institution of its kind in New England, where information of every description may be obtained concerning transportation over the 3,500 miles of electric lines which are connected with the city of Boston. The new bureau was opened at No. 365 Washington St. on June 15th. The originator and proprietor of the venture is Mr. Robert H. Derrah, who has become known as an expert in matters pertaining to trolley travel. He announces that it is the purpose to teach trolley touring in all its branches free to all who apply at the bureau, either in person or by mail.

All of the trolley roads in the eastern states and western New England are embraced by the information bureau service, and if it is desired to learn the easiest way to reach all points by trolley, the rate of fare, running time and what may be seen en route Mr. Derrah and his assistants will be pleased to furnish the information.

Trolley Excursion

FOR TWO DAYS

.. Personally Conducted by ..

ROBERT H. DERRAH

BOSTON, THROUGH WORCESTER AND SPRINGFIELD

TO THE SUMMIT OF

MT. TOM

AND ALONG THE BEAUTIFUL

CONNECTICUT VALLEY

TO HISTORIC

Deerfield and Greenfield

ITINERARY AND DESCRIPTION OF TRIP MAY BE OBTAINED HERE

If inquiry is made by mail it will be necessary to enclose five cents in postage stamps.

Mr. Derrah has been studying the trolley situation at close range for a dozen years or more. He was the originator of the Boston-New York trolley trip over which he personally conducted a party in special electric cars, and two years ago he made a trip from Michigan to Boston for the purpose of studying the opportunities offered by the different trolley lines for pleasure travel. His experiences and deductions at the time were published in the "Review" for October and November, 1902.

On Monday and Tuesday, June 6th and 7th last, Mr. Derrah personally conducted a trolley excursion from Boston to Springfield, Mass., Mt. Tom, Northampton, Deerfield and Greenfield, leaving Boston over the Boston & Worcester Trolley Air Line and remaining in Springfield over night. The trip included a ride to the summit of Mt. Tom on the incline railroad. The cost of the entire trip, including transportation, meals and hotel accommodations, was $9.00. The accompanying illustration shows a poster which was used to advertise the excursion.

The Montreal Street Railway Co. recently put in service 50 semi-convertible cars with revolving individual seats similar to those which have been used in Brooklyn, N. Y., for several years.

For the past six years the Chillicothe (O.) Electric R. R. has employed eight women conductors. Recently they were discharged, owing to their inability to properly switch the cars at the railroad crossings.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

The decisions which have been reported in the Legal Department of the "Street Railway Review" since 1895 have been published separately by the Windsor & Kenfield Publishing Co. under the title "Street Railway Law," four volumes of which have been printed. Vol. I covers the period from January, 1894, to January, 1897; Vol. II from January, 1897, to July, 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901, to April, 1903. Vol. V is now in press. Price: Bound in sheep four volumes, $10.00; single volume, $3.00. Bound in buckram: four volumes, $6.50; single volume, $2.00.]

RUNNING PRESIDENT'S CAR AT HIGH SPEED AROUND CURVE OR OVER ROAD WITHOUT DUE CARE TO AVOID COLLISIONS.

Hennessy vs. St. Louis & Suburban Railway Co. (Mo.), 73 S. W. Rep. 162. Mar. 18, 1903.

Where the president of a street railway company knew that there was another car still out on the road, which would come in at some time that evening, the supreme court of Missouri, division No. 1, holds that it was negligence to run his private car at a high rate of speed around a curve, where a coming car could not be seen, or to run it out over that part of the road without taking proper precautions to prevent a collision with a car he knew would come in at some time in the evening.

INFERENCE AND DUTY AS TO LOOKING AND LISTENING—CROSSING IN FRONT OF APPROACHING CAR.

Kansas City-Leavenworth Railroad Co. vs. Gallagher (Kan.), 75 Pac. Rep., 469. Feb. 6, 1904.

In the absence of evidence to the contrary, the supreme court of Kansas holds, a jury may infer from the universal instinct of self-preservation that a person about to cross an electric street railway track both looked and listened before venturing to do so. It is the duty of a pedestrian upon a city street, who is about to cross the track of an electric street railway company, to exercise his faculties of sight and hearing, and in other respects to take ordinary precautions to avoid collision with the cars. If he do look and listen, he will be held to an apprehension of that which should have been seen and heard, and, if he fail to look and listen, he will be charged with the same liability in case of disaster as if he had done so. But a traveler may cross an electric street railway track in front of an approaching car which he plainly sees and hears, and not be negligent. If, in view of his distance from the car, the rate of speed of its approach, and all other circumstances of the event, a reasonably prudent man would accept the hazard and undertake to cross, a traveler may do so, and the propriety of his conduct is ordinarily a question for the jury.

STREET RAILWAYS OPERATED IN MORE THAN ONE COUNTY NOT TAXABLE AS "RAILROADS" SO OPERATED—CLASSIFICATION OF INTERURBAN RAILROADS NOT DECIDED.

San Francisco & San Mateo Electric Railway Co. vs. Scott (Cal.), 75 Pac. Rep., 575. July 1, 1903. Rehearing Feb. 15, 1904.

On rehearing, the supreme court of California holds that the provision of section 10, article 13, of the constitution of that state that "the franchise, roadway, roadbed, rails and rolling stock of all railroads operated in more than one county in this state, shall be assessed by the state board of equalization at their actual value, and the same shall be apportioned to the counties," etc., does not apply to street railroads. Whether or not interurban railroads, when operated in more than one county, are to be classed as street railroads, or as ordinary railroads to be assessed by the state board of equalization, and, if the latter, whether they may be attached to a system of street railroads, and so make the entire mileage of such system subject to assessment by the state board, or must, for the purpose of such assessment, be limited exclusively to the part of the system traversed by the cars of the interurban line, the court says were questions which did not arise in this case and need not be considered, the railroad in question not being one of this class.

DANGER FROM WORK CAR BEING ON TRACK AN ASSUMED RISK.

Nelson vs. Oil City Street Railway Co. (Pa.), 56 Atl. Rep., 933. Jan. 4, 1904.

A motorman on a car running at the rate of 12 or 15 miles an hour on a single track railway was fatally injured in a collision with a work car which was standing or was nearly stationary at a curve in the road. Various grounds of negligence were alleged, but the supreme court of Pennsylvania says that the only one contended for at the trial related to the manner in which the company operated its work car. Since this car was used as necessity required, and often in sudden emergencies, it was evidently impracticable that its movements should be regulated by a fixed schedule. There was no danger in its use that could not be avoided by the exercise of reasonable care on the part of the deceased. Moreover, there was such an habitual use of the car that whatever danger might result from its presence on the track was a risk of the employment, open, manifest, and fully known to the deceased, and assumed by him without objection. It follows that there was no error in entering a nonsuit.

INTERURBAN CARS AN ADDITIONAL BURDEN ON CITY STREETS.

Younkin vs. Milwaukee Light, Heat & Traction Co. (Wis.), 98 N. W. Rep., 215. Feb. 2, 1904.

The supreme court of Wisconsin points out that under its decisions an electric street railway operating within a city is not an additional burden upon the streets, whereas an interurban line is an additional burden upon the highway, entitling the abutting land-owners to compensation therefor, and it now holds that one connecting one city with another and the latter city with a summer resort six or seven miles beyond is not only to be treated as an additional burden upon the highway between such points, but upon the streets of the latter-mentioned city over which its interurban trains or cars are run, or rather the running of the interurban trains and cars over the street railway tracks in such city is an additional burden upon the lands of abutting lot owners.

RIGHT TO CONNECT BRANCH WITH MAIN LINE OF SYSTEM—AFTER TIME FOR COMPLETION OF ROAD—CONTRACT TO RUN CARS "TO" VILLAGE MEANS BEYOND BOUNDARY LINE.

Houghton County Street Railway Co. vs. Common Council of Village of Laurium (Mich.), 98 N. W. Rep., 393. Feb. 16, 1904.

The supreme court of Michigan says that the purpose of the company was to construct a street railway running through and accommodating all the centers of population within the county of Houghton. The articles of incorporation were specific, and mentioned three lines as part of the system. The common council of the village of Laurium knew the situation and the provisions of the articles of incorporation, and clearly contracted with reference thereto. That the parties contracted in reference to these lines was apparent from the language of the franchise, by which, for the accommodation of its own inhabitants and all travelers to and from Laurium, the franchise required the company to run cars from any terminus of the line or lines of its road without the limits of said village at regular intervals to said village, and without change or transfer, and without any discrimination between said village of Laurium and any other city or village. No such language would

have been used if but one line had been contemplated. One of the things which the company unequivocally contracted to do was to connect all the lines of its road so that cars should run from any terminus outside the village along its track or tracks within the village without change or transfer. This was obviously for the accommodation of the inhabitants of the village of Laurium and travelers thereto. If the company contracted to do this, the common council certainly contracted to give it the right to do it. No place was fixed for the union of the lines. It followed that the parties contemplated and contracted for a union at a place convenient both to the company and to the inhabitants of Laurium and those having occasion to travel over the road to Laurium. Again, the court says that by the ordinance the company contracted to run all its cars without change to the village of Laurium. "To" means within, not up to. It was not a compliance with the terms of the contract for the company to construct its road up to the boundary line of the village. It is therefore clear that the franchise granted to the company the right to connect a second or branch line with the main line at some convenient and proper place, and was not limited to a connection outside the village of Laurium. Nor does the court consider that the right to make the connection was forfeited by a failure to construct the second or branch line before the date it was required to have its railway within the village completed and in full operation along the streets.

FIRST GRANTEE OF RIGHT TO CONSTRUCT ROAD MAY ENJOIN INTERFERENCE WITH ITS ROAD BY A SECOND GRANTEE—LAYING SECOND TRACK WITH ONE RAIL BETWEEN RAILS OF FIRST TRACK A TAKING OF PROPERTY.

Hamilton, Glendale & Cincinnati Traction Co. vs. Hamilton & Lindenwald Electric Transit Co. (Ohio), 69 N. E. Rep. 991. Jan. 19, 1904.

When a city council has, by ordinance, legally granted to one street railway company the right to construct its railway and lay its track on and over a particular part of a designated street within said city, and such company has duly accepted said grant, and entered upon and taken possession of the right of way so specifically granted, the supreme court of Ohio holds that a subsequent grant by said city council, or its successor in office, the board of control, of the same right of way, or a substantial part thereof, to another street railway company, for like purposes, will not of itself confer upon the second grantee the right to enter upon and take possession of the route or right of way so granted, where such entry and possession by it will materially and injuriously interfere with, interrupt, and abridge the first grantee's use and enjoyment of the said right of way. And where said second grantee threatens and is about to take possession of said route and right of way under and by virtue of its said grant, without the consent and against the will of said first grantee, and without having appropriated the right so to do, it will be restrained from so doing by injunction.

In this case the first grantee constructed an electric street railway, with a gage of 4 feet 8½ inches, along the central portion of a certain avenue. The second grantee was to construct its tracks with a gage of 5 feet 2½ inches along a portion, and as near the center as practicable, of said avenue, the east rail of its track to be placed between the rails of the first grantee, 8 inches west of the east rail, and the west rail to be placed 14 inches west of the first grantee's west rail, the second grantee to make excavation under the rails and between the ties of the first grantee's roadbed for the purpose of constructing its road by putting its ties therein and its rails thereon. The supreme court holds that this would constitute and be a taking of the first grantee's property, within the constitutional meaning of that term, and that the first grantee was entitled to an injunction against the second grantee constructing its road in the manner described, unless it acquired the right by appropriation. It says that the interruption and injury that would necessarily result to the use of the first grantee's property was at once manifest from the nature of the right claimed by the second grantee, for it was not susceptible of doubt that the imposition of a portion of the second grantee's track upon the roadbed and track of the first grantee would be productive of delay and obstruction to the cars of the latter in the reasonable and necessary operation of its road. Indeed, the obstruction and delay would be precisely the same as if the two companies were running and operating their cars over the same track. Yet the second grantee would admittedly be without right to run its cars over the tracks of the first grantee without its consent, or unless it should first have obtained the right so to do by an authorized appropriation.

RIGHT OF PASSENGER RIDING FOR THAT PURPOSE TO RECOVER PENALTIES FOR REFUSALS TO GIVE TRANSFERS—AVAILABILITY OF ANOTHER ROUTE NO DEFENSE—NOR DESIRE TO UNDUE CROWDING OF STREET—CONSTRUCTION OF NEW YORK STATUTE.

Topham vs. Interurban Street Railway Co. (N. Y. Sup.), 86 N. Y. Supp. 205. Jan. 19, 1904.

This action was brought to recover penalties, based upon repeated refusals to furnish transfers. The appellate term of the supreme court of New York says that the plaintiff on each occasion was a bona fide passenger, but, even if he had ridden for the very purpose of obtaining a penalty, he was entitled to recover, if the defendant was legally bound to transfer him. It also holds that the fact that there was another route embraced within the defendant's system, over which the plaintiff on each occasion might have traveled for a single fare, could make no difference; and the fact that the giving of transfers at the point in question might cause undue crowding in the street and at the crossings was no excuse for not giving them, unless sanctioned by legislative action.

Section 104 of the New York railroad law requires, under penalty, contracting corporations to carry for one fare. It provides that "every such corporation entering into such contract" shall carry for one fare, and give transfers. "The provisions of this section shall only apply to railroads wholly within the limits of any one incorporated city or village." The court holds that the true construction of section 104 is that it applies to railroad corporations and all other corporations within this state which, while formed under some other than the railroad law, have the right to own or operate a railroad within this state, and that it applies to leases as well as traffic contracts, and that the duty of giving transfers for a single fare shall apply only to such railroads as are wholly within the limits of any incorporated city or village. That the legislature intended section 104 to apply to all street railroad corporations, without regard to the law under which they were incorporated, or the date of their incorporation, appears by the amendments which were made to section 90 of the railroad by chapter 434, p. 908, of the Laws of 1893, and by chapter 933, p. 791, of the Laws of 1895. The concluding sentence of section 104 refers to railroads, and not to corporations. It was added when the right to lease was extended to every corporation owning a railroad within this state, to prevent the right of transfer for a single fare from being fastened upon long lines of country railroads.

FILED ROUTE AND MAP UNAFFECTED BY ORDINANCE BEING HELD VOID—INSUFFICIENT MAP—EFFICACY OF CONSENTS—DETERMINATION OF ROUTE.

Mercer County Traction Co. vs. United New Jersey Railroad & Canal Co. (N. J. Ch.). 56 Atl. Rep. 897. Jan. 20, 1904.

A decree holding a township ordinance void because no legal consents had been filed with the township clerk previous to the passage of the ordinance giving consent to the construction of the road on the route defined in the description and map filed, the court of chancery of New Jersey holds, left the filed description and map unaffected, with the power in the company to acquire new consents and a fresh ordinance. But a statute requiring the filing in the office of the secretary of state before the beginning and construction of an extension or new line of a description of its route, together with a map exhibiting the same, with the courses and distances thereon, the court holds was not satisfied by filing a map upon which there were no written statements of distances nor of courses along the route designated thereon, although upon the map there was a scale, by applying which to each of the several courses the distance could be ascertained with sufficient certainty to perhaps comply with the requisition of the statute. It says that it is impossible to believe that the legislature intended that one who inspected the map must be an engineer, or employ an engineer

to work out the courses from such data. And not only does the court hold that on account of such failure to state the courses was the map filed, not in compliance with the statute, but that because of this defect in filing the original description and route the petitioner had the right to begin its proceedings do novo, or anew.

While the case of Currie v. Atlantic City, 66 N. J. Law, 671, 50 Atl. Rep. 504, decides that, when the governing body has once acted upon the consents, the efficiency of the consents is spent, nevertheless, until the corporation so acts, the court says that it does not see why the authorization might not be as broad as any other power of attorney. In the present instance the consents were of the most general character, the only limitation contained in them being that the road built by the petitioning company should be constructed along the highway in front of consentor's land. The fact that the consents were given before the last description and route were actually filed the court thinks of no importance, except, perhaps, upon the point that the consents must be regarded as referable to a description and route already on file. Of the efficacy of consents given before the actual filing of a description and map the court has no doubt. If the map previously filed was defective, there arose no legal presumption that the consents were given in reference to it. Nor, having regard to the situation and the general language of the consents, in the court's judgment no inference of facts arose that the consents were made in reference to the original survey. In its judgment, the consents were a sufficient authorization to the township committee to pass an ordinance giving permission to the petitioner to construct and maintain a road upon any route thereafter filed if the township committee in its judgment thought it wise to do so. The consents endowed the township committee with plenary power to pass an ordinance without conditions, or with such conditions for the benefit of the public or protection of the abutters as the municipal body thought fit.

RULE AS TO CARS NOT STOPPING WHEN LATE NOT ADMISSIBLE IN EVIDENCE WHEN CONTRARY TO ORDINANCE—POWER TO MAKE RULES—RIGHT OF INTENDING PASSENGER TO ACT ON APPEARANCES —LENGTH OF TIME CARS TO BE HELD.

Maguire v. St. Louis Transit Co. (Mo. App.), 78 S. W. Rep. 838. Dec. 1, 1903. Rehearing denied Feb. 16, 1904.

The plaintiff was injured in attempting to board a car, which, he alleged, had slowed down to a stopping point and was negligently started again. The defendant offered to prove that it had a rule as to cars stopping for passengers when the car was eight minutes late. The court of appeals at St. Louis, Mo., holds that there was no error in excluding this evidence. It says that section 1761, of city ordinance 19,919 of the city of St. Louis, regulating the stopping of street cars to let passengers on and off, pleaded by the plaintiff, and offered in evidence, makes no exception in favor of a car that is eight minutes or any other number of minutes behind its running time, but requires all cars operated in the streets of the city of St. Louis for the purpose of carrying passengers to make the stops that are required to afford an opportunity for passengers to get on and off the cars, when to do so will not obstruct the operation of the line. The street railroad companies were not granted the use of the streets of the city solely for their own emolument and profit, but primarily for the carriage of passengers upon their cars. That they may make and enforce all needful rules and regulations in respect to the conduct of their business, including stops at street crossings, not inconsistent with the charter and ordinances of the city, is manifest; but they have no power to bind or affect the public by an unreasonable rule that is opposed to an ordinance of the city, as was the one offered in evidence, and excluded by the court.

Nor was the rule admissible for the purpose of showing or tending to show that the intention of the motorman in slowing down his car was not to stop or slow down for the purpose of letting the plaintiff board the car. The plaintiff could not be affected by the rule, unless he had knowledge of it, nor was he bound by the uncommunicated intentions of the motorman. He had a right to act upon appearances, and to attempt to board the car, if he gave the usual signal to the motorman to stop, and the motorman, in apparent response to the signal, slowed down the car to a speed so slow that it was not negligence on the part of the plaintiff to attempt to board it. Again, the court holds that if the plaintiff did make a mistake in supposing the car had slowed down for the purpose of receiving him as a passenger, according to the evidence the mistake was induced by the conduct of the motorman in turning off the power, twisting the brake, and slowing down the car at a time and place and under circumstances that would induce any one in the plaintiff's place to believe as the plaintiff believed—that is, that the motorman intended to stop the car to let him and the other eight or ten persons present and waiting for a car to get aboard; and the defendant, not the plaintiff, was responsible for the consequences of the mistake, if the plaintiff himself was not guilty of contributory negligence in attempting to board the car while in motion.

It is not the rule that the car must be held until a passenger who has just boarded it can be seated. The rule is that the car must be stopped for a reasonable time; that is, time sufficient for a passenger to board the car.

VALIDITY OF ORDINANCE REQUIRING PASSENGERS TO BE CARRIED TO DESTINATION ON A CAR'S ROUTE WITHOUT CHANGE OF CARS—DESTINATION OF CAR INDICATED BY SIGN.

City of New York vs. Interurban Street Railway Co. (N. Y. Sup.), 86 N. Y. Supp., 673. Feb. 4, 1904.

The appellate term of the supreme court of New York holds valid and reasonable a city ordinance which, in substance, requires street surface railroad companies to carry a passenger "to any regular stopping place desired by him upon such car's route" without change of cars, except for transfer to a connecting line going in another direction, or in case an accident renders compliance with the ordinance impossible. In this case three passengers, on a car bearing a "Columbus Avenue" sign, who desired to be carried, respectively, to 100th street, 98th street, and 104th street and Columbus avenue, were told by the conductor, when the car reached Columbus avenue and 79th street, to get out and take the car ahead. This they refused to do, and were taken back downtown, and afterwards into the car barn, and forty minutes or so after that on to their several destinations. The court holds the ordinance violated, Columbus avenue beginning at 59th street, and the Columbus avenue line of cars running ordinarily to 110th street. It thinks somewhat overwrought in refinement the argument that there was no violation of the ordinance, because it only required that the passenger be carried to the destination named on the sign upon the front of the car, which in this case was "Columbus Avenue"; that the words "Columbus Avenue" did not indicate any particular point on that avenue as the destination of the car; that that destination was not a particular part of the avenue to be specified by the passenger, but that the point at which the car first reached Columbus avenue was the destination designated in the ordinance, and therefore the passenger's destination. Effect, it says, must be given to that part of the ordinance which requires the company to carry "every passenger to any regular stopping place desired by him upon such car's route." The desire of the passenger determines his destination, not the will of the railroad company.

PRIVATE INDIVIDUAL CANNOT IN INTERESTS OF PUBLIC BY MANDAMUS COMPEL GIVING OF TRANSFERS—PROPER REMEDIES FOR REFUSAL TO GIVE TRANSFERS—FORFEITURE OF CHARTER.

People ex rel. Lehmaier vs. Interurban Street Railway Co. (N. Y.), 69 N. E. Rep. 596. Jan. 29, 1904.

The court of appeals of New York says that the relator in this case did not seem to have any grievance of his own, but, in behalf of the public, applied for a peremptory writ of mandamus requiring the defendant to do certain things which he claimed it was by law bound to do, namely, to carry any passenger for a single fare between certain points, and, upon demand, and without extra charge, to give the requisite transfers therefor. There may be some cases where the peremptory writ of mandamus is given as a legal right, but obviously in this case the nature of the relief sought was such, and the other legal remedies available to the relator were such, that it would seem to be plain that mandamus was not the proper remedy.

In the first place, if it was true that the [illegible] violating the statute in refusing the transfers, then an action for a penalty of $50 would lie in favor of any individual who had been refused, and also an action to recover any damages which the individual sustained in consequence of the illegal refusal. A vigorous application of the statutory right to recover penalties has generally been found to be an adequate remedy for the grievance complained of. But in addition to that the attorney general is authorized to bring an action against a railroad company to vacate its charter for any violation of law of which it is guilty, and a refusal to obey a statute to give transfers in certain cases would doubtless bring the defendant corporation within the scope of that statute. Code Civ. Proc. sections 1785, 1798. Sections 157 and 162 of the railroad law prescribe remedies for a redress of the grievance complained of that would seem to be ample. It is there provided that the railroad commissioners shall have power to investigate all complaints of any neglect of duty on the part of railroad companies in the operation of their roads for the accommodation of the public, and to make report upon all complaints of the public in regard to the violation of its charter obligations, and it is provided that any decision or recommendation of the board may be enforced by mandamus. Here the writ of mandamus is expressly given as a remedy, but not in the first instance, and only after investigation of the facts by the public authorities in charge of the affairs of railroads. In the present case, the relator, as has already been stated, showed no legal right in himself. So far as the public was concerned, and so far as any individual might acquire such a right, the law gives adequate legal remedies. In this state of the case it was a matter of discretion with the supreme court to withhold the writ.

Again, the court says that the proper function of the writ of mandamus is to compel the doing of a specific thing, based upon a legal right. It does not require much argument to show that the writ of mandamus was not, in this case, an appropriate remedy to compel a general course of official conduct or a long series of continuous acts, as it is impossible for the court to oversee the performance of such duties. The relief which was sought to be attained by this application affected a multitude of people who might become passengers upon the railroad from time to time in the future, and the act which the defendant was required to perform was to deliver to all these people transfer tickets entitling them to ride upon its cars. It is difficult to see how a return to the writ, if issued, could be enforced, or how the final judgment could be executed, under section 2073 of the code.

VALIDITY AND CONSTRUCTION OF GENERAL FRANCHISE PROVIDING FOR EXTENSIONS AS NEEDED—PRELIMINARY NOTICE NOT REQUIRED FOR PERMISSION FOR EXTENSION INTO ANOTHER STREET AS FOR NEW FRANCHISE — REQUIREMENTS OF SMALL CITIES—COMPETITION NOT PREVENTED.

Thurston vs. Huston, Mayor, et al. (Ia.), 98 N. W. Rep. 637. Feb. 17, 1904.

A city ordinance of Cedar Rapids, accepted by the Cedar Rapids & Marion City Railway Co., contemplated a system of street railways for the accommodation of the city generally; that so much of said system as was reasonably required for immediate needs should be constructed without delay; and that extensions of these lines into new neighborhoods, and upon other streets, should be made from time to time in the future as the growth of said city should demand, and the city council designate. The provision that the company should, in its acceptance of the grant, designate the streets to be occupied by its tracks, the supreme court of Iowa says, had reference only to the minimum of mileage which was exacted as the price or condition of the privilege granted. The future growth of the system was provided for in the clause, "and in such other streets and public places as said council may from time to time designate."

The supreme court of Iowa sees no occasion to question the grant on the ground of uncertainty. It says that if the construction of an ordinary railway is contemplated between two designated terminal stations, the route to be occupied may perhaps be designated with reasonable certainty in its charter, but a street railway system intended for the use and convenience of a growing city for a long period of years presents a different problem. Of necessity, it must be a growth—a development—and the direction or number of the lines or tracks which will be required in the future cannot be foretold with any precision. New streets will be opened, new additions to the city will be laid out, and other changes not now anticipated will take place. To meet these contingencies, the city council, in granting a charter for a comprehensive street railway system, must either in sweeping terms grant the right to occupy all streets now or hereafter opened, or it must adopt some such expedient as was made use of in this case, and provide for the extension of lines from time to time as the need therefor may arise, and the city council direct. These provisions are not for the granting of new privileges or franchises, but for the reasonable regulation and control of the company in the use of the franchise originally granted. To adopt the other plan, and grant a franchise expressly allowing the company to enter upon and occupy any or all streets, without any power of veto or regulation by the city council, even if of any validity, would be a most unwise and impolitic abandonment of an important right. To say that it is not within the power of a city to grant a franchise in general terms, as was here attempted, and that every permission for the extension of the railway into another street or alley is a new franchise, requiring preliminary notice, and possible submission to the popular vote, as upon an original grant, is to hamper the progress and usefulness of a public utility by an unreasonable restriction, and tends to a multiplication of petty franchises, from which a confusion of claims, with resultant burdensome litigation, is sure to arise, to the detriment of public interests. There is nothing, therefore, which is unreasonable or against public policy in holding the city clothed with power to grant a franchise in the terms here employed, nor does the court find anything in the Iowa statutes which forbids it.

If, then, the supreme court goes on to say, as it must conclude, the consent of the council for the extension of the company's track into another avenue was not the granting of a new franchise, but was simply an exercise of the reserved power to regulate the company's use of the city streets under the original grant, then the provisions of sections 955, 956 of the code requiring preliminary notice, were not applicable, that statute, by its express terms, being made applicable only to the granting of an original franchise, or to a renewal or extension of the period for which a grant has been made, and not to mere extensions or enlargements of the facilities which the franchise holder employs in exercising the power originally granted.

It is to be conceded that a franchise for a street railway may be confined to any one or more streets or neighborhoods of a city, and if the terms of the grant, when fairly construed, indicate that such restriction or localized privilege was intended, then, of course, any extension of such railway into other streets or districts is subject to all the conditions pertaining to the grant of a new or independent franchise. It is a matter of common observation, however, that, outside of the very large cities, street railway franchises confined to a few streets or districts of the municipal territory are very rare; and, while exclusive franchises, except for limited periods, are not allowable, there can be found very few investors disposed to undertake the construction and operation of a street railway system in our small cities, if the right to expand its lines to accommodate the growth and expansion of the city is denied, or if such successive extension of its track into another street involves the procurement of a new and additional franchise. The court feels quite certain that the practical construction which has been given the law by the cities of Iowa is in accordance with these views, and that to hold otherwise would result in disastrous confusion.

Further, the court says that it may be that in a small city the company first in possession of a general franchise, and with a system already inaugurated, holds such a position of vantage that under ordinary circumstances no competitor will care to enter into a competition, even if another franchise be granted; but competition is excluded or prevented by the operation of natural laws, and not by the terms of the statute or ordinance. While the court holds that the defendant company has a right to enter upon all such streets as the council, in the reasonable exercise of its discretion, may designate, this is not necessarily inconsistent with the existence of another street railway system in the same city, operating under another franchise embodying the same general terms and conditions.

Financial.

The gross earnings of the Salem (O.) Electric Railway Co. for April amounted to $9,297, an increase of $778 over the previous year.

The gross earnings of the Cincinnati, Dayton & Toledo Traction Co. for April amounted to $34,718; operating expenses, $25,943; fixed charges, $16,456; deficit, $7,681. In April, 1903, the company reported a surplus of $1,035. Floods affected the earnings this year.

The New York, New Haven & Hartford Railroad Co. paid $52 per share, or $1,664,000, for the stock of the Winchester Ave. Street Railway Co., and $59 per share, or $8,700,075, for the stock of the Fairhaven & Westville Railroad Co. The former company was capitalized at $800,000 and the latter at $3,000,000.

A plan to reorganize the Lehigh Valley Traction Co. was agreed upon at a meeting of the Philadelphia & Lehigh Valley Traction Co. bondholders. It is proposed to merge all the main and branch lines into one system, to create a new mortgage of $4,600,000, and with this to liquidate the present blanket mortgage of $3,000,000 and use the balance for improvements.

The gross earnings of the St. Louis Transit Co. for May amounted to $837,872, as against $641,549 last year, a gain of $196,293, or over 28 per cent. The average daily receipts for the first month of the World's Fair increased by $6,332, representing an increase of 126,640 revenue passengers. The average increase each month for the first five months of this year exceeded $100,000.

The annual report of the Sao Paulo Tramway, Light & Power Co., of Sao Paulo, Brazil, shows that the gross earnings for the year ending Dec. 31, 1903, amounted to $1,303,175, an increase of $179,890 over the previous year. After the payment of dividends there was a surplus of $211,164. The expenditures for the year amounted to $537,296, in which were included the construction of an additional track, a duplicate pipe line, installation of a 1,000-kw. generator at Parnahyba, and the extension of the overhead light and power systems.

INTERURBAN STREET RAILWAY CO.

The consolidated statement of earnings and expenses of the Interurban Street Railway Co. (now New York City Railway Co.) for the year ending Dec. 31, 1903, including the Metropolitan and Third Ave. systems, shows the gross earnings to have been $21,221,519; operating expenses, $10,990,002; net earnings, $10,230,917; other income, $1,373,793; fixed charges, $8,191,106; surplus for rental under Metropolitan lease, $3,413,604, which is equivalent to 6½ per cent on Metropolitan stock. The assets amount to $26,728,004, including $14,223,634 cost of road and equipment and stocks and bonds of other companies, and profit and loss deficiency, $68,092. The capital stock (common) is $7,921,200; stocks and notes due Metropolitan Securities Co. under subscription, $10,754,800; rentals, $1,883,507.

The Metropolitan Street Railway Co. balance sheet as of December 31st shows: Franchises and property, $53,789,705; capital stock, $51,997,400; bonds, $37,030,000; profit and loss surplus, $4,726,746.

EAST ST. LOUIS & SUBURBAN.

The East St. Louis & Suburban Railway Co. reported for April as follows:

	1903.	1904.	Increase.
Gross earnings	$83,172	$98,425	$15,253
Operating expenses	40,754	50,960	10,206
Net earnings	42,418	47,465	5,047

ST. JOSEPH RY., LIGHT, HEAT & POWER CO.

The St. Joseph Railway, Light, Heat & Power Co. reported for April as follows:

	1903.	1904.	Increase.
Gross earnings	$38,889	$45,956	$7,067
Operating expenses	22,083	28,154	6,071
Net earnings	16,806	17,802	996

CHICAGO & MILWAUKEE ELECTRIC R. R.

The earnings statement of the Chicago & Milwaukee Electric Railroad Co. for May is as follows:

	1903.	1904.	Increase.
Gross earnings	$20,042	$34,476	$14,434
Operating expenses	7,157	13,773	6,617
Net earnings	12,886	20,703	7,817
For five months:			
Gross earnings	$71,238	$122,412	$51,175
Operating expenses	32,104	57,451	25,347
Net earnings	39,134	64,962	25,828

TOLEDO RAILWAYS & LIGHT CO.

Following is the comparative statement of the Toledo Railways & Light Co. for April:

	1903.	1904.	Increase.
Gross earnings	$127,563	$134,421	*$6,858
Operating expenses	69,710	77,391	7,681
Net earnings	57,853	57,030	* 823
Fixed charges	40,360	41,969	1,609
Surplus	17,493	15,060	* 2,433
Operating ratio	.5465	.5757	.0292

*Decrease.

UNITED TRACTION CO.

The United Traction Co., Albany, N. Y., reported for the quarter ending March 31st as follows:

	1903.	1904.	Increase.
Gross earnings	$376,911	$390,402	$13,491
Expenses	252,870	284,478	31,608
Net earnings	124,041	105,924	*18,117
Other income	2,592	2,374	* 218
Total income	126,633	108,298	*18,335
Charges	72,651	76,147	3,496
Surplus	53,982	32,151	*21,831

*Decrease.

INTERNATIONAL TRACTION CO.

The comparative statement of the International Traction Co. system, Buffalo, N. Y., for April follows:

	1903.	1904.	Increase.
Gross earnings	$295,332	$312,708	$17,376
Operating expenses (ex. taxes)	167,669	216,248	48,579
Net earnings	127,663	96,460	*31,203
Fixed charges (int., taxes, etc.)	127,168	132,704	5,536
Net income	495	*36,244	*36,739
Net income July 1st to date	136,237	56,498	*79,739
Operating ratio (ex. taxes)	.576	.701	.125

*Decrease.

NEW YORK & LONG ISLAND TRACTION CO.

The New York & Long Island Traction Co., of Freeport, N. Y., reported for the quarter ending March 31st as follows:

	1903.	1904.	Increase.
Gross earnings	$6,669	$10,152	$3,483
Operating expenses	9,586	13,265	3,679
Net deficit	2,917	3,113	196
Other income	.....	163	163
Gross deficit	2,917	2,950	33
Fixed charges	130	443	313
Deficit	3,048	3,393	345

MUNCIE, HARTFORD & FT. WAYNE.

The May statement of the Muncie, Hartford & Ft. Wayne Railway Co., of Muncie, Ind., is as follows:

Earnings	$15,505
Operating expenses	6,907
Net earnings	8,598
For five months:	
Earnings	64,613
Operating expenses	35,310
Net earnings	29,302

Operating expenses include taxes, insurance and 2 per cent of the gross receipts for an accident fund

NORTHERN TEXAS TRACTION CO.

Following is the comparative statement of the Northern Texas Traction Co. for May:

	1903	1904	Increase.
Gross earnings	$38,278	$50,737	$12,459
Operating expenses	22,982	25,116	2,134
Net earnings	15,296	25,621	10,325
Fixed charges	9,118	12,194	3,076
Surplus	6,178	13,427	7,249
For five months:			
Gross earnings	$166,050	$211,722	$45,672
Operating expenses	93,137	121,945	28,808
Net earnings	72,914	89,777	16,863
Fixed charges	45,105	50,519	5,414
Surplus	27,809	39,258	11,449

NORTHERN OHIO TRACTION & LIGHT.

Following is the comparative statement of the Northern Ohio Traction & Light Co. for April:

	1903.	1904.	Increase.
Gross earnings, railway	$53,285	$54,664	$1,379
Gross earnings, light	8,371	8,400	29
Total gross earnings	61,656	63,064	1,408
Operating expense, railway	31,882	33,995	2,113
Operating expense, light	3,325	3,509	184
Total operating expenses	35,208	37,504	2,296
Net earnings	26,449	25,560	* 889
Fixed charges	23,063	22,467	* 596
Surplus for stock	3,385	3,094	* 291

*Decrease.

DAYTON, SPRINGFIELD & URBANA.

The statement of the Dayton, Springfield & Urbana Electric Railway Co. for the year ending Dec. 31, 1903, is as follows:

Gross earnings	$224,779
Operating expenses and taxes	121,509
Net earnings	103,270
Received from track rentals, net	9,500
Total net income	112,770
Bond interest	37,500
Surplus	75,270

The Urbana, Bellefontaine & Northern division was not opened for through business until December, 1903, and its earnings are not included. The interest requirements for the Urbana, Bellefontaine & Northern guaranteed issue are $25,000 per year.

LAKE SHORE ELECTRIC RY.

The comparative statement of the Lake Shore Electric Railway Co., Cleveland, O., for April follows:

	1903.	1904.	Increase.
Gross earnings	$42,501	$46,705	$4,203
Operating expenses	30,716	37,027	6,311
Net earnings	11,784	9,677	* 2,107
Interest	20,370	20,404	33
Deficit	8,586	10,727	2,114
For four months:			
Gross earnings	$151,591	$157,606	$ 6,015
Operating expenses	119,998	147,742	27,761
Net earnings	31,609	9,864	*21,745
Interest	77,779	81,583	3,804
Deficit	46,169	71,719	25,549

*Decrease.

ELGIN, AURORA & SOUTHERN.

Following is the April statement of the Elgin, Aurora & Southern Traction Co.:

	1903	1904.	Increase.
Gross receipts	$33,295	$33,425	$ 130
Operating expenses	20,191	22,011	1,820
Net earnings	13,104	11,414	* 1,690
Deductions	9,216	9,133	* 83
Net income	3,888	2,280	* 1,608
For 10 months:			
Gross receipts	$353,274	$378,055	$24,781
Operating expenses	206,094	229,589	23,495
Net receipts	147,180	148,466	1,286
Deductions	91,162	91,774	612
Net income	56,017	56,692	675

*Decrease. Operating expenses include an accident appropriation equal to 2 per cent of gross receipts.

MONTREAL STREET RAILWAY CO

Following is the comparative statement of the Montreal Street Railway Co. for April:

	1903	1904	Increase.
Passenger earnings	$170,050	$184,905	$14,855
Miscellaneous earnings	2,036	1,567	* 469
Total earnings	172,086	186,473	14,387
Operating expenses	107,876	125,372	17,497
Net earnings	64,210	61,100	* 3,110
Fixed charges	19,717	20,837	1,120
Surplus	44,493	40,264	* 4,230
Operating ratio	.6344	.6785	.0441
For seven months:			
Passenger earnings	$1,170,294	$1,298,166	$127,872
Miscellaneous earnings	19,283	10,986	* 8,297
Total earnings	1,189,577	1,309,152	119,575
Operating expenses	759,932	891,706	131,774
Net earnings	429,646	417,446	*12,200
Fixed charges	119,856	126,435	6,579
Surplus	309,790	291,012	*18,778
Operating ratio	.6493	.6869	.0376

*Decrease.

CINCINNATI, NEWPORT & COVINGTON

Following is the comparative statement of the Cincinnati, Newport & Covington Light & Traction Co. for April:

	1903.	1904.	Increase
Gross receipts	$92,945	$99,460	$6,515
Operating expenses	38,048	43,891	5,843
Damages, taxes, rents and tolls	16,675	16,742	67
Total expenses	54,723	60,633	5,910
Net earnings	38,222	38,826	604
Fixed charges	20,917	21,135	218
Net profit	17,305	17,691	386
Operating ratio	.4093	.4412	.0319
Same inc. damages, taxes, etc.	.5887	.6096	.0209
For four months:			
Gross receipts	$368,250	$393,461	$25,211
Operating expenses	153,499	170,392	16,893
Damages, taxes, rents and tolls	66,700	67,132	432
Total expenses	220,200	237,525	17,325
Net earnings	148,050	155,936	7,886
Fixed charges	84,331	84,418	87
Net profit	63,719	71,518	7,799
Operating ratio	.4168	.4330	.0162
Same inc. damages, taxes, etc.	.5979	.6036	.0057

CHICAGO UNION TRACTION CO.

The receivers of the Chicago Union Traction Co. reported a deficit for the six months ending Feb. 29, 1904, amounting to $81,326. The Traction company proper reported net earnings applicable to dividends of $126,298, but the Consolidated Traction Co. earnings showed a deficit of $207,624. There was charged off for "depreciation reserve" on the North and West side lines $502,221, making the total technical deficit $583,548. The passenger receipts amounted to $4,100,338, compared with $3,650,358 for the corresponding period of 1899-00, when the last previous report giving passenger receipts for the same period was issued. The operating ratio for the six months ending Feb. 29, 1904, was .7318, as against .584 in 1901-02 and .54 in 1900-01.

The statement of the North and West Chicago companies and both together for the six months follows:

	West Chicago.	North Chicago.	Both.
Gross earnings	$2,651,974	$1,499,203	$4,151,177
Operating expenses	1,907,865	1,090,449	2,998,314
Net earnings	744,109	408,753	1,152,862

Other income	19,443	11,405	30,008
Total income	763,552	420,218	1,183,770
Deductions	683,840	373,031	1,057,471
Reserve for depreciation	330,213	103,008	502,221
Proportion for C. C. T. Co. deficit	132,685	74,939	207,624
Net deficit	302,188	101,300	583,548

The statement of the Chicago Consolidated Traction Co. shows that in the six months operating expenses were 87.8 per cent in excess of the gross earnings. Only one previous statement of earnings by this company has been made public, and that was for the year ending Dec. 31, 1898. It compares with the report of the receivers as follows:

	Six mos. to Feb. 29, '04.	Year to Dec. 31, '98.
Gross earnings	$645,706	$1,026,780
Operating expenses	562,427	620,488
Net income	83,278	406,292
Other income	40,248	....
Total income	123,527	406,292
Deductions	331,151	337,458
Deficit	207,624	* 68,834

*Surplus. The Consolidated Traction Co. has notes payable outstanding to the amount of $1,231,313.

End of Crawfordsville (Ind.) Litigation.

June 3rd Judge Baker, of the United States Circuit Court, overruled the demurrer of the Consolidated Traction Co. to the Indianapolis & Northwestern Traction Co's. cross-complaint, and at the same time sustained the demurrer of the Northwestern company to the cross-complaint which had been filed by the city of Crawfordsville, Ind., this action of the court giving the Northwestern company legal right to use the streets of Crawfordsville. The case has been in the courts for more than a year. The Northwestern company was first granted a franchise and later the city rescinded its action and granted a similar franchise to the Consolidated company. The Northwestern company had laid its tracks when the city secured an injunction. Upon appeal to the federal court the city withdrew from the case, but Judge Baker ordered that it be continued a party to the suit. The case was previously mentioned in the "Review" for February, 1904.

The Strike at Houston, Tex.

June 2nd the employes of the Houston (Tex.) Electric Co. went on strike, about 200 men being affected. The union claimed that the company had violated a section of its agreement which provided that there should be no discrimination against the union. This charge, which was denied, was provoked by the company having discharged the president of the union for cause. The union had been disgruntled since March 22nd, when the company discharged 21 men, principally conductors, for alleged abuse of the transfer system, and a board of arbitration had been trying to adjust matters since that time. The first day of the strike the company made no attempt to run cars, but it notified the men that all those who failed to report for duty might consider themselves discharged. The company secured plenty of men from outside sources and began to operate on June 3rd. Mobs stoned the cars and took the motormen from the platforms without police interference. The next day the militia was called out and the cars run under guard on three or four lines. The rioting continued and June 5th, at the suggestion of the mayor, no cars were run. Special policemen were sworn in and the following day the cars were operated with their assistance, instead of the militia. From that time the rioting became less noticeable. June 8th the cars were run in the evening for the first time and were freely patronized. The company agreed to take back all of its old men whom it deemed suitable, but would not agree to bind itself to a strict recognition of the union.

The commencement exercises at the Worcester Polytechnic Institute were held during the week of June 5-9. The commencement address was by Dr. Ira Remsen, president of Johns Hopkins University.

Personal.

MR. E. F. BRYANT has been appointed receiver of the Chicago General Railway Co., succeeding Mr. E. F. Zimmer.

MR. H. W. M'KAY has resigned as superintendent of the Haverhill division of the Boston & Northern Street Railway Co.

MR. J. M. M'FARLAND has resigned as superintendent of the Steubenville, Mingo & Ohio Valley Traction Co. and will reside in Colorado.

ALBERT BOYNTON STORMS, A. M., D. D., was installed as president of the Iowa State College of Agriculture and Mechanic Arts on June 6th.

MR. JOHN T. CONWAY has been appointed superintendent of the Quincy Division of the Old Colony Street Ry., of which he was formerly assistant superintendent.

MR. ROBERT M'F. DOBLE, of San Francisco, consulting and supervising engineer, announces that he has become identified with the Abner Doble Co., of the same city.

MR. C. V. MILLS has been appointed general superintendent of the Chester Traction Co., of Chester, Pa. He was formerly superintendent of the West Chester Traction Co.

MR. EVERETT M. WINSLOW, chief engineer of the Brockton power station of the Old Colony Street Ry., has been appointed chief engineer of the new Quincy Point station.

MR. JAMES HAMILTON, M. E., LL. B., has removed his offices to Nos. 129-130 Loan & Trust Building, Washington, D. C. He was formerly at No. 53 State St., Boston Mass.

PROF. W. F. M. GOSS, dean of the Schools of Engineering of Purdue University, La Fayette, Ind., has received from the University of Illinois the degree of Doctor of Engineering.

MR. J. T. HAMBLETON has resigned as superintendent of the Susquehanna Traction Co., of Lock Haven, Pa., to become superintendent of the Slate Belt Electric Traction Co., of Bethlehem, Pa.

MR. H. L. SMITH on June 15th resigned as superintendent of the Columbus, Delaware & Marion Electric Railroad Co. He was formerly superintendent of the Central Market Street Railway Co.

MR. HARRY E. REYNOLDS, formerly assistant general superintendent of the Old Colony Street Ry., has been appointed purchasing agent for the Old Colony and the Boston & Northern companies.

MR. M. E. M'CASKEY, formerly superintendent, has been appointed general manager of the Pennsylvania & Mahoning Valley Railway Co., and he has also been elected second vice-president of the company.

MR. JOHN POWERS has been appointed general superintendent of the Sterling, Dixon & Eastern Eelectric Ry. Mr. Powers, who is 30 years old, entered street railway work 15 years ago, when he was employed changing horses on the horse cars.

MR. B. E. SUNNY, president of the Civic Federation of Chicago, is the author of "The Proposed Amendment to the Constitution of the State of Illinois and a New Charter for Chicago," which has been published in pamphlet form by the Federation.

MR. A. G. DAVIDS, who has been general superintendent of the Auburn & Syracuse (N. Y.) Electric Railroad Co. for the past two years, recently resigned to go with the Chester (Pa.) Traction Co., where he has charge of the Philadelphia division, with headquarters at Penrose Ferry.

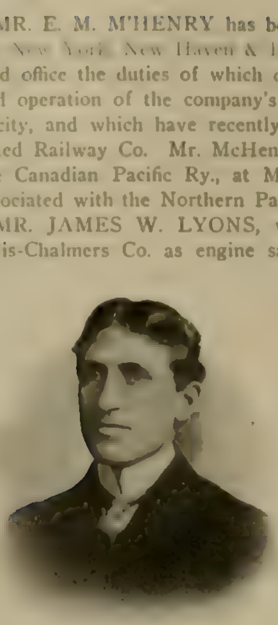
DR. JOHN MACFAYDEN has resigned as general superintendent of the Chester (Pa.) Traction Co., and on June 6th he was the recipient of a silver service given by the conductors and mortormen of the road. It is understood that he will remain with the company in another capacity.

MR. T. F. MANVILLE, president of the H. W. Johns-Manville Co., New York City, accompanied by Mr. E. B. Hatch, president of of the Johns-Pratt Co., of Hartford, and Mr. J. W. Perry, manager of the electrical department of the Johns-Manville company, sailed for England April 26th and returned June 10th.

MR. W. K. PALMER, M. E., on June 1st removed his offices from 402 Lyceum Building to 718 Dwight Building, Kansas City, Mo., owing to the Lyceum Building having been discontinued as an office building. In the new offices Mr. Palmer will have exceptional facilities for the prompt preparation of plans, specifications, estimates and reports, and for the proper supervision of engineering construction.

MR. E. M. M'HENRY has been chosen fourth vice-president of the New York New Haven & Hartford Railroad Co., a newly created office the duties of which cover the construction, maintenance and operation of the company's lines which are operated by electricity, and which have recently been consolidated as the Consolidated Railway Co. Mr. McHenry was formerly chief engineer for the Canadian Pacific Ry., at Montreal, and previous to that was associated with the Northern Pacific Ry.

MR. JAMES W. LYONS, who has been associated with the Allis-Chalmers Co. as engine salesman for many years, has been appointed manager of the newly-created power department of the company, the appointment taking effect May 16th, with headquarters at Chicago. Mr. Lyons has many business friends throughout the country who will be glad to learn of his well-deserved promotion. The newly-created power department of the company, over which Mr. Lyons has assumed control, will take care of the sales of reciprocating steam engines, steam turbines (including turbo-generators), condensers, gas engines, pumping, blowing and hoisting engines and air compressors.

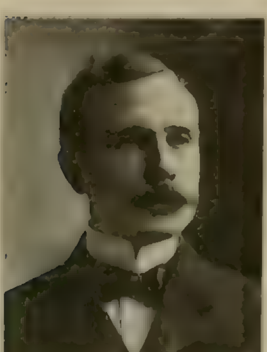


J. W. LYONS.

MR. C. C. TYLER has resigned as superintendent of the works of the Westinghouse Electric & Manufacturing Co., to become the general superintendent of all the works of the Allis-Chalmers-Bullock interests in the United States. Mr. Tyler entered upon his new duties June 15th, his headquarters being at Milwaukee, Wis. His record in the practical management of great machine shops is one of the best in the country, and in the equipment of manufactories, in the design and construction of machine tools, in the handling of machinery and material and, in fact, in all that pertains to the economy of machine shop administration, Mr. Tyler is recognized as an expert.

MR. MASON D. PRATT, who for the past 13 years has been connected with the Pennsylvania Steel Co., first as street railway engineer and for the past two and one-half years as engineer in charge of the construction of new shops for the frog and switch department of this company, has resigned that position and will conduct a general engineering business with headquarters at No. 18 Third St., Harrisburg, Pa., giving particular attention to electric railways, power plants and water works. Mr. Pratt graduated from Lehigh University in 1887, his first work after leaving college being with the Phoenix Bridge Co., and later with the Johnson Co., now the Lorain Steel Co.

MR. JOHN B. ALLAN, whose resignation as vice-president and general manager of the Allis-Chalmers Co. was announced in the "Review" for May, has been appointed western manager of the Westinghouse Machine Co., with headquarters at 171 LaSalle St., Chicago. Mr. Allan had been prominently associated with the E. P. Allis Co. and the Allis-Chalmers Co. for 24 years. He was born in Davenport, Ia., in 1860, and received a common and high school education in his native city, followed by a course at the Worcester Polytechnic Institute, from which he was graduated in 1880 as a mechanical engineer. He entered the service of the Edward P. Allis Co. shortly after leaving college and was successively employed as draughtsman, machinist and erecting superintendent. He also had charge of making economy tests of engines and steam plants. In January, 1895, the company opened an office in Chicago and Mr. Allan was made manager, the engineering as well as the selling departments coming under his supervision. Mr. Allan has a wide acquaintance and is popular in the field to which he has devoted his main efforts. He is a member of the American Society of Mechanical Engineers and the Engineers' Club, of New York.



J. B. ALLAN.

THE PITTSBURG RAILWAYS CO. has made the following changes among the officials of the transportation department: Mr. J. S. Shedd, formerly assistant superintendent of transportation, to be superintendent of the Birmingham division; Mr. Charles E. Long, superintendent of overhead lines, to be superintendent of the Second Ave. division; Mr. John B. Loftus, chief dispatcher of the Monongahela division, to be assistant superintendent of the Second Ave. division, in charge of the McKeesport sub-division; Mr. J. M. Loftus, superintendent of the Butler St. division, to be superintendent of the Homewood division; Mr. C. J. King, chief dispatcher at East Liberty, to be superintendent of the Highland Park division; Mr. W. J. Fleming, dispatcher on the Butler St. division, to be superintendent of that division.

MR. GEORGE A. DAMON, managing engineer of the Arnold Electric Power Station Co., of Chicago, was married on June 8th to Miss Harriet Diller, of Chicago. The wedding, which was attended only by relatives and a few intimate friends, took place at Lake Bluff. Mr. and Mrs. Damon immediately started on an extended tour throughout the west. Mr. Damon, who is an alumni of the University of Michigan, has been associated with Mr. Bion J. Arnold since the completion of his university work, and to the able assistance he has given Mr. Arnold the success of the Arnold company is in no small measure due. Besides his professional work, Mr. Damon finds time for active work in various engineering and social societies, of which he is a member.

MR. JACOB MELLINGER, superintendent of the York (Pa.) Street Railway Co., and general superintendent of the York Traction Co., which controls all the lines running in and out of York, was born June 30, 1862, in Lancaster County, a short distance from Lancaster, Pa. He was educated in the Lancaster schools and for a short time engaged in the milk business. When the Lancaster street horse car company was organized in November, 1887, Mr. Mellinger became a driver and later conductor, and when the electric railway company was formed he became a motorman, operating the first car through the streets of Lancaster. Two years later he was made foreman of repairs at the car barn and in August, 1892, he went with the York Street Ry., to fill a similar position, which he held until April, 1895. In 1903 Mr. Mellinger was appointed to his present position.

J. MELLINGER.

MR. ARTHUR WEST, formerly engineer with the Allis-Chalmers Co., and whose resignation was announced in the "Review" for May, has been appointed chief engineer of the Westinghouse Machine Co., with headquarters at East Pittsburg, Pa. Mr. West had been associated with the Allis-Chalmers Co. about 17 years, and for several years he has had full charge of the entire pumping station work. Mr. West was born at Milwaukee, Wis., in 1867, and was educated in the Milwaukee public schools, supplemented by a technical course at the University of Wisconsin, from which he graduated in the class of 1887. This was followed by post-graduate work at the University, and he entered the employment of the Edward P. Allis Co. as a machinist. He has since filled the positions of erecting engineer, assistant to shop superintendent, assistant superintendent, private engineer for Edwin Reynolds in his special work, general trouble engineer on all steam engine work, salesman in the pump department, engineer of tests, manager of pump department and, finally, assistant chief engineer. Mr. West is a member of the American Society of Mechanical Engineers and the Engineers' Club, of New York. He recently started for Europe to investigate the most recent practice of engine builders abroad.

The Mississippi Valley Traction Co., of Moline, Ill., opened Campbell's Island, its new summer resort in the Mississippi River, Sunday, May 22nd.

Some of the Exhibits at the St. Louis Exposition.

David R. Francis, president of the Louisiana Purchase Exposition, on Opening Day thus epitomized the Fair in his address:

"So thoroughly does it represent the world's civilization that if all man's other works were by some unspeakable catastrophe blotted out the records here established by the assembled nations would afford all necessary standards for the rebuilding of our entire civilization."

To give a comprehensive idea in words of these "records of civilization" here concentrated within the confines of this World's Fair would be impossible. Even to do full justice to a single department, as the electric railway industry, would be out of the question in the pages of any periodical. Sufficient it is to say that the exhibits appertaining to the science of electric traction represent in concrete form the development and progress made in all countries during the past decade.

A word as to the location of the exhibits in which the electric railway visitor will take particular professional interest may be in order.

With few exceptions these will all be found in three of the main buildings, Palace of Electricity, Palace of Transportation, and Machinery Hall. A scattering of exhibits allied in one way or another to this industry have been located in the Palaces of Varied Industries, Manufacture and Liberal Arts, and one or two, such as the display of German scientific instruments, will be found in Education Building. In addition there are a few outdoor exhibits that will invite the attention of the street railway man, such as the German railway exhibit near the German Building, the railway test track at the side of Transportation Building, and the Mining Gulch, where is located a working example of electric industrial railway transportation for mining and other purposes.

The Palace of Electricity occupies a central position on the Exposition grounds. It is a fine exhibit structure, pentagonal in shape, with a spacious court in the center. The exhibits within this building cover all the modern applications of electricity and each department of education, science and industry associated with electricity is represented in about equal measure. The application of electricity to railways has been given the attention it deserves and in both the northwest and southeast quarters of the building will be found fine demonstrations of the most modern apparatus.

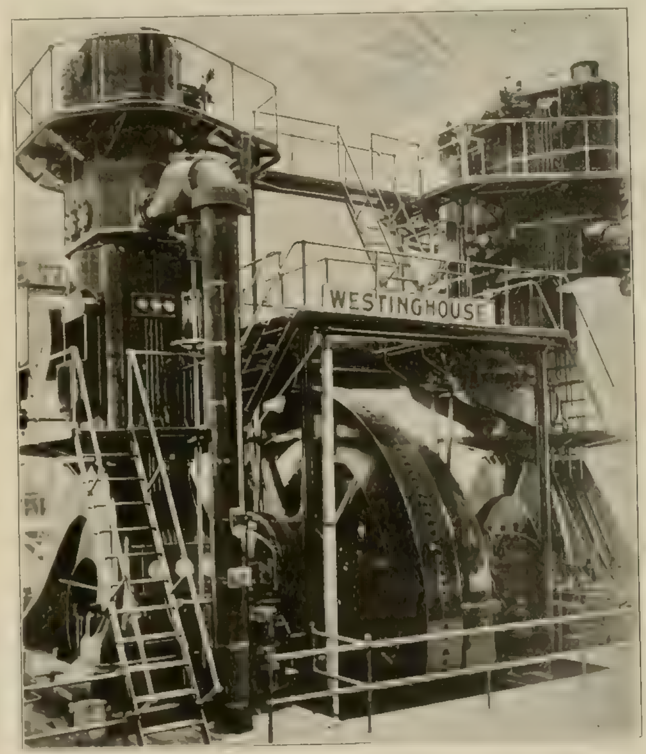
The Palace of Transportation is a great oblong building running parallel with the Pike. This building is devoted to displays associated with steam railroads, electric railways, marine work and automobiles. In this building the Pennsylvania R. R. has installed the most complete locomotive testing plant ever attempted and locomotive testing will be carried on during the Fair by a joint committee of the American Society of Mechanical Engineers and the American Railway Master Mechanics Association. The electric railway interests are not classified by themselves but will be found mixed in with steam railroad exhibits. The electric railway test tracks will be found just outside this building.

Machinery Hall with its annex, the Steam, Gas, and Fuels Building, is close to the two palaces previously mentioned. The western half of Machinery Hall comprising a space about 600 ft. long by 300 ft. wide contains the various power plants. Installed here are engines and generators representing the best type of prime movers from all the leading works of this country, England, France, and Germany. Steam for the operation of these engines is generated in the Steam, Gas and Fuels Building, a fireproof structure 330 ft. long by 300 ft. wide situated about 100 ft. distant from the Palace of Machinery. The pipe lines conveying the steam from the boilers to the engines and returning the condensed water back to the boiler from the condensers fill a tunnel 7 ft broad and 8 ft deep The eastern end of Machinery Hall is occupied by machine tools and machinery and devices comprising all the accessories needed in a complete power plant and machine shop.

The following are descriptions of exhibits made by some of the leading manufacturers associated with the electric railway industry:

WESTINGHOUSE COMPANIES' EXHIBITS

A notable feature of the Westinghouse exhibits is the main service plant at the Exposition for which this company received the general contract. The commanding size of the four large electrical generating units, each of 2,000 kw. capacity, appeals to practically all visitors to the Fair. These generators, which operate at a speed of 83½ revolutions per minute and deliver a 25-cycle current at 6,600 volts, are not at this day remarkable on account of their size, as the entrance to the service plant exhibit is through a large 35 ft. plaster ring in exact duplicate size of the stationary armature of the 5,000-kw. alternating current Westinghouse generators built for the elevated and subway trains in New York City. Generators of 10,000 kw. capacity are also being built by this company for the Ontario Power Co. It is interesting to note the advantage in floor space economy of direct connected generators. The space occupied by the smallest of the belt driven generating units at the Chicago Exposition was about 65 x 27 ft. and the units at St. Louis, which are almost three times as large, are direct



WESTINGHOUSE-CORLISS ENGINES, EXPOSITION SERVICE PLANT.

driven and the space occupied by each over all, including the 36 and 75 x 54-in. Westinghouse corliss vertical cross compound engines, is only about 55 x 15 ft. and 32½ ft in height, the flywheel being 23 ft. in diameter.

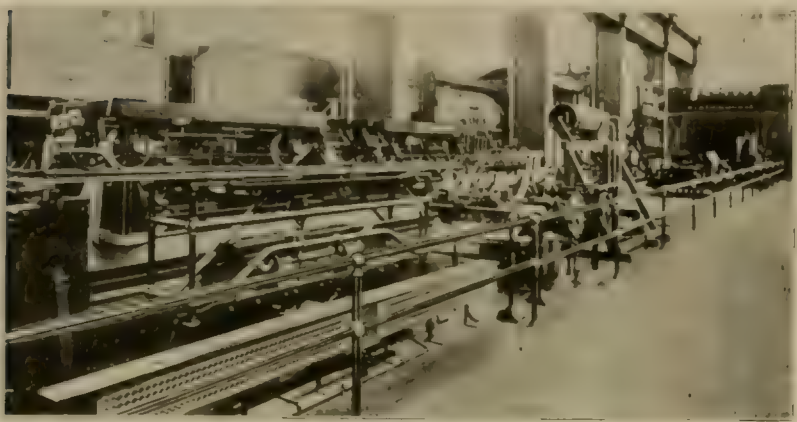
The total space devoted to the service electric plant in Machinery Hall with the exciter units, condensers, cooling towers, and 35-panel switchboard is 26,260 sq. ft. The entire plant was designed and equipped by Westinghouse, Church, Kerr & Co., and all the motive power apparatus was furnished by the Westinghouse Machine Co.

The various organizations under the title of the Westinghouse Companies represented at the St. Louis Fair are as follows:

Westinghouse Electric & Manufacturing Co.

Westinghouse Machine Co.

Westinghouse Air Brake Co.
Westinghouse, Church, Kerr & Co.
Westinghouse Brake Co., Ltd., London, Paris and Hanover.
British Westinghouse Electric & Manufacturing Co., Ltd.
Westinghouse Automatic Air & Steam Coupler Co.
Westinghouse Traction Brake Co.
Canadian Westinghouse Co., Ltd.
Societe Anonyme Westinghouse, Havre, France.
Societe Anonyme Westinghouse, St. Petersburg, Russia.
Westinghouse Electricitats-Actiengesellschaft, Berlin.
Sawyer-Man Electric Co.



WESTINGHOUSE TRANSPORTATION EXHIBIT.

Union Switch & Signal Co.
American Brake Co.
Nernst Lamp Co.
Pittsburg Meter Co.
R. D. Nuttall Co.
Cooper-Hewitt Electric Co.
Bryant Electric Co.
Perkins Electrical Switch Manufacturing Co.

The Westinghouse exhibits and preparations for the reception of visitors are on a complete scale. In Machinery Hall, in addition to the electric service plant and the main exhibit of Westinghouse gas engines, turbo-generators, rotaries, exciters and motors in operation, is the Westinghouse Auditorium, which seats 350 persons, and in which are displayed at regular hours biograph and mutoscope pictures of scenes in the various Westinghouse works. The Cooper-Hewitt lamps, which made possible the Westinghouse mutoscope shop views, are shown in the booths in Machinery Hall and in the Palace of Electricity. These lamps are designed for use in general illumination, photography and photo engraving.

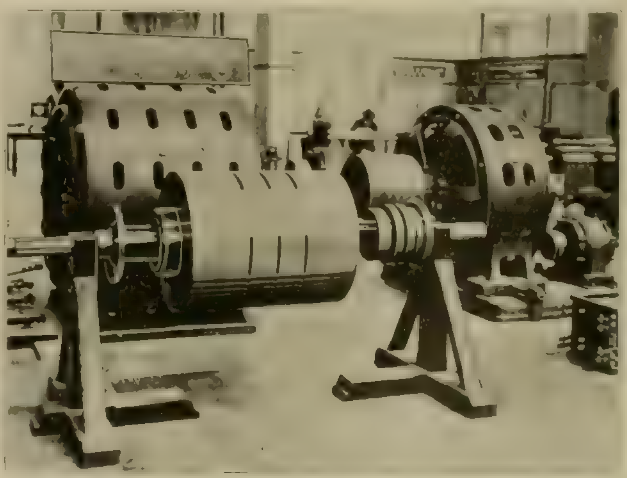
There are in all about 10,000 Nernst glowers in use in the Exposition buildings, of which 6,000 are in the Fine Arts Museum. The Illinois State building is lighted by them, as well as several exhibits of the National Cash Register Co., and the Westinghouse Companies use 300 big street glowers in their exhibits. The Pittsburg Meter Co. has a separate booth on block 35 of Machinery Hall. There are exhibited the Keystone water meter and parts, with Westinghouse fish traps; Westinghouse gas meters; water meter provers; and a Westinghouse proportional 12-in. gas meter, with a capacity of 100,000 cu. ft. an hour.

Steam for the Westinghouse electric service plant is piped from the boiler house known as the Steam and Fuels Building, in which there has been installed a large battery of Babcock & Wilcox water-tube boilers built into a single setting with a total capacity of 6,400 h. p. The equipment here includes Roney mechanical stokers at the furnaces, operated by Westinghouse "Standard" steam engines, a complete coal conveying system furnished by the Link Belt Engineering Co., Cochrane feed-water heaters, Worthington steam pumps, mechanical draft, condensers, cooling towers and other apparatus found in a model station of the present day. Each of the four chief generating units receive steam from a separate line supplied by a separate battery, the entire plant thus consisting of sections which may be operated independently or together.

The exhibits of this plant immediately west of the company's headquarters is utilized to furnish power for various purposes and includes a Westinghouse-Parsons steam turbine generating set of 400 kw. capacity, operating at a speed of 3,600 r. p. m., and delivering a three-phase, 60-cycle current at a potential of 440 volts. This unit is of a size that has met with most extended introduction by reason of its applicability to power stations of moderate size, although it is at the present time the smallest turbine unit built by the Westinghouse Machine Co. A number of these units now nearing completion in the company's shops are of 7,500 h. p. capacity.

In the Electricity Building the Westinghouse Electric & Manufacturing Co. occupies a space of over 10,000 sq. ft. including 1,600 sq. ft. devoted to the display of electric trucks and locomotives built in conjunction with the Baldwin Locomotive Works. Two locomotives built for mine service are shown, one weighing 20,000 lb. and the other 30,000 lb. each equipped with No. 79, 500-volt motors. The 20,000 lb. locomotive for switching is equipped with two No. 75 motors at 220 volts. In the regular electrical equipment display are a 400-kw. turbine type generator; typical generators for direct and alternating currents, for belt or direct connection; rotary converters; motor-generator sets; oil insulated and air blast transformers; direct current and alternating current railway motors and controllers; single and polyphase induction motors of constant and variable speeds; direct current motors of many types, including motors for variable speed service from single and double voltage circuits; switchboard apparatus, ammeters, voltmeters, wattmeters, synchroscopes, power factor meters, circuit-breakers and switches, many of them electrically operated; portable instruments; instruments of precision; potential regulators, and innumerable other forms of auxiliary apparatus and instruments. The alternating current, series wound, single phase crane motors, similar in type and general construction to the single phase railway motors exhibited in the Transportation Building, and the new "Westinghouse unit switch system of multiple control" are also to be seen in this section.

The combined exhibits of the various Westinghouse brake companies extends a distance of 150 ft. along the aisle from the turntable in the Transportation Building. Included in this operating exhibit is a display of the Westinghouse alternating current single phase railway motors which have been recently introduced in railway traction. The Westinghouse Air Brake Co's. exhibit shows



WESTINGHOUSE TURBO-GENERATOR EXHIBIT.

a rack made up of apparatus constituting the equipment for a six coach passenger train with engine and tender, all fitted throughout with the high-speed brake and signal equipment. The engine and tender are equipped also with the combination automatic and straight air brake which is now largely used. A novel feature of this exhibit is that all valves are placed in duplicate, one being

sectioned so as to show the internal mechanism and connected to the valve in use so that it moves as the regular valve is operated. The Westinghouse friction draft gear is also shown in section with a machine specially designed for testing it in operation. The straight air brake rack shows the equipment now used in the straight air outfit on electric cars that are operated by the company's standard compressors. Both axle and motor driven compressors are shown in section for inspection of their internal working power. One of the sectional compressors is fitted to move with a regular compressor in operation.

The Union Switch & Signal Co's. exhibit is a group of signals full size and in working condition erected in Transportation Building. The company's most important exhibits at St. Louis, however, are the installations in actual service, including the Westinghouse electro pneumatic interlocking system at the Union Station, which controls all of the passenger yard movements and is the largest interlocking apparatus ever built.

A guide pamphlet to the Westinghouse exhibits may be secured at the headquarters and exhibits office, consisting of a neat folder which includes maps of St. Louis and the Exposition and a list of typical Westinghouse installations in St. Louis. The company's headquarters in Machinery Hall is open for the reception of guests from all over the world to all of whom a cordial welcome is extended.

INGERSOLL-SERGEANT AIR COMPRESSORS.

The Ingersoll-Sergeant Drill Co., of New York, has a heavy-duty air compressor in connection with the power plant of the Tyrolean Alps, on the Pike. The company has no other regular exhibit on the ground, but it calls attention to the 40 air-compressing stations it has installed for the St. Louis Transit Co., and which supply air for the storage air-brake system used on all the cars of the Transit system. These compressing plants have been described in the "Street Railway Review."

BRILL CARS AND TRUCKS.

The exhibit of the J. G. Brill Co. occupies a space 300 ft. long on aisle D of the Transportation Building, and consists in the main of a suburban type of semi-convertible car, a double-truck convertible car, and a 13-bench "Narragansett" car; three sizes of the high speed truck No. 27-E, and one size each of the single-truck No. 21-E, the "Eureka" maximum traction, and the suburban truck No. 27-G. An exceedingly attractive office is in a section of a car finished in solid mahogany, with windows of the semi-convertible style.

The semi-convertible car is 30 ft. 8 in. long over the end panels, and has 5 ft. 6 in. platforms; width over sills, 8 ft. 0½ in., and over posts at belt 8 ft. 4 in. The car has the well known patented roof storage window system of the builders, patented semi-accelerator doors in the ends, and vestibuled "Detroit" platforms enclosed at one side. The platforms are divided with a brass rail leaving space for passengers to move around at each end. The window sashes of the vestibules are arranged to drop into pockets. The seats are 36 in. long and upholstered in figured plush. These are of the walk-over back type with the exception of stationary-back seats at either end accommodating three passengers. The interior is finished in vermilion wood richly inlaid. The car is mounted on Brill No. 27-G-E-1 trucks. Attention is particularly directed to the curved glass windows between the double corner posts which enable the conductor to watch from any point of the car passengers mounting or dismounting the steps.

The convertible car is 25 ft. 9 in. over the end panels, and has 4 ft. 8½ in. platforms; width over sills, 7 ft. 6¼ in., and over posts at belt, 8 ft. 1 in. It is vestibuled at both ends. The double sash windows and flexible metal-sheet panels are arranged to be raised into roof pockets, and the sashes in the vestibules have pockets in the wainscoting. Instead of grab-handles on the side posts, brackets which enclose the space between the back of the seats and the posts are conveniently arranged for that purpose. Entrance guards slide upon the inside of the posts, and when not in use are held under the curtain guards by gravity catches. The interior is finished in mahogany of natural color inlaid with holly and ebony. The car is mounted on Brill "Eureka" maximum traction trucks.

J. G. BRILL CO.

The "Narragansett" car is 36 ft. 8⅜ in. long over the crown pieces. This type of long open car is arranged with double-steps and yet keeps within the width of the standard single-step double-truck car. The upper steps are upon the middle web of Z-bar sills. It is specially adapted for summer excursion service, as ingress and egress are made rapid and safe by pairs of easy steps on either side. The car is mounted on Brill No. 27-G-E-1 trucks.

These three patented types of cars have come into large use in the last few years and are claimed by the builder to be the most highly developed types in their respective fields. They are the inventions of Mr. John A. Brill, vice-president of the J. G. Brill Co., whose broad experience and keen foresight have brought into being

J. G. BRILL CO.

and matured many of the most important types and features of electric cars and trucks.

Among the patented specialties of Brill make with which these cars are equipped are angle-iron bumpers, radial draw-bars, ratchet brake handles, "Dedenda" gongs, conductors' gongs, folding gates, round-corner seat-end panels, track scrapers, and "Dumpit" sand boxes.

All the trucks shown have side frames solid forged in a single piece—a method of construction peculiar to the builder.

BURT MANUFACTURING CO.

Although the Burt Manufacturing Co., of Akron, O., has no regular exhibit at the Fair, the "Cross" oil filters, made by this company, are in evidence in a number of places at the Exposition. The main service power plant is equipped with a large No. 3 "Cross" oil filter, and visitors to the Fair interested in the mechanical features of this apparatus will have an opportunity of seeing this filter in practical operation. Besides the one just mentioned, other "Cross" oil filters have been ordered for exhibitors' purposes by the C. H. Bradley Co., of Pittsburg, the Buckeye Engine Co., of Salem, O., and the De Laval Steam Turbine Co., of Trenton, N. J., and will be found at the booths of the several companies.

THE HALE & KILBURN MANUFACTURING CO.

The Hale & Kilburn exhibit occupies a prominent location at the head of two of the main aisles near the eastern entrance of Transportation Building. The company's space has been laid out with a

THE HALE & KILBURN MANUFACTURING CO.

definite color scheme and the booth is one of the most artistic at the Exposition.

The floor space is well filled with car seats illustrating all the various types made by the Hale & Kilburn company. About 20 distinct types are shown and these are exhibited in rattan, plush and imitation leather in different patterns, so that the exhibit as a whole represents all the latest ideas in seats and coverings.

In addition to seats for steam railroads the following are shown for electric railways:

No. 3 stationary seat in rattan, for cross seat in car always running head-on.

No. 80¾ seat with spring edge cushion. Upholstered in carpet. This is a popular seat and is used on many large systems. The supporting frame is under the seat, so that greater cushion length is secured. The cushion tilts but does not slide.

No. 80¾ seat in rattan.

No. 80¾ seat in quartered oak, slot cushion.

No. 84 seat in rattan. This is a modification of the 80¾, by which the back recedes at bottom edge, giving greater width of cushion in front of the back.

No. 84 seat in plush of standard gold shade.

No. 88 seat with wall casting. The cushion slides forward, giving more seat room, but otherwise like No. 80¾, with spring edge cushion.

No. 99-A seat with pedestal base. Has metal rails. Is simple in construction and operation.

Seats Nos. 99-B, 99-C, 99-D, 99-E and 99-F, which are modifications of the 99 seat.

No. 199 seat, which has new steel pedestal and aisle plate at both ends.

At the back of the booth is a handsome screen illustrating the fine cabinet work turned out by this company. On top of the screen are two seats of the reversible back type, and these are automatically operated at intervals by a small electric motor.

JONES STOKERS.

The Under-Feed Stoker Co. of America, whose headquarters are at Chicago, is not making a set display within the Fair grounds. However, the company is well represented by very practical exhibits in several large power houses in and near St. Louis. The Union Electric Light & Power Co's. Biddle St. station will be equipped entire with Jones stokers. The first plans of the plant called for the installation of twenty-six 600-h. p. internally fired boilers with three Jones stokers per boiler, or a total of 78 stokers. The installation of boilers and stokers is now in progress, although the building is in somewhat of an incomplete condition as regards interior fittings. A short time ago the Under-Feed company received an order for six more stokers to go into this plant and to equip 1,000 h. p. additional (two units), which will make, when installed complete, 84 stokers in this plant, probably the largest internally fired plant in the world. In the Imperial station of this same company, at 10th and St. Charles Sts., there are 19 Jones stokers in operation under Heine boilers. This constituted a second order from the company, making a total of 20,040 h. p.

The St. Louis & Suburban Railway Co. has given five distinct orders for Jones stokers, covering equipment aggregating 8,500 h. p., all Heine boilers, type W. T. The greater portion of these stokers are installed and in operation and a rush installation is in progress for the balance. The latest order called for six stokers, which, taken with those that have gone in the past, will make, when installation is finished, an unbroken line of 45 stokers in this company's one boiler room.

THE AMERICAN DIESEL ENGINE AT THE EXPOSITION.

American engineers who visit the Exposition will have an opportunity of studying the much-talked-about Diesel engine in operation under severe service conditions. The American Diesel Engine Co., whose headquarters are at No. 11 Broadway, New York City, has taken the contract for supplying practically all of the power required at the establishment of the German Tyrolean Alps, located at the head of the Pike on the Fair Grounds. This attraction includes the finest restaurant on the grounds, a large open-air garden, electric fountain, and various side attractions. The power plant is located in one corner of the Alps enclosure.

The generating units include three 225-h. p. Diesel engines each of which drives a 160-kw. Bullock generator.

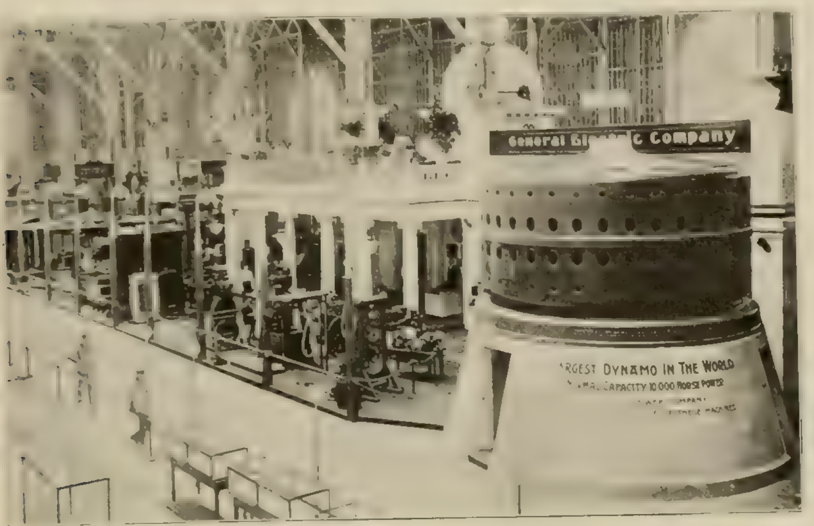
These engines burn crude oil and the builders guarantee one brake horse power with 6 lb. of crude oil, or 1 kilowatt hour at the switchboard with .85 lb. of crude oil.

Briefly, the operation of the Diesel engine is as follows: The engine is started by compressed air, which is stored in the starting reservoir under a pressure of about 55 atmospheres or 800 lb. per square inch by an air pump during the previous run of the engine. After speed has been reached the operation is as follows: First stroke takes in air alone at atmospheric pressure and temperature. Second stroke compresses this air to a high pressure with a rise in temperature of about 1,000 degrees Fahrenheit. Third stroke is the working stroke, during the first part of which the combustion of the fuel is carried on at constant pressure for a period which is determined by the amount of oil sprayed in, which is controlled by the governor. The second part of this stroke is approximately an adiabatic expansion. Fourth stroke exhausts the gases.

A cordial welcome is extended to all engineers to visit this power plant, where all questions as to the cost, economy and engineering details of the Diesel engine will be answered by Mr. J. Edward Megson, the engineer in charge.

THE GENERAL ELECTRIC EXHIBIT.

The great diversity of electrical application at the World's Fair is exemplified by the exhibit of the General Electric Co., not only in its large booth in the Electricity Building, but in the large number of applications of its apparatus to various purposes throughout the Exposition grounds. One of the most interesting features of this exhibit is the Curtis steam turbine, which is of 3,000 h. p.



GENERAL ELECTRIC CO.

capacity, direct connected to a three-phase, 6,600-volt, 25-cycle generator. This is the first of these units to be built with the condenser in the base of the machine. Two of the four generators in the Exposition company's power plant were furnished by the General Electric Co. These give 6,600 volts, 25 cycles, at 83½ r. p. m., and are of 2,000 kw. capacity. This company also furnished the entire car equipment for the Intramural Railway, consisting of 57 four-motor equipments. Of these equipments 51 use G. E. No. 70 motors with the Sprague-General Electric multiple unit control, and six of the cars are equipped with G. E. No. 67 motors with K-6 controllers.

The incandescent lamps used by the Exposition were all furnished by the General Electric Co. and represent the largest incandescent lamp order ever placed. The number of lamps furnished exceeds 500,000, and of these over 80,000 are colored lamps for use about the Cascades. For lighting the outlying parts of the grounds, the exterior of the buildings and the Pike, the G. E. series alternating street system is used. This installation includes 1,800 lamps of 7½ ampere capacity. The searchlights used by the Exposition company were also supplied by the General Electric Co. One searchlight, built for the Lewis Publishing Co., is the most powerful one ever built. It throws a beam 80 in. in diameter.

General Electric transformers of the oil cooled and water and air cooled types are used in all of the sub-stations of the different exhibit buildings, including Festival Hall, Fine Arts Building, and the Cascades. The power house for lighting the Administration Building is also equipped with this company's apparatus. The electric fountain in the Tyrolean Alps is operated by this company's induction motors, and the Scenic Railway in the Alps is equipped with G. E. No. 54 motors. Altogether, the General Electric Co. has furnished over 11,000 h. p. in generating apparatus at the Exposition, and more than 41,000 h. p. of all other apparatus.

In the Electricity Building the company occupies the largest space used by any individual company, and it presents a most attractive appearance, for the reason that practically everything shown here is in operation. The railway exhibit is a reproduction of the equipment furnished for the cars of the Interborough Rapid Transit Co. The [illegible] of the floor framing of a car suspended 9 ft. above the exhibit floor, with all of the electrical and air brake equipments mounted [illegible] under side. The wiring is of fireproof construction, the same as used by the Interborough company. At one end of the [illegible] a typical cab in which are found the master controller and other parts of the equipment, and under the opposite end of the platform is shown a Hedley truck with two G. E. No. [illegible] motors of 200 h. p., the truck being so supported that it may be operated. Various types of controllers are shown and the G. E. No. 70 motor used on the Intramural road is also exhibited. One of the company's air compressors is used to supply air for cleaning about the exhibit.

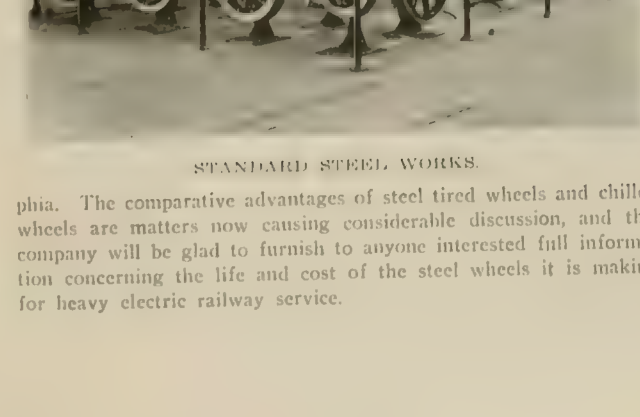
The conspicuous feature of this exhibit is a model of a 10,000-h. p. Niagara Falls generator, similar to those furnished for the new Canadian Falls power house. This exhibit comprises a stationary armature, the interior of which is utilized as a picture gallery, in which are shown photographs of Niagara Falls and drawings of various electrical works in that neighborhood. Other features of the exhibit are a 60,000-volt oil break switch in operation; a 14,000-lb. mining locomotive with the new cable reel attachment; small motors applied to over 20 different kinds of machines; switches and switchboard devices; wires, cables and wiring devices; the largest transformer at the Exposition, having a capacity of over 2,300 kw.; air blast transformers; type H, oil-cooled transformers and voltage regulators of different types.

The company is exhibiting for the first time its new mercury vapor arc lamp, used for photographing and other purposes, for which this quality of light is desirable. It also shows the new "orthocrome" lamp, which is the mercury arc lamp adapted for general illumination and having none of the defects due to the color of the naked mercury vapor lamp. The luminous arc lamp, developed by Prof. Steinmetz, is exhibited; also a complete line of the company's meridian lamps. A novel feature is the mercury arc rectifier, which is shown in operation on a single phase alternating current charging the batteries of an automobile which may be operated.

The company has established attractive reception quarters in the Electricity Building, consisting of a handsome white booth decorated with green and gold, containing artistically furnished reception rooms. This booth is surmounted by a dome, on top of which is a cluster of mercury vapor arc lamps, which add materially to the decorative scheme of the exhibit. One of the reception rooms is devoted especially to the British Thomson-Houston Co., this room being furnished in Old English style.

STANDARD STEEL WHEELS.

Managers of interurban and suburban electric railways will be particularly interested in the steel tired wheels and solid rolled steel wheels exhibited by the Standard Steel Works, of Philadelphia. The comparative advantages of steel tired wheels and chilled wheels are matters now causing considerable discussion, and this company will be glad to furnish to anyone interested full information concerning the life and cost of the steel wheels it is making for heavy electric railway service.



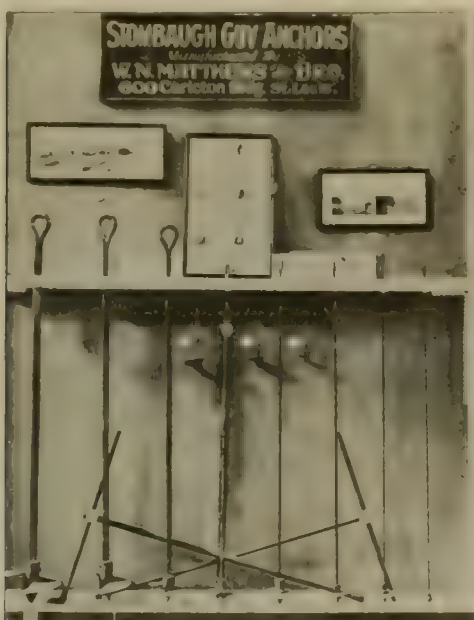
STANDARD STEEL WORKS.

STOMBAUGH GUY ANCHORS.

A small, but very interesting, display in Section 8 of the Electricity Building is that of W. N. Matthews & Brother, Fullerton Bldg., St. Louis, who exhibit different styles and sizes of the Stombaugh guy anchor. This device, although not appreciated by the pole-using public when first placed on the market, has now become standard with many of the largest railway companies in the country. When this device was first presented to Messrs. Matthews they were equally as doubtful of its merit before taking hold of it as nearly every one else, and, to satisfy themselves, had Prof. R. C. Carpenter, of Cornell University, make some 70 odd tests of the different size anchors to determine their holding power. These tests are very interesting and are covered in a report of considerable length, from which the following is an extract:

"During the past few months the writer had an opportunity of investigating the holding power of a simple anchor, the results of which are believed to be of considerable general interest, as this anchor can be placed in the ground without any digging and will hold an enormous strain.

"The anchors to which I refer are termed after the inventor, the Stombaugh Guy Anchor. They are made of various sizes, and



W. N. MATTHEWS & BRO.

consist in each case of one full helix or screw thread of cast iron, which is attached either to a long iron bar or to a guy wire as desired. In general the anchors are quickly and readily inserted in the ground. Before making the tests the writer considerably underrated the holding power of these anchors, and was much astonished to find the magnitude of the resistance which they offered.

"During the tests, a slight movement of the anchor was always obtained before the maximum resistance was reached. After a movement which varied from ½ in. to 2 in. the resistance fell off very rapidly. The holding power in clay was essentially greater than that in sand when the averages of all cases are considered, the resistance being from 15 to 20 per cent greater, but the range of testing could not, on account of conditions, be extended so far.

"By comparison of the various results it was found that the resistance of the anchors in sandy ground can be expressed very closely by the formula $R = 100\,D\,H^2$, in which R is the resistance offered by the anchor, in pounds; D is the diameter of the helix of the anchor, in inches; H is the depth of the helix, in feet, from the surface. The resistance for clay ground would probably be 20 per cent more.

"As an example: A 10-in. anchor should have a holding power, in sandy ground, when 3 ft. deep of $100 \times 10 \times 9 = 9{,}000$ lb. This was less than was found with an anchor of this size. In a similar way, the 12-in. anchor, 4 ft. in the ground, should have a holding power equal to $100 \times 12 \times 16 = 19{,}200$ lb. In an actual test the anchor in this condition resisted 18,400 lb. This was about the only case found when the holding power of the anchor was less than would be given by the formula. For these reasons the formula is believed to be a safe one, especially when it is considered that the resisting power of the anchors will be increased after they have remained sufficiently long for the ground to consolidate.

"Taking all in all, the test gave some valuable data as to the holding of ground anchors, and indicated that great resistance can be secured by the use of simple helix form of anchors."

This formula, compiled by Professor Carpenter from tests made four years ago, has been proved correct by actual practice in the last four years' service.

A feature of the anchor which should specially interest railway companies in large cities is the fact that they can be bored into the ground under sidewalks, fences, barns and in lawns and places where property owners will not allow digging and where it would necessitate expensive work in digging up and replacing streets and sidewalks. An instance of this kind is illustrated by a photograph in the display of Messrs. W. N. Matthews & Brother, showing one of the 8-in. anchors bored under a sidewalk on the Union Ave. line of the St. Louis Transit Co. In this case a saving of about $25 in the cost of the anchorage was secured as there was no expense for digging up the granitoid pavement and replacing it.

In the accompanying illustration the 8, 10 and 12-in. anchors are shown on the left side, while the 3½, 5 and 6-in. rod anchors are on the right. The wrenches for their installation are in the background and the rodless anchors are shown on the shelf.

EXHIBIT OF ST. LOUIS CAR CO.

One of the most interesting exhibits at the great St. Louis Fair is that of the St. Louis Car Co.

This exhibit shows the evolution of travel from the early days down to the present time. Beginning with an old 'bus, which saw service in the early 60's, every style of conveyance is shown winding up with the handsome private coach the St. Louis Car Co. has constructed for Mr. John I. Beggs, of Milwaukee.

Following the 'bus come an old and new horse car; then the first cable car, put in service on the Clay Street Line, San Francisco. This is followed by the first electric car built by the company for Topeka, in 1887. Next in line is the company's car for export, of which over five hundred have been built for Argentine. Two double-deckers are also shown, one representing the London type and the other the style used in Dublin, Ireland. Among the modern cars are the St. Louis Transit Co., Northwestern Elevated, New York Underground, Oakland Transit, Pacific Electric and the Beggs parlor cars.

There is also a display of the company's trucks, including the following: No. 23-B heavy interurban, Hedley motor, interurban and elevated No. 50, elevated, and No. 47, short wheel base city truck.

In addition to these bronze trimmings of every description, as turned out in the brass foundry, are shown to good advantage.

Seats, arc headlights and arc lamps for interior lighting are also to be found among the exhibit.

This exhibit is a credit to the St. Louis Car Co., and will prove both interesting and instructive to people in general and to street railway men in particular.

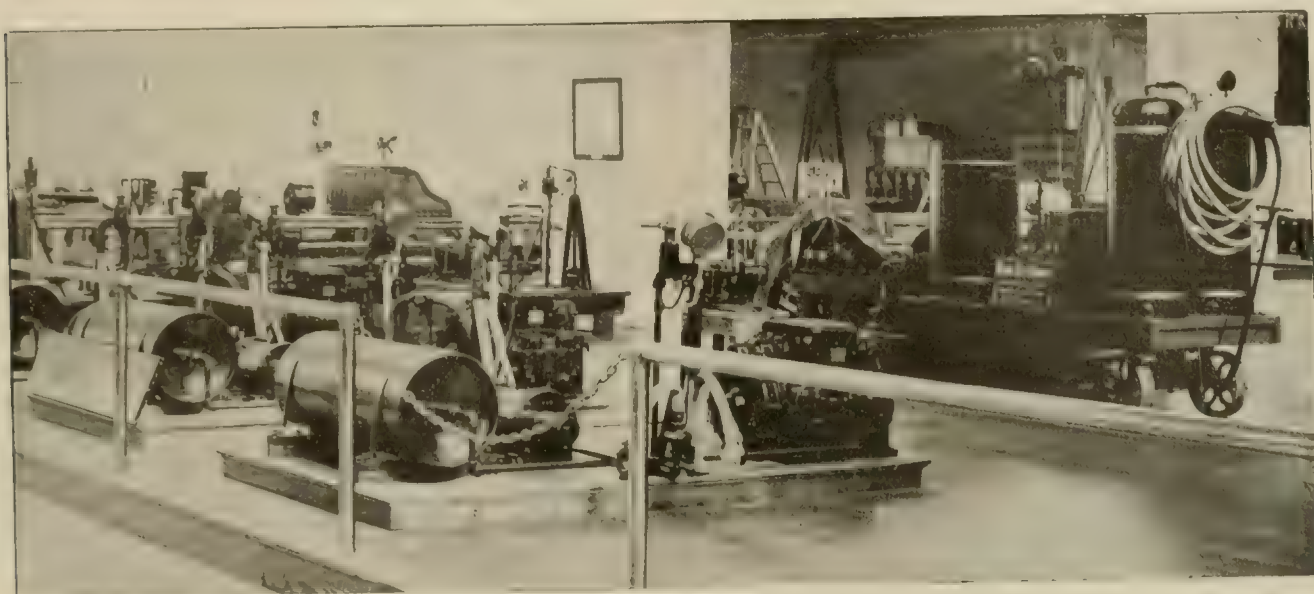
HEYWOOD BROTHERS & WAKEFIELD CO.

The Heywood Brothers & Wakefield Co., of Wakefield, Mass., has an exhibit in connection with that of the Consolidated Car Heating Co., and shows two very fine Wheeler seats, upholstered in leather, with bronzed back bands and mahogany arm rests. These seats are of the Wheeler slideover type, with pedestal bases and automatic adjustable foot rests, and represent the finest thing which it is possible to produce in the reversible car seat line. They are of the size and construction adapted to use in interurban cars or narrow gage railway coaches. The seats were lent to the Consolidated Car Heating Co. to be shown in connection with its heaters, an arrangement that is mutually advantageous, as these two important parts of the equipment can be seen together.

NATIONAL ELECTRIC CO.

The National Electric Co., successor to the Christensen Engineering Co., has a very complete and interesting exhibit located in the Electricity Building. The exhibit covers 2,500 sq. ft. and occupies almost the entire space in block No. 6.

The exhibit includes a Christensen motor-driven air brake equipment in operation; also an equipment in process of construction. There is also an instruction equipment, which is a duplicate of the school equipments used by the large street railways for the instruction of their motormen.



AIR BRAKE EXHIBIT OF NATIONAL ELECTRIC CO.

All cars of the Intramural Railway operating through the Exposition grounds are equipped with the Christensen air brakes, and visitors can observe the operation of the brake in actual service when riding on these cars. In addition to the air-brake exhibit, a number of direct and alternating current generators are shown at the space. The generating plant at Machinery Hall includes a 1,500-kw. National alternator, which supplies a portion of the electric current for lighting and power purposes. This alternator is direct connected to a 2,500-h. p. Hamilton-Corliss vertical cross-compound engine. The rate of output is 1,500 kw., 25 cycles, 6,600 volts, running at 83 r. p. m., and the power generated will be used for various Exposition purposes.

Like all of this company's standard alternators, this machine is of the revolving field type, with the armature stationary and easily accessible. The difficulty of properly insulating the armature coils is eliminated, as the windings are not subject to any mechanical strains. The revolving fields of large diameter give additional flywheel effect to the engine.

The field is made up of cast steel in halves, which are bolted and secured together by shrunk links. The rim of the wheel is in channel cross section, to which the cast steel pole pieces are bolted. Laminated pole shoes are secured to the ends of the pole pieces and serve to hold the field coils in position.

The frame is a circular cast iron housing, into which laminated punchings with inwardly projecting teeth are assembled, for the reception of the armature windings. The frame is divided horizontally, the halves being firmly bolted and keyed together. Large open spaces are provided in the sides of the frames, allowing a free passage of air from the ventilating ducts in the core.

The armature core is built of laminated soft steel, annealed and japanned before being assembled, and ventilating space blocks are inserted at suitable intervals. Cast iron collector rings and carbon brushes are used, allowing the machine to be operated with a minimum amount of attention and at the same time providing for a heavy temporary overload. The net weight of this alternator is 155,000 lb. The efficiency between one-half load and one-quarter overload ranges from 94.75 per cent to 95.5 per cent.

The rise in temperature in armature and magnets will not exceed 30° on a continuous run at full load, and 40° on a continuous run of 45 per cent overload.

FOR AUTOMATICALLY STOPPING ENGINES.

The Consolidated Engine Stop Co., of New York City, is making a demonstration at block 36, Machinery Hall, of its device for stopping steam engines in cases of emergency. This device has been described in previous issues of the "Street Railway Review." It consists of a small motor connected with the steam valve of the engine by means of a belt or chain so that the valve can be instantly closed by starting the small motor, which can be done by pressing a push button located at any convenient point. The device also includes an automatic mechanism for closing the steam valve of the engine after a predetermined speed has been reached.

BALDWIN LOCOMOTIVE WORKS.

The electrical exhibit of the Baldwin Locomotive Works is made in connection with the Westinghouse exhibit in the Electricity Building, where a space of 1,600 sq. ft. is devoted to the display of electric trucks built by the Baldwin Locomotive Works and equipped with Westinghouse electrical machinery. This exhibit

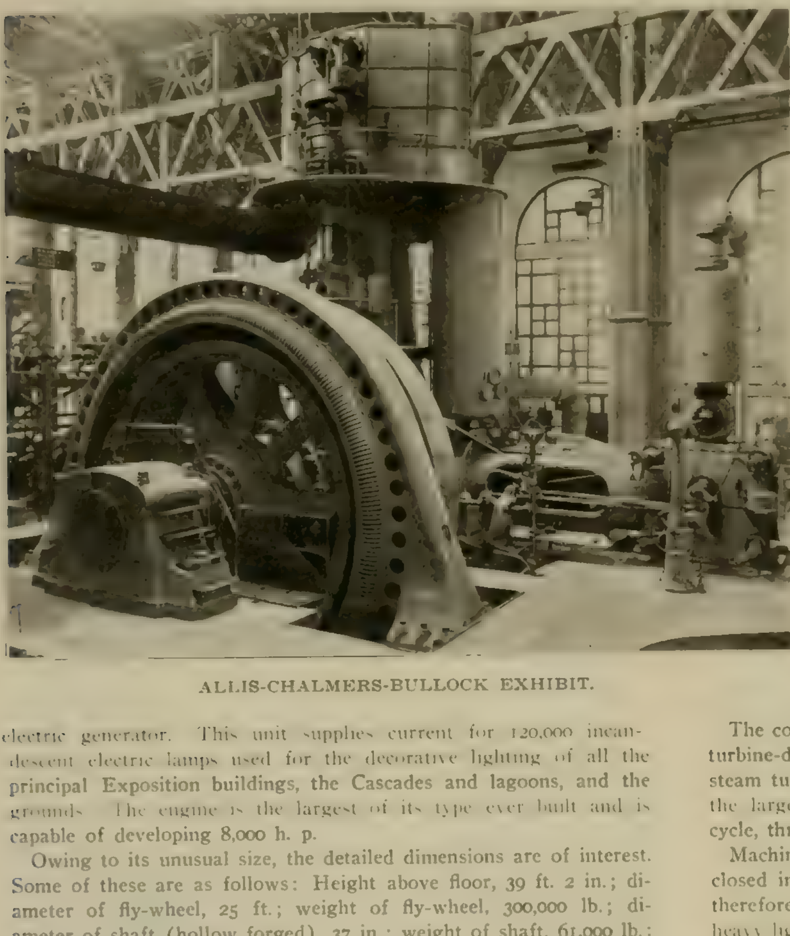
BALDWIN LOCOMOTIVE WORKS.

includes two locomotives built for mine service, one of which weighs [illegible] lb. and the other 30,000 lb., each of which is equipped with Westinghouse No. 70, 500-volt motors. There is also a 20,000-lb. locomotive for switching, which is equipped with two No. [illegible] motors at 220 volts.

ALLIS-CHALMERS-BULLOCK.

The Allis-Chalmers Co. is making three distinct groups of exhibits at the exposition. One of these is located in the Palace of Mines and Metallurgy, and comprises a line of mining machinery including ore crushers, separators, driers, etc. Another is made through the Bullock Electric Manufacturing Co. in the Palace of Electricity. This exhibit comprises a general line of electrical machinery including electric railway apparatus, motors, controllers, transformers, rotary converters, etc., and is fully described elsewhere in this issue.

The third and by far the largest exhibit is in the center of Machinery Hall. The main feature of this is a 5,000-h. p. generating unit consisting of an Allis-Chalmers combined vertical and horizontal C. D. D. condensing engine direct connected to a Bullock



ALLIS-CHALMERS-BULLOCK EXHIBIT.

electric generator. This unit supplies current for 120,000 incandescent electric lamps used for the decorative lighting of all the principal Exposition buildings, the Cascades and lagoons, and the grounds. The engine is the largest of its type ever built and is capable of developing 8,000 h. p.

Owing to its unusual size, the detailed dimensions are of interest. Some of these are as follows: Height above floor, 39 ft. 2 in.; diameter of fly-wheel, 25 ft.; weight of fly-wheel, 300,000 lb.; diameter of shaft (hollow forged), 37 in.; weight of shaft, 61,000 lb.; weight of crank, 32,000 lb. The revolving parts together weigh 514,400 lb.

The high pressure cylinder is 44 in. in diameter, the low pressure cylinder is 94 in. in diameter, and the stroke is 60 in. The exhaust pipe is 36 in. in diameter. The steam pressure is 150 lb.

The low pressure cylinder is vertical with side pipe construction. The valves are in the heads, and are double ported, the heads being single ported. The high pressure cylinder is horizontal, the valves being in the cylinder, and valves and cylinder are double ported.

The slide has a foot under it which rests on a heavy foundation plate. The slide is bolted at the front or crank end to the bed plate and low pressure frame and the foot is bolted to the foundation plate.

The foundation plate is 23 ft. 3¼ in. long, 3 ft. 3½ in. wide and 12 in. deep, extending from under the bed plate (to which it is fastened) to the end of foundation, supporting high pressure slide and cylinder and the brackets for high pressure carrier arms and regulator.

The main bearings are 34 x 60 in., B & S type.

The outer bearings are 32 x 48 in., B & S type.

The valve gears of both cylinders are designed for long range cut-off under control of the regulator. The steam valves of the high pressure and low pressure cylinders are driven from one eccentric and the exhaust valves of both cylinders are driven from one eccentric.

The regulator is the Allis-Chalmers extra heavy weighted type, controlling both high and low pressure cylinders, equipped with an electric synchronizer, hand synchronizer, hand lever for adjusting cut-off in low pressure cylinder and belt rider safety stop.

The Bullock generator is rated at 3,500 kw., and generates 6,600 volt, 25-cycle, three-phase current; the speed is 75 r. p. m. The unit carries the full lighting load of 3,500 kw. The method of handling this load, turning on the lights etc., will be found described elsewhere in this issue under the heading of "Power at the Fair."

The Allis-Chalmers Co. has reserved a wide space on both sides of the big unit and here will be found rocking chairs, tables, writing material, free messenger service, a matron who will look after the convenience of lady visitors, and a clerk who will care for all mail and telegrams sent in the company's care. In other words the company will exhibit a large hospitality as well as a large engine. All interested visitors are cordially invited to make this space their headquarters for mail, telegrams, appointments and general convenience.

Arrangements have been made for adding to the exhibit a working exhibit of the Escher-Wyss turbo-centrifugal high pressure pump, the rights for the manufacture and control of which have been acquired recently by the Allis-Chalmers Co. This pump is practically in principle a steam turbine reversed in action, taking water in at what would be the exhaust end of the steam turbine and gradually accelerating its movements as the water passes through the various sets of fixed and movable vanes until it acquires exceedingly high velocity, the water passing out at what would be the inlet end of the steam turbine but which is the outlet end of the pump.

At all the exhibits of the company a conspicuous feature will be the new Allis-Chalmers trademark, a design that cleverly emphasizes the fact that the Allis-Chalmers is a power in dealing with all forms of application of the four great powers, steam, gas, water and electricity. The familiar Bullock shield is also used to good effect in the exhibits.

The company is also planning to have in operation a new 1,000-kw. turbine-driven generator operating in connection with a Rateau type steam turbine. This unit has been built to operate in parallel with the large 3,500-kw. Allis-Chalmers-Bullock unit at 6,600 volts, 25 cycle, three phase.

Machinery Hall, unlike the other buildings at the Exposition, is not closed in the evening. It is open until 11 p. m. and visitors will therefore have an opportunity to see this large unit at work on the heavy lighting load.

THE PANTASOTE CO.

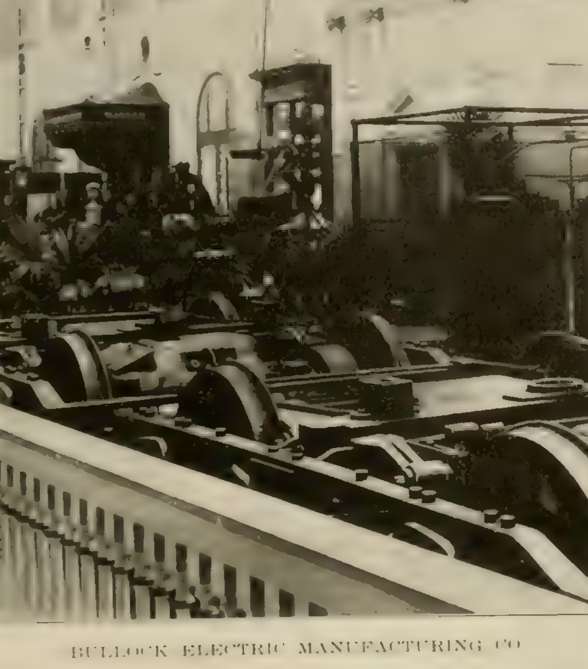
The display of Pantasote is located in the Palace of Varied Industries. The company has classified its goods in three sections: One shows the application of Pantasote to water-proof clothing, sporting goods, etc.; the second is devoted to furniture upholstered in Pantasote and designed to illustrate the beautiful effects produced by the use of this material in house furnishings.

In the third section the application of Pantasote to car curtains and seats is brought to the attention of visitors by showing a section of a Brill semi-convertible car fitted with Pantasote curtains and car seats and chairs covered with Pantasote leather.

The company is distributing literature calling attention to the good qualities of the Pantasote fabric and incidentally giving some good advice to young married people.

BULLOCK ELECTRIC MANUFACTURING CO

The Bullock company has space, 100 x 54 ft., in block No. 15, Electricity Building. In the center is an ornamental pavilion which is neatly decorated and furnished and on the interior walls of which are hanging framed photographs of interesting Bullock apparatus. Among the special exhibits is a complete multiple voltage outfit, consisting of various machine tools driven by Bullock motors controlled by special multiple voltage controllers and a balancer. This outfit shows the practical workings of the Bullock patented multiple voltage system, which provides a most successful means for controlling the speed of motors driving machinery requiring variable speeds.



BULLOCK ELECTRIC MANUFACTURING CO

A complete line of "Type N" motors, which are specially adapted for direct connection to machine tools, are also shown; also a complete line of "Type B" motors, which are small motors used for driving all sorts of machinery.

The company also has a number of alternators, ranging in capacity from about 50 kw. to 350 kw., some of which are shown in course of construction, illustrating the methods adopted by this company.

Of special interest to electric railway men will be found a complete railway sub-station in operation, comprising a 500-kw. rotary, transformer and switchboard. The sub-station is designed to receive 6,600-volt, 25-cycle, three-phase current, and changes this to 550-600 volt direct current for railway purposes.

There will also be found here a 200-kw. motor-generator set for changing 60-cycle, 2,200-volt current to direct current suitable for railway purposes.

The Bullock company is also showing a complete car equipment, consisting of four 50-h. p. Bullock motors, mounted on a truck, with controllers and wiring complete—thus calling special attention to the fact that the company is prepared to supply every requirement for modern electric railway equipments.

Another feature is a turbo-generator set, consisting of a 200-kw. 575-volt generator direct connected to a De Laval steam turbine.

The entire Bullock exhibit in Electricity Building is arranged as a model test floor, necessary instruments, switchboards, and test tables being provided. The Bullock company will also have a completely equipped car on the electric railway testing tracks, near Transportation Building.

Bullock apparatus will also be found in connection with the Allis-Chalmers-Bullock exhibits in the Mines Building, and in Machinery Hall, as described elsewhere in this issue.

U. S. ELECTRIC SIGNAL.

The exhibit of the United States Electric Signal Co., located in the northeast corner of the Palace of Electricity, was complete and in working order on the opening day. The company shows a complete working block of its automatic electric signals as used on single track electric railways.

The company has recently placed on the market an improved form of signal box in which especial attention has been given to insulation and the prevention of short circuits. The box is almost completely lined with fibre.

The fuses are mounted on porcelain separated by partitions of the same material. Porcelain resistance tubes are used in place of enameled iron plates. In this new type of box all of the mechanism is placed on one piece of slate under the dome and can easily be removed in its entirety without disconnecting any wires or taking the signal box from the pole. The semaphore disks have been enlarged and as in the former type are removable from the box.

The new trolley switch shown is of an entirely new type, depending for its operation upon the lifting of the trolley wire by the trolley wheel as a car passes. On this switch there is nothing whatever for the trolley wheel to come in contact with so the objections which many engineers have had to placing a moving "flopper" in the trolley circuit are fully overcome, while at the same time the speed of the cars is not limited in operating the switch.

ST. LOUIS CAR WHEELS.

The St. Louis Car Wheel Co., of St. Louis, has a large exhibit of wheels, showing wheels loose on stands in upright position, and wheels on axles, which embrace all styles of chilled cast iron wheels used for steam railroad service, as well as the St. Louis Car Wheel Co's. improved spoke "Twentieth Century" street car wheel. None of the wheels have been polished or painted in any manner, the intention being to show them in their original state after coming from the foundry. Each wheel being vertical and supported in a manner to afford easy access for careful examination, will give opportunity for those most interested to examine the chill and quality of the metal, as well as the mechanical form of the designs. The street car wheels on axles are shown in two forms of equipment. Those for interurban electric railroading weigh 550 lb. each and were designed especially for such service on the lines of the Milwaukee Electric Railway & Light Co. The lighter weight wheels are such as are furnished for city street car service. A double-plate car wheel is also shown with a section cut out to show the depth and quality of the chill, and to give means of making a minute inspection of the quality

ST. LOUIS CAR WHEEL CO

of the iron. The display is a joint exhibit of the St. Louis Car Wheel Co., St. Louis; the Decatur Car Wheel & Manufacturing Co., Birmingham, Ala., and the Atlanta Car Wheel & Manufacturing Co., Atlanta, Ga. The exhibit is located in Transportation Building, aisle C, post 17.

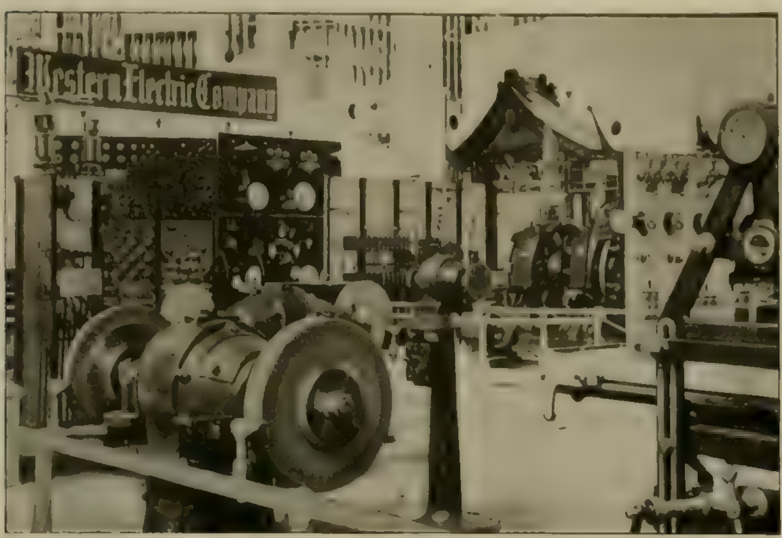
WESTERN ELECTRIC EXHIBIT.

The space of the Western Electric Co. is block No. 17, located near the southwestern corner of the Electricity Building. This space contains 5,764 sq. ft., having a frontage on the main aisle of 88 ft. and a depth of 65 ft. Immediately adjoining on the south is the space of the American Telephone & Telegraph Co.

In the center of the Western Electric Co's. space a motor generator equipment has been installed, consisting of two L-5, 100-kw. frames, the motor side taking current at 500 volts and the generator side delivering current at 220 volts. This unit operates in conjunction with a 15-kw. compensator, permitting the use of 110-volt current.

The center space also contains two switchboards, one for controlling the operation of the apparatus receiving current from the motor generator. This board contains all the necessary switches, circuit breakers, ammeters, etc. The other board is for display purposes only and on it is located a line of knife switches, circuit breakers, voltmeter switches and kindred apparatus.

In the extreme northeast corner of the space a small machine shop has been installed where are exhibited in actual operation some of the modern machine tools driven by Western Electric motors on the three-wire multi-voltage system. There is also shown in this space a line of new emery grinding machines brought out by the Western Electric Co. West of the machine shop are exhibited a few of the company's type "L" direct-connected and belt-driven generators; also a number of Cornish "Cycle" engines direct connected to Western Electric generators, these sets being for marine use especially. In the northwest corner of the space is shown a line of power motors arranged in the form of a pyramid, the smallest ones at the top.



WESTERN ELECTRIC CO.

In the southwest corner of the space is shown a series alternating arc light equipment, consisting of a full line of transformers, regulators and switchboards. Opposite this, in the extreme southeast corner, are exhibited ornamental arc lamps from which are suspended the various types of arc lamps made by the company. In this corner are also a number of sewing machine motors in actual operation. Fan motors and ceiling fans have been distributed throughout the space, suspended from overhead.

A number of display boards containing supplies made by various leading supply houses, for which the Western Electric Co. is agent, are also shown. These include the following:

A large board of fuses, and one of boxes, as made by the D. & W. Fuse Co., of Providence, R. I.

Brass sockets, cluster balls and other electric fixtures from The Dale Co., of New York.

Metal shades, street hood reflectors, mirror reflectors, etc., from the Tea Tray Co., of Newark, N. J.

Special porcelain insulators, brackets and cleats, from the Fletcher Manufacturing Co., of Dayton, O.

High tension insulators, from the R. E. Thomas & Sons Co., of East Liverpool, O.

Insulating material, from the Electrose Co., of Brooklyn, N. Y.

Among other specialties will be noticed fenders from the Hipwood-Barrett Car & Wheel Fender Co., automatic time switches from Ballou-Hutchins Electric Co.; "Sunbeam" incandescent lamps; and small batteries from Gladstone Battery Co.

CENTRAL UNION BRASS CO.

If it is made of brass or iron the Central Union Brass Co. has it or can make it. This company, whose foundries and shops occupy nearly a city block at 11th and Mullanphy Sts., St. Louis, has one of the largest and best equipped brass and iron foundries in the middle West, and is making a specialty of electric and steam railway supplies. Its line includes about everything in the way of brass or iron castings, but its particular forte is car trimmings. For over 23 years it has been supplying car trimmings to the leading car building companies and electric railway companies who build their own cars, and in this time, as can be imagined, the company has accumulated a rare stock of patterns and is therefore prepared to turn out trimmings of any conceivable style.

In recent years the company has broadened its scope and now handles a full line of supplies which include motor bearings, journal bearings, mica and mica bond, commutator bars, line material and insulating material. Its stock of overhead material for city and interurban electric railways is particularly complete and includes several specialties of new design. The Central Union Brass Co. supplied a large part of the line material for the Intramural Ry. at the St. Louis Exposition. It has also filled several large orders for brass and iron castings of special designs for the St. Louis Exposition Co., including the complicated brass parts for the new coin-in-the-slot turnstiles used at the various Exposition entrances, by which a 50-cent piece is deposited directly in the turnstile, thus doing away with the sale of admission tickets. When the coin is dropped into this machine, the turnstile is automatically released to admit the visitor, and at the same time an electrical attachment records the coin and also gives visible indication of the record in the office of the department of admissions.

The Central Union Brass Co. was established in 1881 by Mr. George Kingsland. The officers now are: President, George Kingsland; vice-president, Abe Cook; secretary, F. L. Bouquet. Mr. Cook was formerly secretary of the Laclede Car Co. and is therefore thoroughly familiar with the requirements of car builders in the car trimmings line.

The company is now bringing out a 1,000-page catalog which is said to be the most complete catalog ever published on car trimmings and railway supplies. The company will be glad to send this catalog to any electric or steam railway man upon application to the Central Union Brass Co., 11th and Mullanphy Sts., St. Louis, Mo.

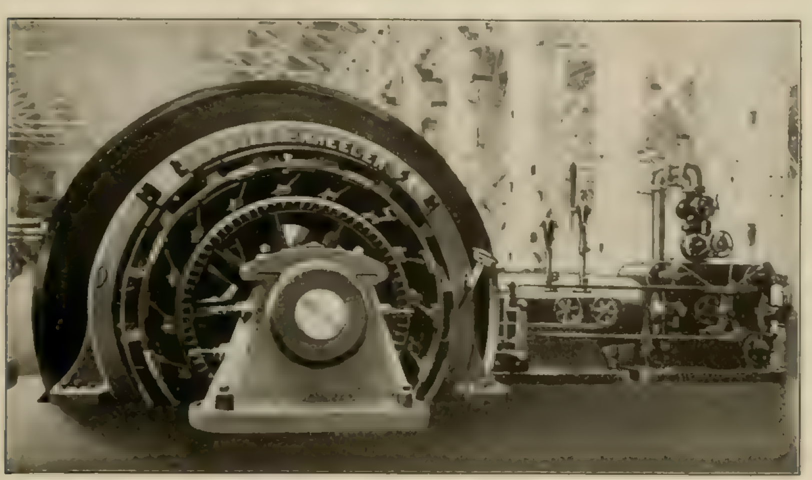
Among the many specialties of the Central Union Brass Co. may be mentioned the ratchet brake handle, which is particularly recommended on account of its few parts and general simplicity. This brake handle is made of bronze metal, highly polished, and has but six different parts. All parts are accurately fitted to standard gages and consequently are thoroughly interchangeable. It can be adjusted to, or removed from, the brake shaft with facility. The handle is furnished complete with steel stub end ready for welding to the brake shaft.

CAMP CONDUITS.

The H. B. Camp Co., of New York and Chicago, maker of vitrified clay conduits for electric wires, is located in the court of Electricity Building where is shown a section of a complete installation of underground conduit system, built under the H. B. Camp patents. The exhibit will be found interesting to all engineers who have to do with underground wiring of any kind.

CROCKER-WHEELER APPARATUS IN THE INTRAMURAL POWER PLANT.

All of the power for operating the Intramural Ry. is supplied from seven units located in Machinery Hall and having a combined generating capacity of 3,500 kw. The electrical generating equipment was all furnished by the Crocker-Wheeler Co., of Ampere, N. J., each unit being a standard Crocker-Wheeler railway type generator direct connected to the prime mover.



CROCKER-WHEELER GENERATOR, MURRAY IRON WORKS ENGINE.

There is one unit of 900 kw. capacity, running at 100 r. p. m. and driven by a Buckeye cross-compound steam engine. A 600-kw. generator running at 85 r. p. m. is driven by a Lane & Bodley horizontal cross-compound 20 and 40 x 54-in. engine. Three units are of 500 kw. capacity each, one with a speed of 100 r. p. m. is driven by a 26 x 48-in. single cylinder rolling-mill type of corliss engine, manufactured by the Murray Iron Works, the other two being driven by Brown-Corliss vertical cross-compound engines at a speed of 135 r. p. m. The sixth unit is of 400 kw. capacity, runs at 150 r. p. m. and is driven by a Harrisburg horizontal tandem compound 15 and 40½ x 26-in. engine. The last generating unit in the series is driven by a Doble water wheel made by the Abner Doble Co. of San Francisco, the water pressure being furnished by a Jeansville Iron Works pump. The unit is of 100 kw. capacity and runs at 700 r. p. m.

It will be noticed that the six steam driven units include a variety of types of engines; two are of horizontal cross-compound form, two vertical cross-compounds, one horizontal tandem compound, and another of large single cylinder. The design of the Crocker-Wheeler generators adapts them equally well to these widely varying types of engines.

With the exception of the differences in size and in details of proportion, the several generators are the same. The cast-iron magnet frame is of the internally flanged type, which gives a maximum magnetic reluctance and a maximum strength. The field coils are made up in three or four sections which are "mummified," that is, individually wrapped, taped and insulated, and separated from one another by small wooden blocks to improve the heat radiating qualities. To allow the removal or replacing of the coils the pole shoes are detachable. The armature is of the iron clad type, consisting of a toothed core of laminated mild steel in the slots of which windings are protected by wooden wedges fitting in notches near the tips of the teeth. Very careful attention is given to the insulation, the formed conductors being bound and varnished and the slots lined with heavy insulation.

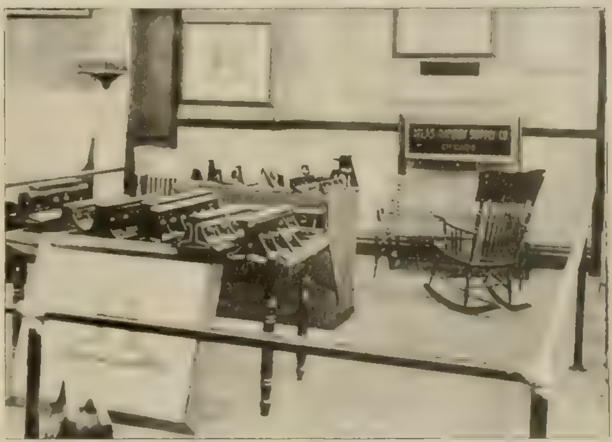
The commutators are constructed of high grade drawn copper with ample surfaces to carry current without undue heating and to give a large radiating capacity. Each brush rigging consists of a rocker-ring held by brackets bolted to the field frame, which in turn supports brush-holder arms with independent brushes on each. The brush-holders are of the parallel movement type characteristic of the Crocker-Wheeler apparatus. On each one four sets of laminated copper strips carry the current and control the movement of the brush from or towards the commutator, always maintaining the same angle with its surface. This causes the brushes to wear away evenly, and as they become shorter allows them to be extended and clamped in a new position without altering the surface of contact. The brush pressure is regulated by a helical spring which does not carry current and hence is less inclined to heat and vary its tension. When desired, the brushes may be lifted from the commutator and held away from it by a half turn of the adjusting screw. This is a feature that is especially useful when it is expedient to test individual brush resistances, or certain windings for grounds. To compensate for any inequalities among the magnetic circuits or to secure the position of sparkless commutation the brush-holder arms may be shifted independently. When the various circuits are in equilibrium, the entire rocker ring may be revolved, by the hand wheel, sufficiently to give a further adjustment.

The use of both steam and water as prime movers of these generators of virtually uniform type establishes a valuable comparison between the two methods.

Besides the generators which the Crocker Wheeler Co., of Ampere, N. J., has in the Intramural Power Plant at the World's Fair, the model printing office in the Administration Building is equipped with Crocker-Wheeler motors, and a large number of this company's motors are also in operation in the exhibits of machine tools.

ATLAS RAILWAY SUPPLY CO.

The space reserved by the Atlas Railway Supply Co. contains a full line of samples, consisting of "compromise" or "step joints," for steam and street railways; insulated joints; straight joints for T and girder rails; chairs; braces and tie plates. Also Atlas primer and Atlas surfacer for use on cars and engines of both steam and street railways.



ATLAS RAILWAY SUPPLY CO.

The company is located in aisle C, post 28, Transportation Building, and is represented at different times by different members of the company.

E. W. BLISS CO., BROOKLYN, N. Y.

This company's exhibit in Machinery Hall is devoted chiefly to metal working machines. In connection with these, however, it has a line of gears and pinions which will be of interest to electric railway men.

STOW FLEXIBLE SHAFT CO.

The Stow Flexible Shaft Co. has a working exhibit in block 28, aisle F, Electricity Building, showing the application of electric control to flexible shaft driving.

WHEEL GRINDING BRAKE SHOES.

The Wheel Truing Brake Shoe Co., of Detroit, Mich., maker of the well known wheel grinding brake shoe, has an attractive exhibit at space 117, Electricity Building, in connection with the Wesco Supply exhibit. The company shows shoes of various sizes, and designs adapted for different uses. Some are designed for removing flats from chilled iron wheels of electric cars, some are for dressing down flattened wheels of locomotive driver wheels, and others are especially designed for dressing down tread worn or grooved tires of locomotive drivers.

The company reports that business is steadily increasing in the electric field, and a large trade is being secured among the steam trade. The exhibit is in charge of a representative, who will be pleased to greet old friends of the brake shoe, and to explain its merits to those who are not familiar with it.

WESTERN WHEELED SCRAPER CO.

The Western Wheeled Scraper Co., of Aurora, Ill., has two large exhibits, one in Liberal Arts Building and one in Transportation Building. The space in Liberal Arts Building is devoted to working models of road graders, wheel scrapers, wagon loaders, dump wagons, and, in fact, a full line of machinery, vehicles and apparatus for handling earth and dirt under all conditions of road building, excavating work, trenching, electric and steam railroad roadbed work, etc.

WESTERN WHEELED SCRAPER CO.

In Transportation Building is a still larger exhibit of various kinds of dump cars and wagons which this company makes for earth-handling purposes, but especially for track and roadbed work.

The accompanying illustration shows a ten-yard center dump car made by this company. The doors are hung by angle iron hinges and are operated by means of two chains fastened to each door. These chains pass through sheaves at the side of the car and are wound around a roller at the end of the car. The doors are operated by means of a worm gearing in connection with the clutch. By throwing the clutch the doors drop and the load is discharged immediately. When the load is to be distributed while the car is in motion the width of the opening may be regulated by the worm gear and the load discharged at any rate desired. The trucks are of standard freight-car pattern, and wheels of any desired tread and flange can be furnished. These cars are specially adapted for ballasting purposes or for filling in trestles, hauling cinders, coal, gravel, crushed stone, etc.

THE PHOTOSCOPE CO.

Headquarters for the "Photoscope" are in Liberal Arts Building, where machines are shown in operation to demonstrate their workings. As readers of the "Review" know, the "Photoscope" is a nickel-in-the-slot machine that automatically takes photographs as fast as persons can get into position in front of it, and delivers a perfect photo, neatly framed and finished, in less than a minute. The "Photoscope" works continuously, the developing and printing going on within the machine while it keeps on taking new pictures. This is believed to be one of the biggest money-making nickel-in-the-slot machines ever built, and should prove a valuable attraction for electric railway parks.

At the booth of the Photoscope Co., in Liberal Arts Building, one of the machines is anchored in a glass case, with all the mechanism exposed to view, so that the workings may be understood readily.

The company also has 200 machines distributed around the grounds, where they will be operated for profit.

The company's permanent headquarters are at 1369 Broadway, New York City.

ELECTRIC STORAGE BATTERIES.

The Electric Storage Battery Co. has built in the Palace of Electricity a "model battery house and regulating railway battery." The battery is complete in every detail and is shown operating on variable loads in connection with special booster and switchboard. The load is an artificial one, secured by means of a bank of lamps and the starting up of a 100-kw. booster, giving a sudden throw varying from 150 to 300 amperes, the fluctuations all falling on the battery, thus giving conditions similar to actual railway operation.

The switchboard shown in the company's space consists of the following standard switchboard panels:

Panels controlling operation of model battery and booster.

Battery and booster panels for regulating railway power house load.

Battery and booster panels for regulating combined lighting and power load.

Standard railway feeder panels.

Edison 3-wire panel for three buses. This panel controls the operation of three end-cell switches, which are shown in actual operation. These switches are motor driven and electrically indicated.

The 100-kw. railway booster is shown in operation under conditions similar to those encountered in regular railway work.

Of different types of "Chloride Accumulators" there are shown three type H-16 cells for central station service with discharge capacity of 4,800 amperes for one hour. Also six type G-77 "Chloride Accumulators" with capacity of 3,000 amperes for one hour. Of this latter type 584 cells have recently been installed on the system of the St. Louis Transit Co. There are also exhibited single cells of various types as manufactured by the Electric Storage Battery Co., including automobile cells of the "Exide" type. A panel board of cell parts illustrate in detail the plates and construction of various types of exide and chloride cells.

The most conspicuous feature of this company's exhibit is a huge map of the United States, measuring 30 by 45 ft., showing by means of colored jewels the location of various railway Edison and isolated battery plants installed by the Electric Storage Battery Co.

AMERICAN BRAKE SHOE & FOUNDRY CO.

A comprehensive collection of steel castings is displayed by the American Brake Shoe & Foundry Co., of Mahwah, N. J., in aisle E, post 54, the samples having been selected with a view of indicating the wide variety and high standard of castings turned out by this company. Realizing the different conditions under which steel castings are used making varying degrees of hardness necessary if best results are to be secured, this company divides its output into three classes, as follows:

Dynamo Steel, in which the carbon and manganese are brought to the lowest point possible. The uniformity of its composition renders this grade of steel unsurpassed for dynamo and motor field frames, pole-pieces, etc.

Machinery Steel, which is soft and easily machined, though tough and strong, suitable for parts of locomotives, cars, mining machinery, stump machinery, automobiles; also gears, pinions, sprockets, levers, links, cams, flanges, grease-cups, etc.

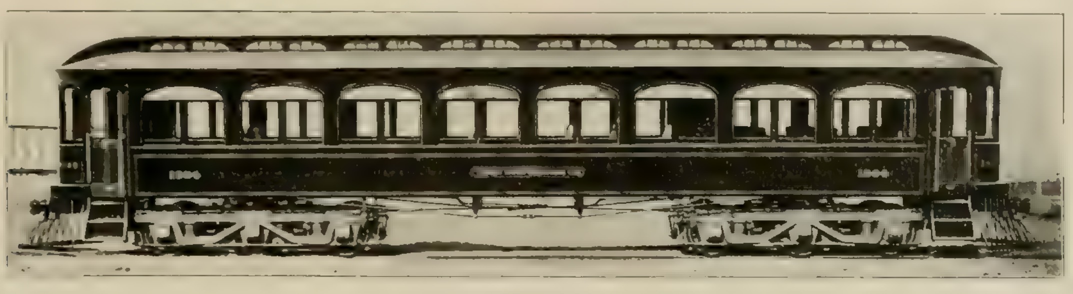
High Carbon Steel, castings being made from this grade of steel being readily tempered in oil or water. Used in such castings as wrenches, hammers, picks, plowpoints, die-blocks, etc.

The American Brake Shoe & Foundry Co. is showing in this same connection a large variety of the brake shoes which it makes for steam and electric railway service.

STEPHENSON EXPOSITION CAR OF 1904.

The John Stephenson Co., Elizabeth, N. J., is exhibiting on one of the main aisles of the Transportation Building a high-speed car of the interurban character. There has been no attempt made at fancy work or elaborate finish in the construction of this car, and only standard woods and plain bronze trimmings have been used. The object of the construction has been to produce a car capable of running at the highest rate of speed with entire safety for express or regular service.

The general dimensions of the body are as follows: The length over corner posts, 46 ft.; the length of the bumpers, 57 ft.; total length, 61 ft. 6 in.; width over sheathing, 8 ft. 9 in.; height from bottom of sill to top of roof, 9 ft. 8 in. The framing is very rigid and is exceptionally well braced and trussed to withstand the severe strains experienced in high-speed service.



JOHN STEPHENSON CO.

The floor framing consists of six sills, the four center sills being 6-in. I beams with wood fillers extending the whole length of the car. The side sills are double and made of yellow pine, with steel plate between them. The cross bars are of malleable iron, each carrying two tie rods, and are so arranged that electric or air brake apparatus may be readily suspended therefrom. On top of these bars are laid ¼-in. transite boards. The floor is laid on top of this and securely fastened to side and center sill fillers. All the wood fillers are covered with transite boards, reducing the possibility of burning to a minimum and producing a frame that will not be disagreeably resonant. The bottom frame is equipped with built-in double bolsters having steel centers, all parts being machine fitted.

JOHN STEPHENSON CO.

Care has been taken to make the bolsters perfectly rigid. The king pin is 3 in. in diameter and the center plate exceptionally heavy. The total weight of the bottom frame is 20,000 lb.

The vestibules or platforms accommodate one or two operators and are not designed to carry passengers. The vestibules taper towards the ends of the car so as to present the least resistance to the air when traveling at high speed; although the vestibules are rather small, there is sufficient room for the motorman to operate his car and at the same time allow free passage for passengers to and from the car. The body is divided into three compartments, smoker, passenger and private. The smoking compartment is finished in cherry and has leather upholstered vis-a-vis seats. The passenger compartment is finished in quartered oak and has the usual rattan upholstered slide-over seats. The private compartment is finished in mahogany and is equipped with six plush-covered revolving chairs. The total seating capacity of the car is 52.

As the car is for high-speed interurban service where extra long runs are to be made, with only infrequent stops, the company has designed a special form of truck for high-speed work. These trucks have six wheels each, or 12 wheels to the car, which the company believes are absolutely necessary for very high speed, for the reason that with a six-wheel truck defects in the road bed will not be noticed, whereas a four-wheel truck will register them. These trucks are built heavier than the ordinary six-wheel railway trucks on account of the weight of the motors they carry. The side frames are made of I beams with solid steel fillers, all of which are milled and machine fitted. The wheels are 36 in. in diameter with steel tires and M. C. B. standard treads and flanges. The flanges are omitted on the center wheels so as to enable the trucks to take 60 ft. curves. The axles are 6½ in. in diameter with journals 5½ x 9 in. All of the castings on these trucks are either malleable iron or steel, the only gray iron being the brake shoes. The truck bolster is of special construction and is exceptionally rigid. The weight of the trucks is 10,000 lb. and the total weight of the car is 39 tons.

HEINE BOILERS.

The main working exhibit of the Heine Safety Boiler Co., of St. Louis, is in the Steam, Gas and Fuels Building, and consists of eight 400-h. p. boilers of the single shell type, set in four batteries of two boilers each. These boilers are provided with Green traveling chain grates and induced draft apparatus. In addition to these boilers the company has two 210-h. p. boilers of the single shell type in the fuel testing plant of the United States Geological Survey, located in the outside Mining Exhibit.

Three Heine 250-h. p. boilers of the double shell type are used to operate the Ferris wheel and are located in the power house which supplies power for that attraction.

Besides these operative exhibits the company has in the northwest corner of Machinery Building a still exhibit, wherein are exhibited typical parts of boilers illustrating constructive features; also numerous samples of tested material illustrating the quality of the materials used. A portion of this space is fitted up as an office and is provided with comfortable furniture and current technical periodicals, of all of which visiting engineers are cordially invited to make use.

BETHLEHEM STEEL.

The Bethlehem Steel Co., of South Bethlehem, Pa., has a "process" exhibit in Palace of Mines and Metallurgy. The equipment, methods and processes in the manufacture of iron and steel in ingots, billets, bars and plates are represented by working models, drawings and photographs. The products in commercial form are also shown in still exhibits, and these include typical outputs of the Bethlehem iron and steel foundries.

Of special interest is a large hollow forged steel shaft made after this company's well-known processes.

THE MINIATURE RAILWAY AT THE FAIR

Of all the many attractions on the Pike, none are more popular or well patronized than the Cagney miniature railways, which have been installed along several sections of the Pike and in other parts of the grounds by the Miniature Railroad Co., of 407 Broadway, New York City.

This outfit of miniature steam locomotives and cars is the largest and most complete display of these little midgets ever shown at any exposition, and although entered as one of the money-making attractions of the fair, they in themselves constitute an exceedingly interesting and noteworthy exhibit of accuracy and perfectness in mechanical design and construction. The little locomotives—although the top of the smokestack rises no higher than a man's knee—are just as complete in every detail as the "Twentieth Century" Baldwin locomotive shown at the head of the finest Pullman train in the world in the nearby Palace of Transportation. As examples of energy-capacity confined within very narrow limits, these miniature locomotives are none the less remarkable. Less than 5 ft. long and 2 ft. from rail to top of smokestack, each locomotive is capable of exerting 12½ h. p. continuously, and will haul 24 adults or 36 children in a train of three cars, at a speed of six to eight miles and hour. The locomotives use steam which is kept at 100 lb. pressure, and burn real coal, which is carried in a miniature tender behind the miniature engine.

MINIATURE RAILWAY CO.

The Miniature Railroad Co. has 24 complete trains on the Fair Grounds, and has built about 8 miles of miniature track. Each train consists of a locomotive and three cars, capable of carrying 24 adults or 36 children. The tracks are built of T-rail weighing 12 lb. to the yard and laid on miniature wooden ties. Three miles of the track is 15-in. gage, and 5 miles is 22-in. gage. The locomotives for the smaller gage are rated at 8½ h. p. each, and those for the 22-in. gage at 12½ h. p.

Visitors to the fair who are interested in parks or pleasure resorts of any kind, and who are looking for practical ideas in the line of profitable attractions, will do well to watch this little railway outfit on any pleasant afternoon. Judging from the demands for tickets over this unique and novel "route" the miniature steam railroad train presents a good example of "much in little"—much energy in little space, and also "much" receipts in little time.

WESTON INSTRUMENTS.

The display of the Weston Electrical Instrument Co. is housed in an artistically decorated booth in the Palace of Electricity, and consists of cases containing samples of the many varieties of electrical measuring instruments made by this company. The standard portable instruments include direct reading voltmeters, millivoltmeters, voltammeters, ammeters, milammeters, ohmmeters, ground detectors, and circuit testers for all kinds and conditions of work. On the walls of the booth are shown a full line of station instruments including Weston station instruments, Van Vleck edgewise system, made by the Weston Electrical Instrument Co.

GALENA OILS.

The Galena-Signal Oil Co., of Franklin, Pa., is keeping open house in its booth near the main eastern entrance to Transportation Building. The booth has been richly fitted up as a reception and reading room and a royal welcome awaits every steam and street railway man, or anyone interested in the subject of lubrication.

The management of the Galena-Signal Oil Co. has made a thorough study of the problem of railway lubrication, from a scientific as well as from a practical standpoint and at the present time is supplying under contract 97½ per cent of the total steam railroad mileage of the United States and Canada.

In view of the fact that the mileage of the street railways, trolley lines and interurban railways of the country is constantly increasing, and that much of the equipment of these roads is very similar in size, weight and service to that of steam railroads, and constantly approaching closer to the standard of the latter, the Galena-Signal Oil Co. has decided to enter into contracts with electric railway companies similar to those for some time in use with steam railroads for furnishing lubricating oils. The Galena-Signal Oil Co. has therefore established and efficiently organized a street railway trolley and interurban railway department, and will give the same careful attention to the lubrication of the equipment of this class of consumers as has been for a long time given to that of the steam railroads. The Galena-Signal Oil Co. has no doubt that it will be able to accomplish for its new patrons the same gratifying results which it has for so many years uniformly brought about under similar physical conditions.

The Galena-Signal Oil Co. is now prepared to enter into contracts with any electric railway companies to supply all the lubricating oils needed for power houses, repair shops, and rolling stock, furnishing under written guarantee the best quality of oils that it is possible to manufacture for this special kind of use. It will also, if desired, send its mechanical experts to confer with the heads of the mechanical departments of electric railways and to supervise the use of its oils in order to bring about the most efficient service at the lowest possible cost. If the management of any street railway or electric transportation line desires to receive a proposition or to take up the question of lubricating its equipment and power plants a communication addressed to the home office of the Galena-Signal Oil Company, of Franklin, Pa., will receive prompt consideration.

MICA INSULATOR CO., NEW YORK CITY.

This company's well-known mica specialty, which is sold under the name of "Micanite," has been made a part of the exhibit of the state of North Carolina in the Palace of Mines and Metallurgy. The display has been arranged with the idea of bringing out prominently the extent to which mica enters into the science of electrical insulation and the display forcibly impresses the observer with the fact that mica has come to be almost as essential to the electrical industry as copper. The samples of "Micanite" placed on view cover all forms of the company's manufacture.

CONSOLIDATED ELECTRIC HEATERS.

The Consolidated Car Heating Co., of Albany, N. Y., has installed a very complete and attractive exhibit in the Transportation Building. The electric heating display is claimed to be by far the largest similar exhibit at the Fair, and includes a large number of the standard and special types of electric car heaters, which this company has developed. Among others may be mentioned samples of the special designs furnished for the entire equipment of the Manhattan Elevated Railway Co. and the Interborough Rapid Transit Co. of New York.

Several styles of cross seat heaters are shown, the heating elements being identical, but the cases being so constructed as to be directly attached to any of the various cross seats now on the market. A panel carrying a large variety of switches for car heating service is displayed and shows the various designs which have been developed and are now manufactured by the Consolidated Car Heating Co.

Another division of the exhibit shows a complete line of steam car heating apparatus, with full-size models of various styles of equipments, having the special devices in sections so that they may be examined readily.

The company also exhibits a complete equipment of the McElroy automatic axle lighting system in operation. The conditions of actual service in regard to change of speed, etc., are reproduced as far as possible, and the operation of the system shows the excellent results which have been achieved by several years of tests of equipments in operation on the road.

The Consolidated company's representatives will be pleased to meet their many friends during the Fair and to have them avail themselves of any comfort which their booth may afford.

BENJAMIN ELECTRIC MANUFACTURING CO.

This company has space in Electricity Building and is showing its regular stock of lamp clusters, sub-bases, etc., for electric car lighting, illustrating different modes of distributing light by flat shades and independent shades. Benjamin clusters are used in the cars of the St. Louis Transit Co., Interborough Rapid Transit Co., of New York City, Brooklyn Rapid Transit Co., the electric roads at Los Angeles, Cal., the Boston Elevated, and other important electric railway systems throughout the country.

The lamp clusters, as made by this company, have no sockets to break down, and no soldered connections, there being nothing to get out of order, and at the same time they cost less than the old-fashioned styles of lamp clusters. The Benjamin Electric Manufacturing Co. has offices in Chicago and New York.

PAWLING & HARNISCHFEGER CRANE.

A four-motor, 30-ton electric crane furnished by Pawling & Harnischfeger spans one of the great bays of Electricity Building. The craneway has a span of 57 ft. 5½ in. A 20-h. p., 220-volt motor gives a horizontal speed of 250 ft. per minute, and an 8-h. p. motor gives a trolley transverse speed of 150 ft.

The main hoist is equipped with a 30-h. p. motor, having a speed of 25 ft., and the auxiliary hoist with a 15 h. p. motor, and has a travel of from 30 to 90 ft. per minute. The company also has cranes in Machinery Hall.

TROY LAUNDRY MACHINERY CO.

This company makes laundry machinery of all kinds, and also makes machines for cleaning oil and grease from cotton waste. The company has laundry machines working in the American Inn on the Fair grounds, and in the Indian Building. Mr. E. R. Barrett, representative for the company, spends considerable of his time in St. Louis, and will be glad to meet anyone interested in laundry machinery, or cotton waste cleaning machinery.

PAIGE IRON WORKS, CHICAGO.

This company is making a fine showing of frogs and switches for steam and electric railways in connection with the Buda Foundry & Manufacturing Co. in Transportation Building.

BUDA FOUNDRY & MANUFACTURING CO., CHICAGO.

The exhibit of the Buda Foundry & Manufacturing Co. is located in the Transportation Building, directly opposite the historical exhibit of the Baltimore & Ohio R. R. The company is showing several of its standard devices together with the various new features added during the last few months, the principal lines being as follows: Improved pressed steel wheel hand car; various sizes and

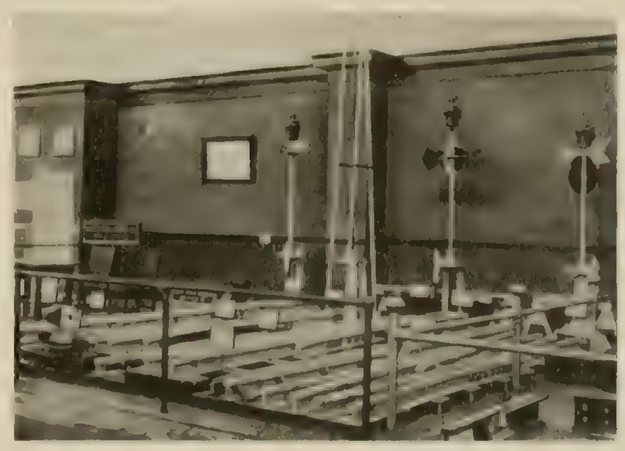
BUDA FOUNDRY & MACHINE WORKS—PAIGE IRON WORKS.

styles of pressed steel wheels; Buda oscillating cattle guard; safety pneumatic crossing gates; rail benders; a large variety of track drills; track jacks; gages, levels and general track tools and material.

ELLIOT FROG & SWITCH CO.

This company has on view in aisle C, post 11, Transportation Building, special switch and frog material of entirely new design, which includes the following pieces:

Three-throw switch with Hasty stand; "Eureka" spring rail frog, anchor block pattern; switch stand, with semaphore target; split switch, wedge adjustable pattern; "Eureka" spring frog, plate pattern; high main line ladder stand; swing rail frog for yards; automatic parallel target ground throw; various attachments for



ELLIOTT FROG & SWITCH CO.

switches; high main line switch stand; "Eureka" spring frog, anchor block pattern; three-throw stand for slip switch crossings and three-throw split switches; stiff frog, bolted pattern, solid welded filling; and stiff frog, steel clamp pattern.

The plant of the Elliot Frog & Switch Co. is in East St. Louis, Ill., just over the river from St. Louis, Mo.

The American Monorail Co., Baltimore, Md., has a car equipped for its monorail system of electric traction on outside space east of Transportation Building near the electric railway test track.

McGUIRE-CUMMINGS MANUFACTURING CO.

The exhibit of the McGuire-Cummings Manufacturing Co. is located in the Transportation Building and is quite extensive, consisting of one each of the following pieces of apparatus:

No. 35 double truck for extra heavy duty and high speed service. This truck is properly called by the company its "Electric Locomotive Truck." The principal features are a solid steel frame supported at each journal box by four coil springs and an M. C. B swinging bolster.

No. 39A high speed interurban truck. This also has a solid steel frame and swinging bolster. Although the wheel base is short, the brakes in this design are inside hung.

"Solid Steel Columbian" truck, which is the well known single truck built by this company and of which over 7,000 are now in use under cars in city service.

The "Royal Flush" fender, which is the type adopted by the Chicago Union Traction Co. to meet the requirements of the Chicago fender ordinance, and has been widely used on other roads also.

The McGuire "Heavy" snow sweeper. This machine is designated "heavy" because of the ease with which it disposes of heavy snow falls. As shown in the accompanying illustration, this is equipped with brooms at each end which cover a space 18 in. greater than the width of the track, and also with steel wings for levelling the snow outside of the sweep of the brooms. The brooms used are set at an angle of 45° with the track and lift the snow to one side. The high rotary speed attained and air currents thus produced permit the brooms to be carried high and yet to thoroughly clean the rail, a point which saves wear on the brooms and enables drifts to be cut through rapidly.

McGUIRE-CUMMINGS MANUFACTURING CO.

Four thousand gallon double truck pneumatic sprinkling car. This car has a steel tank with an air reservoir, motor-compressor, four adjustable sprinkling heads, track nozzles, fire extinguishing appliances and hose for car cleaning. This sprinkler is a most effective piece of apparatus and is particularly advantageous where street railway companies can make arrangements with the municipality or property owners for sprinkling the entire street instead of confining their sprinkler service to the tracks only. A number of roads have provided this equipment and taken contracts for street sprinkling and received from this an income which shows substantial profit.

Champion switch stand, one of the well-known specialties of the company.

The McGuire-Cummings "Clinch" grain door, a steam railroad specialty.

A point in connection with its pneumatic sprinklers to which the company directs special attention is that the sprinkler is available for fire protection at car barns. An outlet for the attachment of a fire hose is provided on the sprinkling car, and when not in service the sprinkler can be kept in the barn with a full load of water under air pressure, where it is always ready for service. The motor compressors are automatically regulated and may be set to any designed reservoir pressure up to 90 lb. per square inch. Another convenient use for apparatus of this kind is in car-cleaning, a small hose being attached to the air reservoir on the sprinkler and a flattened nozzle provided.

KELLOGG TELEPHONES

The Kellogg Switchboard & Supply Co., of Chicago, has installed in Electricity Building a complete operating telephone central station for the Kinloch Telephone Co., the independent telephone system of St. Louis. In connection with this central station the Kellogg company is showing a full line of its telephone instruments and supplies, including the types suitable for telephone systems in connection with electric railway operation.

For the adaptation of the telephone to railway dispatching, etc., the Kellogg harmonic four-party system is especially recommended, as it gives a method of selective calling that lends itself readily to the requirements arising in electric railway dispatching and operating. In this system advantage is taken of the fact that every reed has a natural period or rate of vibration and can be made to take up this vibration by applying to it a succession of comparatively small impulses of force occurring in the same period as that of the reed. The same amount of energy applied at a rate differing materially from the period of the reed will not cause it to take up its full swing. It remained then to design a ringer having a reed or armature which would be acted upon by electromagnetic impulses due to ringing current passing through the ringer coils and thereby made to take up its full swing when the impulses were of a frequency corresponding to the natural period of vibration of the armature. Four different reeds were designed and given different rates of vibration by putting at their ends metal balls of different sizes which were to serve also as tappers, striking the gong direct. A ringing machine was provided giving ringing current of four different frequencies; also a suitable ringing key for throwing any one of the four frequencies out on the line. The four instruments were bridged across the line each with a condenser in series. Then when current of a given frequency is impressed on the line the armature having the proper period of vibration takes up its swing, striking its tapper against the gong, while the reeds at the other three stations will not be affected.

This is the system installed on the Intramural Ry. for general operating purposes.

THE CURTAIN SUPPLY CO., CHICAGO.

This company has no exhibit of its own at the St. Louis Fair. It has, however, supplied curtains and fixtures for a large number of cars that are being used for exhibit purposes; in fact, almost all the electric cars in Transportation Building have the Curtain Supply fixtures. This gives excellent opportunity, therefore, for examining the various types of curtain fixtures for different styles of cars. The fixtures of this company also form part of the equipment of all the Intramural Railway cars, as built for the World's Fair by the St. Louis Car Co.

The Curtain Supply Co. states that it is prepared to furnish on short notice curtains and curtain fixtures of any required style and type for all kinds and descriptions of city, suburban, and interurban cars, and that it is now selling its specialties in some form or other to practically every electric railway company and car builder in this country.

HOLOPHANE GLASS.

An artistic booth in block 25, aisles F, G and Y, Electricity Building, gives a practical conception of the soft and even lighting effects produced by the use of Holophane glass globes and reflectors. Holophane glass is a special glass that diffuses the light, and when applied to incandescent lamps gives an effect entirely different from any other form of globe on the market. Holophane glass globes are coming into extensive use for electric car interior lighting.

INTERNATIONAL REGISTER.

The International Register Co., of Chicago, has its exhibits in Transportation Building, aisle C, post 30. It is showing the standard International single R-7 and standard double R-5 registers which record 5-cent fares and transfers separately on the same register, illustrating the way cars may be equipped with either a rod or cord ringing device. The company also shows the New Haven fare registers square and round, single, double and triple; also two large boards of bronze fittings for rod and cord fixtures and a case of employes' badges and conductors' punches.

THE INTERNATIONAL REGISTER CO.

STANDARD UNDERGROUND CABLE CO.

This company in conjunction with the McRoy Clay Works has an exhibit in Section 3 immediately adjoining the northwest entrance of the Electricity Building. The exhibit shows a cross-section of an actual conduit consisting of 72 ducts with a manhole at either end, one manhole being complete with a cover, the other being open. A trench 7 ft. deep and 5 ft. wide extends the entire length of this conduit, enabling close inspection of the method of laying conduits, including the wrapping, concrete base and top, and the general construction of the manholes, showing hangers, pipes to poles, etc. At one end in the manhole is shown a capstan rigged up for drawing in cables and connected to a cable which is mounted on a reel at the other manhole; the cable being drawn through the ducts and part of the ducts being split so as to show the method of fastening cables to rope, etc. From the manholes, cables go to distributing poles, showing the method of distribution to aerial cables for telephone, electric light and street railway work with various terminals used to protect the ends of the cable in such work. The McRoy Clay Works shows piles of clay as it is dug from the ground and the various processes through which the material goes to produce the finished duct. The Standard Underground Cable Co. shows [illegible] in handsome cases of all the various cables and appliances made by it. An examination of this system will show, in very complete detail, the method of installing conduits and drawing cables into completed conduits.

MALTBY LUMBER CO.

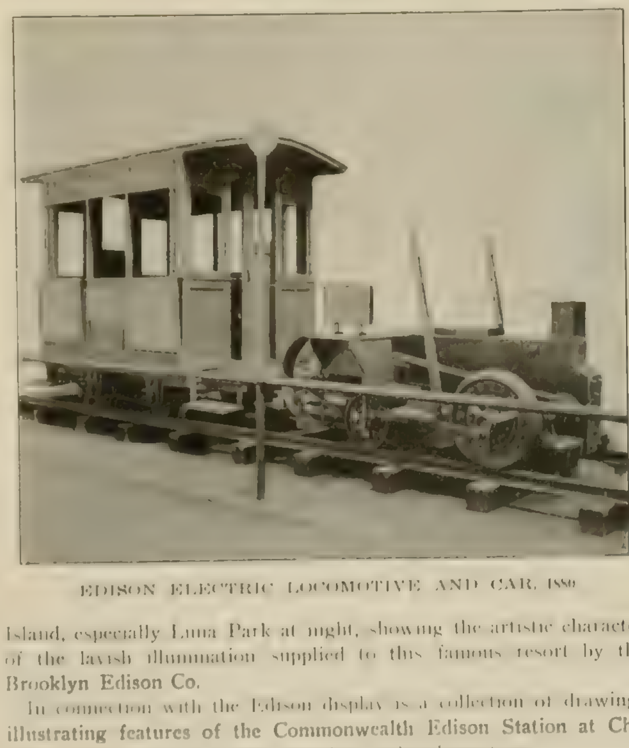
This company will have no booth of its own at the Fair, but it has furnished a large number of photographs to the Michigan Commission on Forest Products. These show the handling of the cedar pole and tie business in the woods and at the concentrating yards, something which very few cedar companies are able to exhibit.

EDISON'S HISTORICAL EXHIBIT.

Under the auspices of the Associated Edison Illuminating Cos. there are being shown in the Palace of Electricity a collection of models, photographs and drawings representing the work of Thomas A. Edison in the field of electrical research. Of primary interest is the original electric locomotive and car built by Edison, and first operated at Menlo Park, N. J., May 13, 1880. Diagrams on the side of the locomotive show the electrical connections for this forerunner of the modern electric railway motor car. The initial arrangement comprised plug resistance boxes in series with the armature for controlling the power and speed of the motor, but this arrangement was shortly replaced by a series coil wound upon the lower leg of the magnet or top of the shunt field magnet winding, the controlling and reversing switch being in the armature circuit.

There is also shown the first Edison "Jumbo" steam dynamo—the prototype of all direct connected steam driven electric generators. The first "Jumbo" was exhibited at Paris in October, 1881. Twenty-four others were commercially installed in London, New York, Milan and Santiago.

The collection of Edisonia also includes photographs of Edison's home, his laboratory, his early factory, the first electric locomotive and cars, the first photograph ever taken by electric lamps, and interior views of early Edison electric lighting stations. A stand of photographs contributed by the Edison Electric Illuminating Co. of Brooklyn, one of the largest electric lighting and power companies in the world, illustrates features of this company's equipment and indicates some interesting phases of its business. The collection includes some views of Coney Island, especially Luna Park at night, showing the artistic character of the lavish illumination supplied to this famous resort by the Brooklyn Edison Co.



EDISON ELECTRIC LOCOMOTIVE AND CAR, 1880

In connection with the Edison display is a collection of drawings illustrating features of the Commonwealth Edison Station at Chicago, which contains several 5000 kw. turbo-alternators.

THE CRANE CO., CHICAGO.

The Crane Co. is making two large exhibits at the Exposition One of these, at the west end of aisle H, Transportation Building, is made up exclusively of valves and fittings for steam locomotives.

The company's main exhibit, however, is in block 26, Machinery Hall. This display is made up of articles selected from the 10,000 or more distinct articles which the Crane Co. makes for steam, gas, and water engineering work. These include: Brass, iron and ferro-steel valves and cocks; cast iron, malleable iron and ferro-steel fittings; pipe bends and special flanged connections for all purposes and pressures; pop safety valves for stationary, locomotive and marine boilers, and water relief valves for all pressures.

The samples of pipe bends which are worked into the artistic

CRANE CO.

design of the booth illustrate forcibly the difficult work that the company is prepared to undertake in this line. The bends include 20 and 24-in. pipe bent to a 10-ft. radius without signs of wrinkling or injury to the surface of the pipe. The valves and fittings are shown for medium, heavy, and extra heavy pressures.

The Crane Co. has a 30-in. atmospheric relief valve and a 24-in. motor operated valve on the big Allis-Chalmers unit in Machinery Hall which supplies the power for the decorative lighting of the Exposition grounds.

WESCO SUPPLY CO., ST. LOUIS.

The Wesco Supply Co., in addition to a regular line of electrical apparatus and supplies used by all electric railway companies, has a railway department within its space, which is located in block 8, Electricity Building. This department contains exhibits of special railway stuff made by houses for which the Wesco Supply Co. is agent. These include the following:

Electric Railway Equipment Co., iron lighting and trolley poles, from which are suspended Adams-Bagnall arc lamps; these poles and lamps making a very attractive railing around the space.

Locke Insulator Manufacturing Co. of Victor, N. Y., samples of porcelain and glass insulators. These are displayed in various sizes from the smallest to insulators capable of withstanding 120,000 volts and over, indicating that the Locke company is prepared to make insulators for every condition of high tension transmission work that it is possible to conceive.

The H. W. Johns-Manville Co., of New York, full line of "Noark" fuses, blocks, and fuse-boxes.

Globe Electric Manufacturing Co., of Cleveland, O., arc headlights for city, suburban, and interurban electric railways. The Globe arc headlight is a complete automatic self-adjusting focusable arc headlight designed to burn with a clear, steady light on railway circuits and is adjustable to from 2 to 5 amperes. The rheostat is of small size, 6 in. round and 10 in. long. The headlights are fitted either with multiplex or with parabolic reflectors.

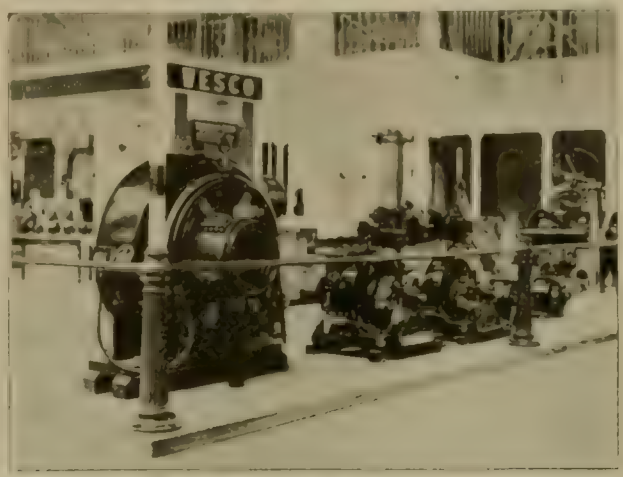
Marshall-Sanders Co., Boston, incandescent lighting sockets, switches, cut-outs, etc.

Diamond Meter Co., Peoria, Ill., recording wattmeters.

Wheel Truing Brake Shoe Co., Detroit, Mich., grinding brake shoes for truing car wheels.

Triumph Electric Co., Cincinnati, O., motors and apparatus for electrically driven direct connected machine tools.

W. N. Matthews & Bro., St. Louis, Stombaugh guy anchors. Peerless lamps.



WESCO SUPPLY CO.

Mr. Charles Scudder, jr., manager of the Wesco Street Railway and Mining Department, will devote considerable of his time to interested electric railway men who visit St. Louis, and Mr. L. Milton Zapp will be in direct charge of the exhibit.

WHARTON EXHIBIT.

Wm. Wharton, jr., & Co., Inc., Philadelphia, Pa., has a display of switches and frogs on aisle C, Transportation Building. The samples shown include: Cast welded "Combination Rails," for uniting track laid with different sections of rails by casting steel around the joint; frog and mate of solid manganese steel casting for T-rail track on electric railways; improved tongue switch, manganese steel center construction, with Dunham spring throw attachment, for electric railways; tongue switch, mate and frog, unbroken main line construction for electric railways; worn out frog, demonstrating that manganese steel will outlast adjoining rails, the specimen exhibited having had 1,600,000 electric cars pass over it, the rails being completely worn out while the manganese steel center is still in fair condition. At the back of the space are shown specimens of special

WM. WHARTON, JR. & CO., INC.

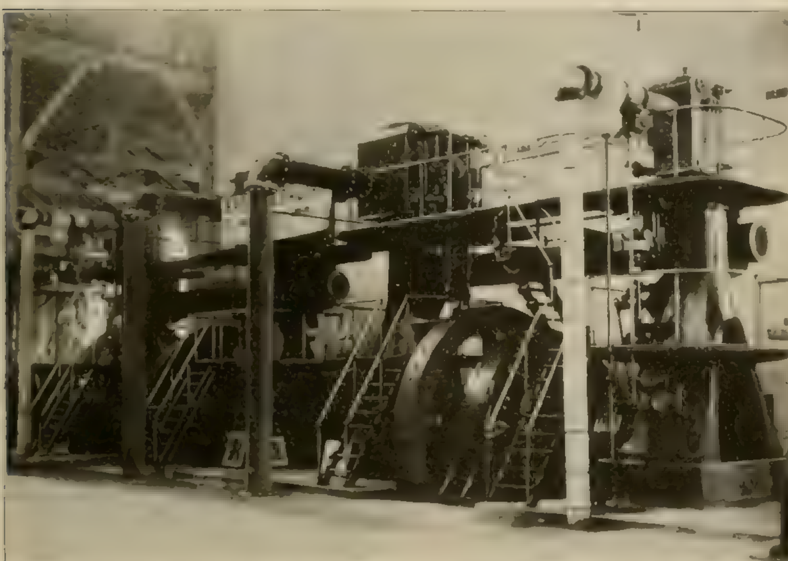
work for street railways, these including street railway crossing with manganese steel center construction; crossing of street railway over steam railroad; curved T-rail cast solidly of manganese steel; crossing of three-rail type, street railway over steam railroad. Samples of manganese steel are displayed bent into various forms

showing its great toughness combined with its extreme hardness. Photographs of Wharton special work adorn the exhibit and a map of the United States indicates some of the many places where Wharton work is used.

The exhibit is in charge of Mr. Arthur S. Partridge, who will be pleased to receive callers or answer communications addressed to him at his office, 421 Olive St., St. Louis.

BROWN-CORLISS ENGINES.

The Brown-Corliss Engine Co., of Corliss, Wis., has supplied the engines for two of the generating units for the Intramural Ry. plant in Machinery Hall. These are two 750-h. p. vertical cross-



BROWN-CORLISS ENGINE CO.

compound Brown-Corliss engines, 18 and 36 in. by 36 in., direct connected to Crocker-Wheeler generators. The engines are of the company's standard type for railway work, with double eccentrics and guaranteed to work with continuous cut-off as late as 15-16 of the stroke. The units operate at 138 r. p. m., steam being supplied to the engines at about 150 h. p. Steam is taken from the Exposition boiler plant in the Steam, Gas and Fuels Building.

The Brown-Corliss Engine Co. is making a specialty of engines for electric railway work and is prepared to build heavy duty and girder frame corliss engines in all sizes for this particular service.

WYCKOFF PIPE & CREOSOTING CO., OF STAMFORD CONN.

A demonstration of the decay-resisting properties of timber treated with the Wyckoff process of cresoting is made in the court of Electricity Building. This company is dealer in creosoted wood, conduits for underground wires and cables, cross-arms, poles, ties, paving blocks, etc. The process used is the dead oil or coal tar process, and to show the efficacy of the treatment samples of wooden conduit for underground wires are exhibited that have been buried in ground in Philadelphia for 15 years. The conduit shows no signs of decay.

Samples of electric railway cross-ties are shown treated by the Wyckoff preserving process and for which it is claimed that they will not rot in any soil.

WHEELER CONDENSERS.

The Wheeler Condenser & Engineering Co., of New York, furnished a surface condenser of the Admiralty type with pump complete for a portion of the Intrammal Ry. power plant in Machinery Hall. This condenser also takes care of the exhaust steam from a Greenwald 600-h. p. cross-compound engine, which is direct connected to a 400-kw., 250-volt direct-current generator.

GEST SUBWAY WORK.

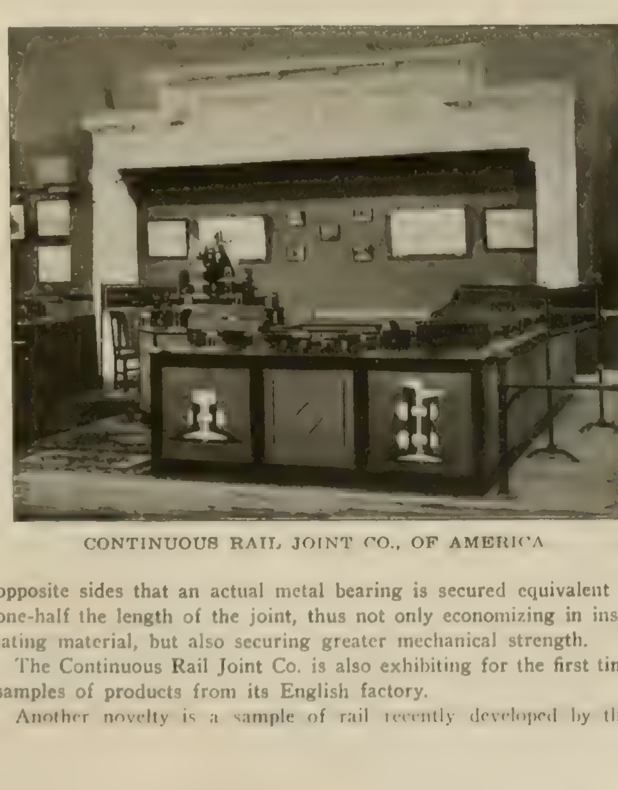
G. M. Gest, of New York and Cincinnati, expert subway contractor, is showing a sample section of subway construction in the court of Electricity Building. The section shows a manhole, method of bringing conduits into the manhole and method of supporting cables around the walls.

CONTINUOUS RAIL JOINTS.

The Continuous Rail Joint Co. of America, whose headquarters are at Newark, N. J., is making a more elaborate display of its products than it has at any previous exposition or convention. The company's space is near the center of Transportation Building and here are shown samples of "Continuous" joints as applied to a wide variety of rail sections, including T-rails from 30 lb. up to 100 lb., and girder sections from 5¾ in. to 9 in. in height.

A portion of the exhibit that will be of particular interest to practical track engineers is a collection of samples demonstrating how every type of accepted rail bond on the market can be applied with the "Continuous" joint. Among these is a sample illustrating an entirely new form of bonding that has just been placed on the market by this company for use with its joints. With this form of bonding a strip of copper 1-16 in. thick and 1 in. wide is placed on each side of the rail between the flange and the base of the fish plate and running the entire length of the plate. The under side of each fish plate is milled out to receive the copper plate, and by special machinery the bearing surfaces, both on the fish plates and on the rail flange, are planed to a bright surface in order to give good electrical contact.

Another new specialty is a cross-insulated joint for use wherever an insulated rail joint is required. In this a sheet of fiber is placed under the rail flange and extends the full length of the fish plates. For insulating the sides of the rail a sheet of fiber is inserted between the rail and one of the plates for half the length of the plate, or up to the end of one rail, and is then continued on the opposite side of the rail from the end of the second rail to the end of the fish plate. The insulation between the ends of the two rails known as the end post is also of fiber. It will be noted that by placing the insulating material for half the length of the joint on



CONTINUOUS RAIL JOINT CO., OF AMERICA

opposite sides that an actual metal bearing is secured equivalent to one-half the length of the joint, thus not only economizing in insulating material, but also securing greater mechanical strength.

The Continuous Rail Joint Co. is also exhibiting for the first time samples of products from its English factory.

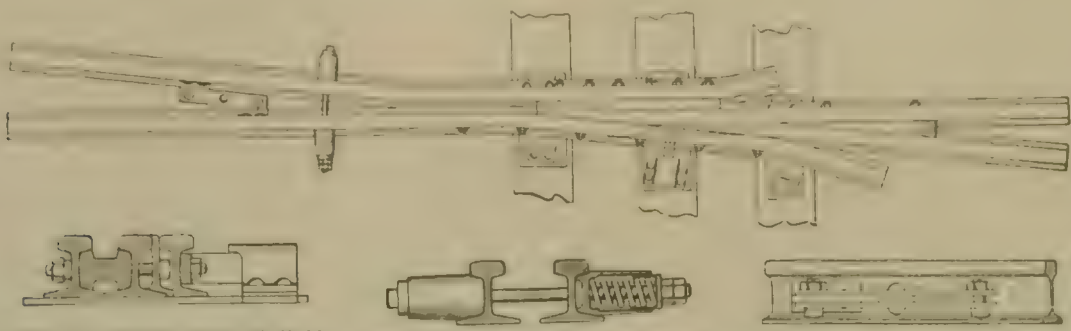
Another novelty is a sample of rail recently developed by this

company for the New York Central, illustrating a method whereby, by adding a lip or tram to existing T rail, all the advantages of a grooved girder rail can be secured. This is designed for use where steam railroad companies or interurban electric railway companies are required to lay girder rails in city streets.

AMERICAN FROG & SWITCH CO.

This company's space occupies 1,000 sq. ft., located between posts 13 and 14, in aisle C, Transportation Building.

Here there are on exhibit three different styles of the company's split switches, from a light rail switch up to the latest design of a re-enforced split switch with adjustable head bars. Also two different styles of spring frogs, one known as the "Des. 1" standard and the other the "Des. 18" hinged wing rail frog. The company also shows three rigid frogs and six different types of switch stands, from the plain ground throw to the high ladder stand with connecting rods. All of this material is of that class which this company has been furnishing to interurban and suburban electric railways throughout the country.



SECTION SHOWING CUFF AND HOLDING DOWN ARM

SECTION OF SPRING AND HOUSING.

SIDE VIEW OF ANTI-CREEPER.

SPRING SWITCH, AMERICAN FROG & SWITCH CO.

SCARRITT CAR SEAT WORKS.

One of the most interesting features of the World's Fair is the Transportation Palace. Fronting the central doorway on the east, will be found the exhibit of the Scarritt Car Seat Works showing the various patterns of car seats for street, intramural and steam coaches as well as for railroad stations. The accompanying cut shows the exhibit pavilion. Immediately in the rear of this pavilion is the Pullman Exposition train. The Scarritt car seats are used in this train and form a part of the Pullman exhibit. Probably the Scarritt car seats are shown to better advantage in this train than in the Scarritt pavilion. Alongside of the Pullman train is found the exhibition train of the Missouri Pacific Railroad. Two coaches are equipped with the Scarritt high back car seat and the chair car with the Scarritt twin reclining chair. These trains form a very attractive exhibit and are constantly crowded with sight-seers, and the Scarritt car seats form not the least interesting feature of the furnishing and the attractiveness of the interiors of these famous trains.

SCARRITT CAR SEAT WORKS.

An attendant invites all visitors to the Scarritt Car Seat Works, which are located at No. 1800 N. Main, St. Louis. They are also cordially invited to visit the offices of the company, southeast corner Broadway and Locust Sts., St. Louis.

A railroad man prominent in Pennsylvania railroad affairs, after a visit to these works, remarked: "I would count on your seats every time. You are not fixed for turning out bad work." This well characterized the product of the factory, the company's motto being "Good Work." The factory is modern, equipped with every improved machine and process, and none but expert labor is employed in each department. The works have set as their aim, the highest standard of excellence and the Scarritt Car Seats are sold and stand solely on their merits.

We learn from the officers of the company that there are over 20,000 Scarritt car seats in use on the electric cars in St. Louis and its suburbs, and visitors to the Fair will appreciate their comfort of riding in the St. Louis street cars.

GOULD STORAGE BATTERY CO.

The Gould Storage Battery Co. has space in Electricity Building, Section 16, where it is showing various adaptations of storage batteries to engineering work.

The central feature of the exhibit is a battery of 60 Gould accumulators of the type known as "O" No. 515. This will be shown doing work under conditions that will demonstrate the wide range of its applications in both central station and electric railway work. By means of an induction motor coupled to a double generator or rotary converter in connection with a booster set various conditions can be artificially produced. For instance, by using the induction motor to drive the generator as a direct-current generator, charging the batteries in connection with the booster set will be represented a direct-current power house operating with a regulating battery in connection with a booster; also when the induction motor is disconnected to operate the rotary representing an ordinary rotary sub-station in connection with battery and booster. Other combinations are created to demonstrate the possibilities in close regulation of which the battery is capable under the most severe conditions. A unipolar generator and two "U" type cells having from 3,000 to 5,000 ampere capacity are also installed to work in connection with the battery and motor-generator set for the same purpose.

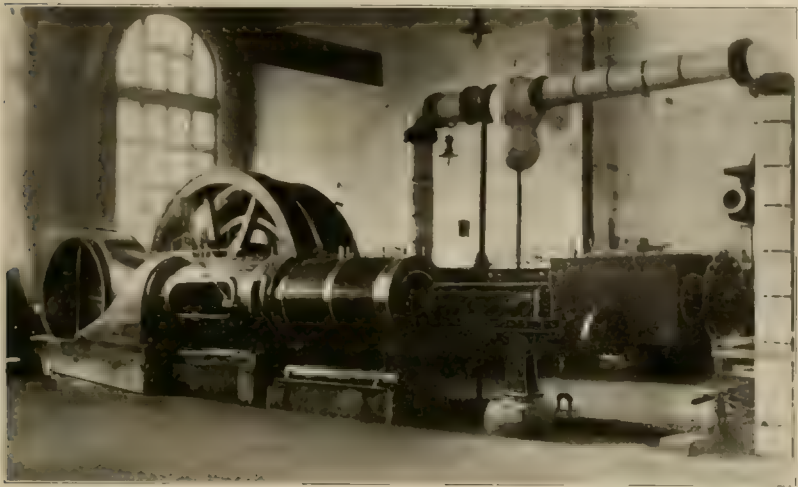
A group of four cells are shown, one of them being the large cell, exhibited at the Pan-American Exposition and which has a discharge capacity of 27,000 ampere hours at a 2,000-ampere discharge rate.

Clonbrock steam boilers form part of the equipment in the Steam, Gas and Fuels Building.

Warren steam pumps as made by the Warren Steam Pump Co., of Warren, Mass., form part of the exhibitors' power plant in Steam, Gas and Fuels Building.

BUCKEYE ENGINE CO., SALEM, O.

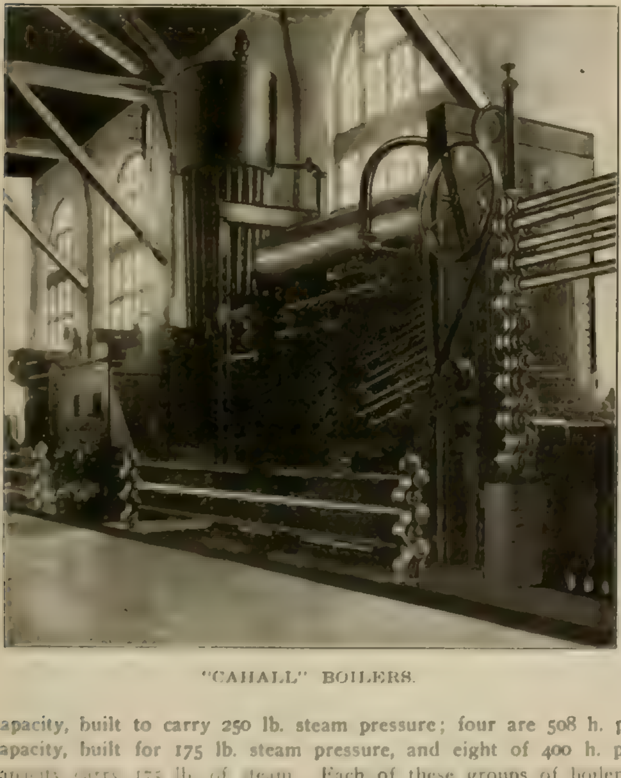
The exhibit of this company consists of a 1,500-h. p. cross compound engine directly connected to a 950-kw. Crocker-Wheeler generator. This engine has 26½-in. high pressure cylinder, 50-in. low pressure cylinder and 48-in. stroke and operates at 100 r. p. m. It is of the heavy duty type, such as the company builds in large powers, for electric railway service. It is located at block 45, Palace of Machinery, near the main entrance to building. This engine is part of the power plant for operating the Intramural Railway and is the largest of the units for this Intramural plant.



BUCKEYE ENGINES, INTRAMURAL RAILWAY POWER PLANT.

AULTMAN & TAYLOR MACHINERY CO.

The exhibit of the Aultman & Taylor Machinery Co. comprises 20 "Cahall" horizontal water-tube boilers and three "Cahall" vertical boilers, all of which are equipped with the company's chain grate stokers. Of the 20 horizontal tubular boilers eight are 508 h. p. capacity, built to carry 250 lb. steam pressure; four are 508 h. p. capacity, built for 175 lb. steam pressure, and eight of 400 h. p. capacity carry 175 lb. of steam. Each of these groups of boilers is equipped with an independent induced draft apparatus and the coal is fed to the stoker hoppers from storage tanks by the conveyor system.



"CAHALL" BOILERS.

The three vertical "Cahall" boilers are of 250 h. p. each, and are also equipped with the company's chain grate stoker. Each of these boilers has an independent stack and is operated with natural draft. The entire boiler exhibit comprises a total capacity of 10,038 h. p., and all of the boilers are in operation and are developing about 12,000 boiler horse power. This plant is said to be the largest boiler exhibit ever made, and it constitutes about 60 per cent of the entire exhibitors' boiler plant at the Exposition. The high-pressure boilers are used for operating the steam turbines located in the Machinery Building. All these boilers and stokers are located in the central portion of the Steam, Gas and Fuels Building, which is directly west of the Machinery Building.

In addition to the working exhibit the Aultman & Taylor Machinery Co. has a large still exhibit situated in block 53, in the northwest corner of the Machinery Building. This exhibit consists of one 125-h. p. horizontal water-tube boiler equipped with the company's superheater and chain grate stoker, and the boiler is bricked up on one side only, leaving the other side exposed so that the entire system can be examined. There is also one cross drum type horizontal water-tube boiler of 100-h. p. capacity, and also one 100-h. p. "Cahall" vertical water-tube boiler, the two latter being bricked up in the manner just described, so that the interior can be easily examined.
being bricked up in the manner just described, so that the interior can be easily examined.

This exhibit is an attractive one, as it permits of a thorough study of the different types and the travel of the gases can be easily followed. In addition these full-size boilers, all of the different parts are shown separately. The company has a pleasant office fitted up on this space, and cordially invites the trade generally to make use of the facilities of this office while visiting the Fair.

WILSON ROLLING DOORS AND SHUTTERS.

The Jas. G. Wilson Manufacturing Co., of New York City, maker of fireproof doors and shutters, has an exhibit in Transportation Building that will appeal to those engaged in building or using car houses, freight sheds, storage buildings, round houses, etc.

On its space on aisle E, post 50, the company has installed several types of steel and wooden doors and shutters for all sorts of conditions. The samples include: Corrugated, double-edge, self-coiling steel shutter; sliding swing door; "Interlooping" corrugated rolling steel shutter, and "Salamander" fireproof rolling shutter.

WILSON ROLLING DOORS.

EDWARDS WINDOW FIXTURES.

Visitors who are interested in the subject of improved car window fixtures will have an opportunity of seeing the latest products of the O. M. Edwards Co., of Syracuse, N. Y., as this company's window fixtures were selected for the handsome Missouri Pacific train exhibit on one of the tracks in the Palace of Transportation. The ease with which these windows can be raised and lowered is in marked contrast to the old-fashioned way of "calling the guard and everybody lift" when a window was to be raised.

The O. M. Edwards Co. makes a complete line of car window and curtain fixtures for city and interurban electric railway cars.

WALWORTH MANUFACTURING CO., BOSTON.

The Walworth exhibit is in block 27, Machinery Hall, where the company has a full line of its gate valves and numerous other specialties. The attention of electric railway engineers is particularly directed to this company's work for high pressure plants. Of prominent interest is the "Walmanco" pipe joint which is a flanged-over joint made without threads or rivets and guaranteed to be absolutely tight under 250 lb. working steam pressure.

WALWORTH MANUFACTURING CO.

The Walworth plant is especially fitted for doing heavy pipe bending work in all sizes from 2½ in. to 24 in., and the company has supplied many prominent steam plants with heavy pipe bends, the best steam engineering practice now calling for long bends in place of elbows in piping design as the bends reduce friction, eliminate joints and better provide for expansion and contraction.

The company's products include all designs of valves for steam power work, long sweep flanged and screwed fittings, engine and boiler trimmings and an unusually complete line of tools for steam engineering construction and repair work.

The company is also showing a track drill for drilling holes in rails which has the commendable feature that it does not require to be disconnected from the rail in order to permit a car to pass over the point on which the men are working.

CHRISTENSEN AIR COMPRESSORS.

All those interested in the subject of compressed air for commercial purposes will have an opportunity of examining the construction, and viewing the practical working of the air compressors made by N. A. Christensen, of Chicago. This house has furnished compressors for use in connection with several exhibits on the Fair grounds, namely, those of the Standard Railway Equipment Co., of St. Louis; the Pneumatic Signal Co., of Chicago, and the Weber Gas & Gasoline Engine Co., of Kansas City.

GOLD CAR HEATERS.

The Gold Car Heating & Lighting Co., of New York, whose exhibits are always of interest to electric railway men, is making a fine display of panel and cross-seat electric heaters in Transportation Building, aisle E, post 61. The heaters are in practical application and are shown in connection with the company's latest regulating switches.

The Gold company is also making a display of its systems of heating for steam railroad trains, and of the Edison storage battery for train lighting which system it controls for this application. The company's representatives on the grounds will be pleased to receive its many friends and patrons, both in the steam and in the electric railway fields.

THE RAILWAY APPLIANCES CO.

The Railway Appliances Co., of Chicago, successors to the Q. & C. Co., has space in aisle E, post 49, Transportation Building. The company is showing "Stanwood" treads for locomotives in the exhibit of the American Locomotive Works on the Vandalia Line engine No. 200. The company's vestibule diaphragms are shown on the cars of the Missouri Pacific R. R., in connection with the exhibit of the American Car & Foundry Co.

The representative of the Railway Appliances Co., in St. Louis, is the Adreon Co., Security Building.

THE WEBER RAILWAY JOINT MANUFACTURING CO.

One of the most attractive and interesting exhibits in the Transportation Building is that of the Weber Railway Joint Manufacturing Co. This company is showing various styles of joints manufactured by it, and also some very interesting pictures showing their joints in track. Among the samples of joints shown are step joints joining 100-lb. A. S. C. E. and various smaller sections of rail, as used by the Pennsylvania R. R., also step joints joining 80-lb. and 70-lb. rails, of the style used by the Chicago & Alton R. R., and the standard insulated joint of this company, which is used in connection with electric track circuit. Of the different styles of standard joints shown, probably the most interesting is that which is a sample of the ones now being placed in the subway of the Interborough Rapid Transit Co., of New York City. These joints are 24 in. long, fitting 100-lb. A. S. C. E. rail, and are laid on all of the express tracks in the subway tunnel.

In addition to the views on different railroads where Weber joints are being used in track, the company also shows some very interesting prints giving details of the joints, and a large size picture of the medal awarded it for first premiums at the Paris Exposition.

The exhibit of the company, while not as large as some others, is very attractive, and will undoubtedly be a meeting place of a large number of railroad officials who visit the Exposition.

STANDARD BRAKE SHOE CO.

The Standard Brake Shoe Co., with offices in the Railway Exchange Bldg., Chicago, is now placing on the market a line of steel back brake shoes. For steam roads, it makes steel back car and driver shoes of special mixture, plain or with insets as desired, and with or without reinforced lugs. For electric and street railways the steel back designs have reinforced lugs, with insets, plain or filled bearing face, as desired. In the filled shoe the pocket is corrugated besides having ordinary draft, thus ensuring the filling being securely held.

The company's manufacturing plant is equipped with the most improved machinery. The two cupolas have independent Sturtevant fans driven by electric motors; motor-driven cranes serve the shops; in the filling room is a 25-ton hydraulic press for filling composition shoes; and throughout the plant the same completeness is found.

The officers of the company are: President, C. M. Hewitt, Chicago; vice-president and secretary, William Boydston, Chicago; superintendent and treasurer, C. T. Wright, Aurora, Ill.

WEINLAND TUBE CLEANERS.

The Lagonda Manufacturing Co., of Springfield, Ohio, has an exhibit in the Steam, Fuel and Gas Building, where has been placed an installation of Weinland boiler tube cleaners which will afford an excellent opportunity for engineers to examine these devices and also to see them in operation on the boilers.

RODGER BALLAST CARS.

Constructing engineers will find dump and ballast cars of the Rodger Ballast Car Co., Chicago, in Transportation Building. The types shown are as follows:

Hart convertible ballast car, class C. S.; length 36 ft.; capacity 80,000 lb.; weight 37,300 lb.

Hart convertible ballast car, class F. H.; length 34 ft.; width 9 ft. 8 in.; height 2 ft. 3¾ in.; weight 30,400 lb.; capacity 60,000 lb.; working limit, 66,000 lb.

Hart convertible ballast car, class C. S.; length 39 ft.; weight 48,200 lb.; capacity 100,000 lb.

DEARBORN DRUG AND CHEMICAL WORKS.

This company as an exhibit supplied its feed-water treatment for about 4,000 h. p. of the Aultman & Taylor boilers. After analyzing the water the company made the vegetable treatment to suit the conditions as found by the analyses. The treatment will keep the boilers free from scale, prevent pitting, corrosion, priming, or foaming. The compound is fed from the dissolving tank through a sight-feed lubricator to the suction pipe of pumps supplying the boiler. Feeding in this manner insures the feed pipes and connections from scaling or pitting, so they are taken care of as well as boilers.

The National Car Wheel Co. has an exhibit of car wheels in Transportation Building.

Stewart-Hartshorn Co., of East Newark, N. J., shows window shade rollers in Palace of Varied Industries.

L. C. Chase & Co., of Boston, Mass., have a beautiful display of mohair plush in Department of Manufactures.

The Crosby Steam Gage & Valve Co., of Boston, Mass., has a line of its steam appliances on view in block 27, aisle 5, Machinery Hall.

The Alberger Condenser Co., of New York, provided the barometric condenser for the 3,500-h. p. Allis-Chalmers-Bullock generating unit in Machinery Hall.

A complete system of signals for steam and electric railways has been installed on the electric railway test track by the Pneumatic Signal Co., of New York.

The fireproof filing cases, safes, office fixtures and appliances made by the Art Metal Construction Co., of Jamestown, N. Y., are shown in Palace of Varied Industries.

A full line of the well-known recording instruments for electricity made by the Bristol Co., of Waterbury, Conn., will be found in block 36, aisles G and E, Electricity Building.

Steam and oil separators as made by the Direct Separator Co., of Syracuse, N. Y., are working in the power plant in Machinery Hall. The company's headquarters are in block 52, aisle 11.

The three massive motor-operated pumps that deliver the 90,000 gallons of water per minute flowing over the splendid central Cascades were furnished by Henry R. Worthington, Inc., of New York City.

The Pennsylvania Steel Co. announces that it has not made a special exhibit at the St. Louis Exposition, but that it has the finest exhibit it has ever made at the new Terminal Station at St. Louis.

Heaters and steam and oil separators have been supplied by the Harrison Safety Boiler Works, of Philadelphia, for the Exhibitors' Power Plant in Machinery Hall and in the Steam, Gas and Fuels Building.

In the court of Electricity Building can be seen a model industrial railway installed by the C. W. Hunt Co., of West New Brighton, New York. On this is operated a Hunt storage battery electric locomotive.

Engineers interested in track work will find a switch and frog of novel construction on aisle C of Transportation Building. This is a design recently developed by the Coughlin-Sanford Switch Co., of New York.

A method of constructing concrete steel railway ties reinforced with old, worn out steel rails is the invention of Mr. C. Buhrer, of Sandusky, O. Sample ties will be found on aisle C, post 6, Transportation Building.

The Power Specialty Co., of New York City, furnished the large fans used in connection with the cooling towers put in by Westinghouse, Church, Kerr & Co., as part of the Westinghouse working exhibit in Machinery Hall.

The Babcock & Wilcox Co., of New York City, states that it has not made an entry of Babcock & Wilcox boilers as an exhibit at the exposition, but B. & W. boilers are in use in connection with the Westinghouse exhibit of working units.

The Ajax Metal Co., of Philadelphia, has an artistic booth in Transportation Building, aisle E, post 50, where will be found samples of the Ajax trolley wheels and bushings, for which the company's motto is, "They stand at the head."

The Electrical Controller & Supply Co., of Cleveland, has an interesting exhibit in Section 5 of the Electricity Building. Mr. John McGeorge, of McGeorge & Sons, engineers, Citizens Building, Cleveland, is vice-president of this company.

W. E. Baker & Co., of New York, were engineers for the Scioto Valley Traction Co., one of whose cars is shown in Transportation Building in connection with exhibit of American Car & Foundry Co. This is one of the finest examples of the car builder's art at the fair.

The W. T. Van Dorn Co., Chicago, has a very practical demonstration of the merits of the Van Dorn automatic couplings. All the cars of the Intramural Ry. are fitted with these devices, and they are put to severe test, as the cars are run in two and three-car trains with heavy loads, and there are numerous sharp curves and severe grades.

Julius Bordollo, Kings Bridge, New York City, announces that William Johnson & Sons, Ltd., of Leeds, Eng., have a complete briquette plant in full operation at the St. Louis exposition. This system is designed to eliminate the waste of bituminous and lignite coal as now used. The fine particles ordinarily wasted are formed into briquettes weighing from 1 to 25 lb. each, making a fuel that is clean, easily handled and can be economically burned.

The Railway Steel-Spring Co. is represented by an exhibit in connection with the Rogers Locomotive Works in Transportation Building. This company's steel tired wheels are now used on many leading city and interurban electric railways and it is said of them that they will run longer, are more durable and more economical than cast iron wheels. The company also makes elliptical and helical springs for all railway purposes.

The Lagonda Manufacturing Co., of Springfield, O., has a space 15 x 20 ft. directly in front of the boiler equipment in the Steam, Fuels and Gas Building at the World's Fair. Here are displayed the entire line of tube cleaners and steam specialties made by the company. A representative is in charge of the exhibit and he will be pleased to show the various machines to all persons interested. Steam users are invited to make this exhibit headquarters and are promised an attractive souvenir.

The De Laval Steam Turbine Co. has a building in the Mining Gulch in connection with the "Outside" Mines and Metallurgy Exhibit in which are installed high and low pressure centrifugal pumps direct connected to De Laval steam turbines and electric motors. Besides this there is a 300-h. p. steam turbine dynamo and a 12-h. p. electric motor pump shown in connection with the

Bullock Electric Manufacturing Co. exhibit and a steam turbine blower in connection with the Western Gas & Construction Co's. exhibit in the Manufactures Building.

J. G. White & Co., who are engaged in building a street railway system for Manila, P. I., will have a number of very interesting photographs, taken in connection with their work in our far eastern possessions, which will be shown in the Philippine Island exhibit at the World's Fair. There has been considerable discussion regarding the ability of the native Filipino in connection with work of this character, and the exhibit which White & Co. will make will be of great general interest, especially as their experience with native work in the Islands has been far more satisfactory than they had been led to believe by others who had similar work in hand there.

The Truth About the Igorot Menu.

Our readers will recall the conflicting reports regarding the gastronomic tastes of the native representatives at the World's Fair

AFTER THE DANCE.

of our Philippine possessions. The reports concerning the demand for dogs for supplying the table of the Igorot delegation were

PREPARING THE FEAST.

strenuously denied, the management of this exhibit doubtless having to defer to the sentiment created by the Society for the Prevention of Cruelty to Animals.

The fact of the matter is that dog meat is one of the staple articles of diet, and thanks to the courtesy and enterprise of Mr. J. V. E. Titus, president of the Garton-Daniels Co., Keokuk, Iowa, we are enabled to present the accompanying illustration showing the preliminary steps in the preparation of this viand.

On the occasion of Mr. Titus' visit to the Igorot village on the morning of June 8th he witnessed the killing of a dog for food, which is a somewhat ceremonious function, and secured a snap shot of the scene. After a dance led by the chief, which lasted perhaps half an hour and was accompanied by singing and music on native instruments, the intended victim, who had been led through the dance at the end of his tether, was thrown high into the air and on descending was caught by two of the chiefs and his throat cut. After bleeding, the head was removed and the carcass, undrawn, put into a pot of boiling water, which had been prepared in the meantime.

Mr. Titus states that he did not remain to watch the completion of the cooking operation or to share in the repast.

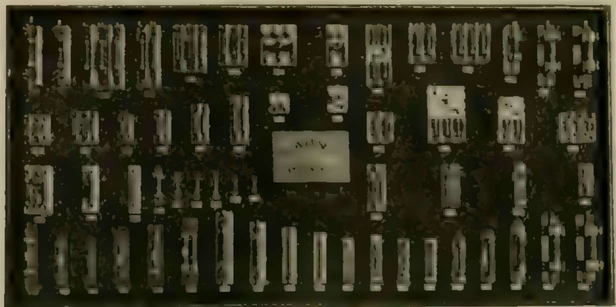
Formation of the Exposition Electrical Club.

At a meeting held in Electricity Building, at the St. Louis Exposition on Tuesday, June 21st, details were completed for the organization of "The Exposition Electricity Club." According to the constitution adopted, the objects of the club are purely social, for the mutual benefit of its members and the promotion of pleasant relations between them. Active membership is open to exhibitors and representatives of exhibitors in Palace of Electricity, representatives of the Electricity Exhibit Department, representatives of the Electrical Bureau of the Department of Works, representatives of the technical press, and all representatives at the Exposition associated with the electrical industry. Honorary members will be elected from time to time by the Executive Committee. The initiation fee to the club was made $1.00, and regular dues will be $1.00, payable the first of each month.

It is the plan to hold regular meetings every Tuesday at 5 o'clock in the afternoon. Professor Goldsborough, Chief of the Department of Electricity, has placed at the disposal of the club a large room in the north balcony of Palace of Electricity, which will be fitted up as a permanent club room. It is proposed to make the meetings social gatherings, at which the electrical men at the exposition can become better acquainted and discuss matters of mutual interest. It is planned to invite men prominent in the electrical field to give informal talks from time to time, and all electrical men who may be visiting the fair will be made welcome.

The officers elected for the term of the Exposition are as follows: President, Frank H. Gale, General Electric Co.; first vice-president, W. K. Dunlop, Westinghouse Companies; second vice-president, H. W. Pope; American Telephone & Telegraph Co.; third vice-president, J. W. Dunfield, Allis-Chalmers-Bullock Interests; secretary, J. S. Hamlin, National Electric Co.; treasurer, F. V. L. Turner, Kellogg Switchboard & Supply Co. Executive Committee, the officers and the following: W. A. Layman, Wagner Electric Co.; Edw. Dixon, British Electrical Section; Cloyd Marshall, Department of Electricity; C. B. Fairchild, jr., "Street Railway Review"; O. A. Mygatt, Holophane Glass Co.

The club starts with a membership of nearly one hundred, which will probably be increased to twice or three times that number.



D. & W. FUSES IN EXHIBIT OF WESTERN ELECTRIC CO.

New Cars for Schenectady Railway.

BY J E BANKAT, MASTER MECHANIC, SCHENECTADY RAILWAY CO

The Schenectady Railway Co., of Schenectady, N. Y., has recently received from the builders, J. M. Jones' Sons, of Watervliet, six cars which were constructed after general plans prepared by the Schenectady Ry. and comprise a number of very interesting features. These cars will be used on the Ballston line. The general dimensions of the cars are: Length over body, 41 ft.; length over all, 51 ft.; width over all, 8 ft. 9 in.; height from rail to top of trolley board, 13 ft.; from bottom of main sill to top of trolley board, 9 ft. 8 in.

NEW CAR FOR SCHENECTADY RAILWAY CO.

The side sills are 7-in. I-beams sandwiched between two pieces of Georgia pine. Besides these main sills there are four intermediate longitudinal sills. The cross framing is all of white oak. The bottom frame is drawn together by ⅞-in. tie rods, the side sills being counter-bored to receive the bolt heads and nuts.

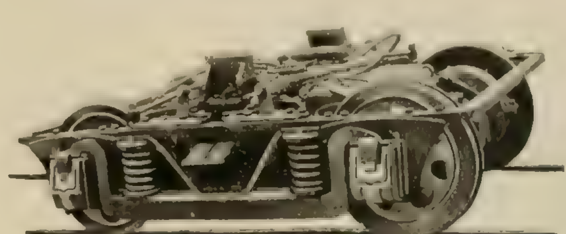
The platforms are carried on four ½ x 6-in. iron knees, which are extended to the bolster and are bolted through the side and intermediate sills. The corners at the end are reinforced with ½ x 6-in. angles bolted through and through. The idea in this arrangement is that in the event of a heavy collision the platform would be gradually driven back, but the corner irons would prevent the car from being telescoped, thus the car would be somewhat cushioned.

INTERIOR OF SCHENECTADY CAR

The general outline of the car windows and doors is semi-elliptical, continuing around the car. The paneling over the side windows is of colonial design.

The interior is divided into two compartments, the so-called regular, and the smoking compartment. The regular has 12 cross and 2 longitudinal seats, and the smoking compartment 6 cross and 2 longitudinal seats. The seats were furnished by the Hale & Kilburn Manufacturing Co., and have spring cushions in both seat and back. The backs are high, with head roll, and arm rests are provided at the aisle ends. The covering for the seats in the regular compartment is "Epingle," an imported covering of handsome design, which is used extensively on English railways, this being its first appearance on American electric railways. The smoker seats have for covering dark leather. The ceiling is the full Empire design and painted a light green with no decoration, the effect of the molding arrangement being more pleasing. Continuous bronze parcel racks extend throughout car on both sides, the graceful lines of same harmonizing with the concave surface to which they are attached. Coat and hat hooks form a pleasing combination with the racks, as also do the register fixtures, bell rope hangers, ventilator openers, etc.

The interior finish is of solid mahogany throughout, inlaid with marquetry work, the moldings being plain with rounded edges, the idea being to prevent dust accumulating in the depressed surfaces. Four clusters of four lamps each furnish the light for the regular compartment, and one five-light cluster furnishes the light for the smoking compartment. Each cluster is incased in a 12-in. hemispherical "Holophane" globe with cast-bronze casings, which are hinged. The side curtains are of pantasote with double face, mounted on spring rollers and having pinch handles. The car is heated by the Peter Smith hot water system, the pipes extending along the sides of the car, and the heater being placed in one end of the smoker. The platforms are arranged on one side of center, with partition work which encloses the motorman and forms a cab.



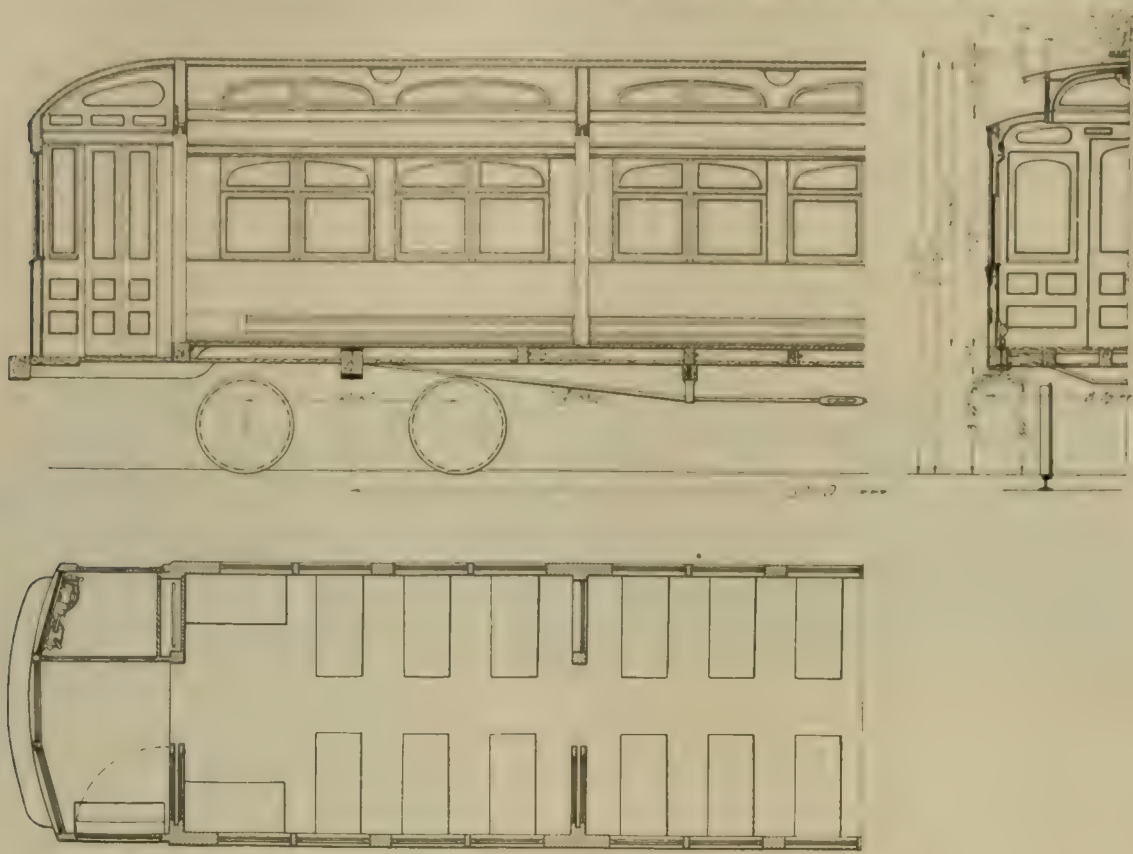
TRUCK FOR SCHENECTADY CAR

The cab in smoker end contains a slate panel, on which are placed all switches and fuses; this is enclosed with a transite lined casing, thus making it fireproof. Transite is one of the new products of the H. W. Johns-Manville Co. and is being very extensively used in car wiring work.

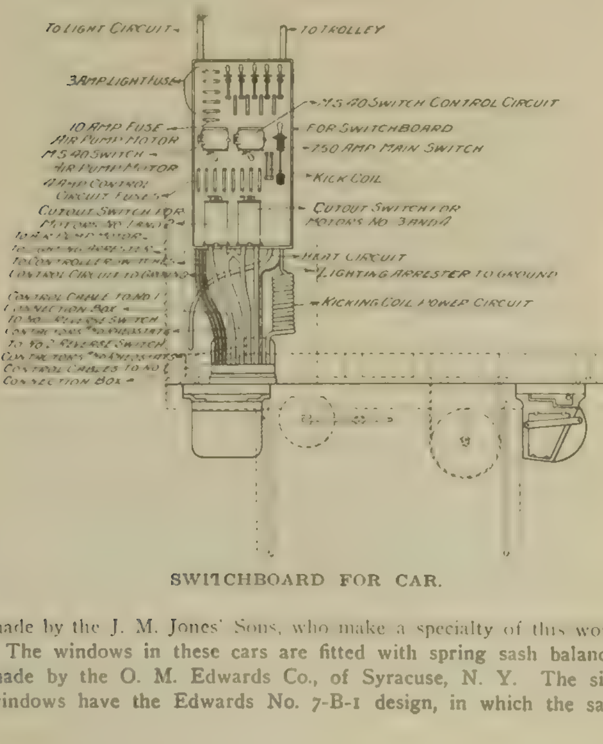
The step openings in the vestibules are closed with O. M. Ed-

wards platform trap doors; this device was illustrated in the "Review" for February, page 135.

The exterior of the car is painted in the railway company's standard colors, the body being maroon with black and nickel striping, the name of the company appearing in large gold letters through the center, and the ends having corner ornaments of gold. The roof color is of a dark Pullman. The coloring of the green opalescent glass used over the windows forms a striking combination. The bronze trimmings inside and outside the car were made by the J. M. Jones' Sons, who make a specialty of this work.

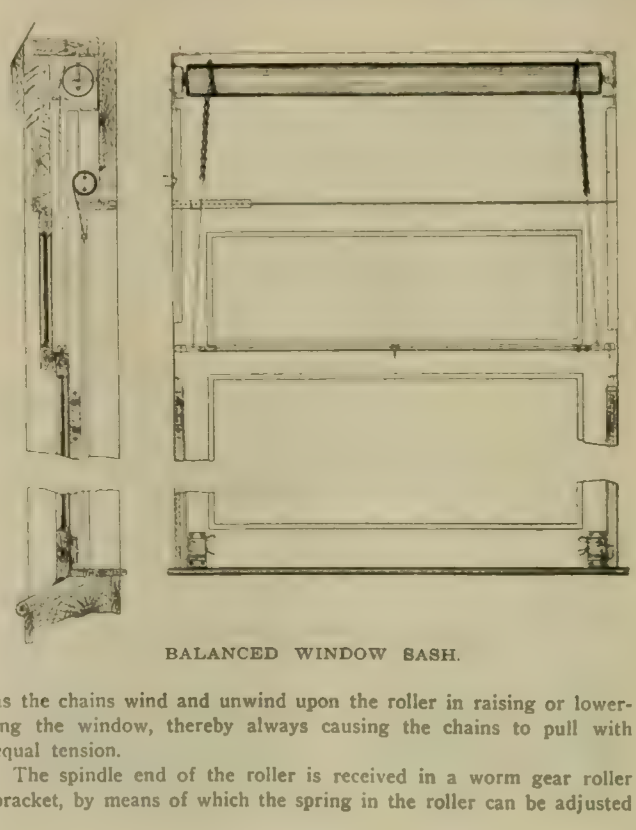


PLAN AND ELEVATIONS OF SCHENECTADY CAR.



SWITCHBOARD FOR CAR.

The windows in these cars are fitted with spring sash balances made by the O. M. Edwards Co., of Syracuse, N. Y. The side windows have the Edwards No. 7-B-1 design, in which the sash is connected with the spring roller sash balance by two chains arranged to draw at an angle and not overlap in winding and unwinding upon the roller. These chains are attached to the sash by means of a rock shaft having the two ends extending at an angle to each other where the chains are attached, so that the rock shaft will rotate in its bearings to give and take any variations as the chains wind and unwind upon the roller in raising or lowering the window, thereby always causing the chains to pull with equal tension.



BALANCED WINDOW SASH.

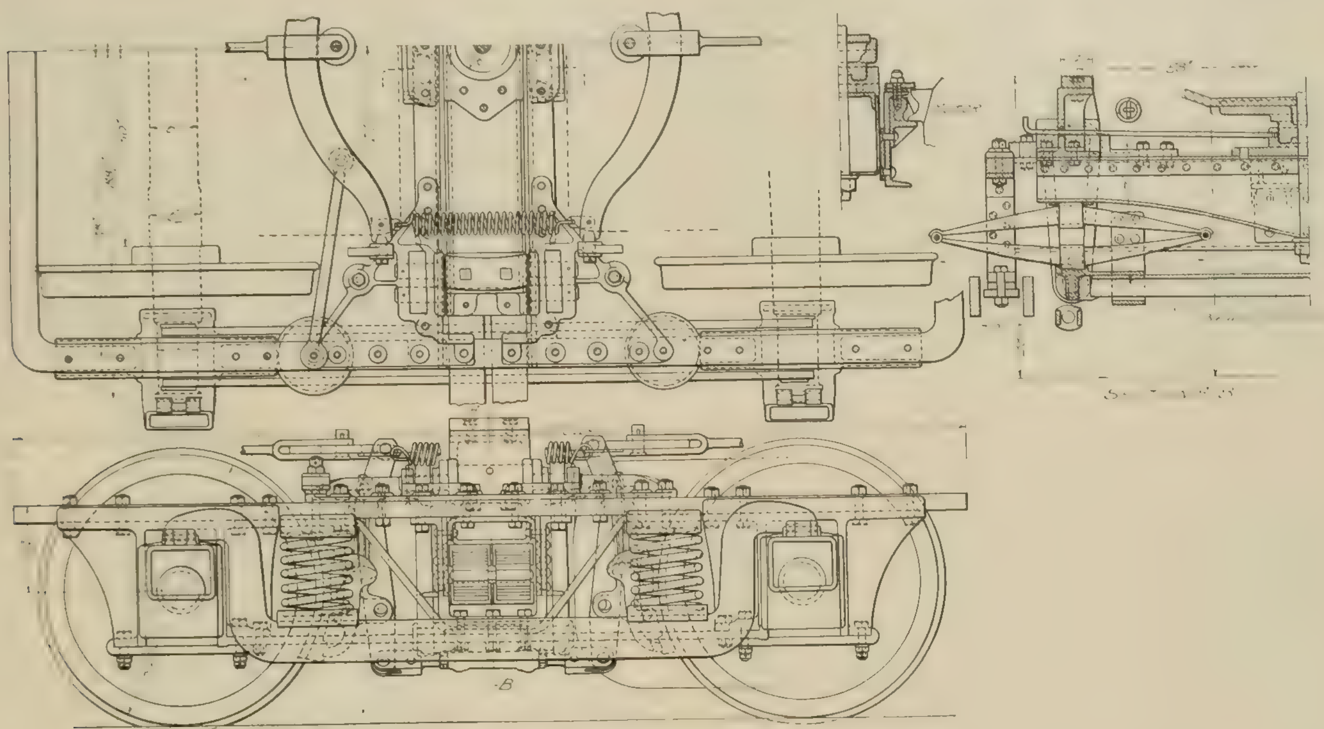
The spindle end of the roller is received in a worm gear roller bracket, by means of which the spring in the roller can be adjusted

as desired without removing the roller from the brackets or disturbing the finish. This is accomplished by inserting a socket wrench through an opening provided in the finish and engaging with the end of the worm projecting from the bracket. The roller brackets have extending flanges designed to receive the sash when raised to its limit, and the sash is provided with rubber buffers placed to strike against the bracket flange.

In this design of window it is intended that the roller shall be adjusted to balance the sash. At each of the two sides of the top of the sash. Weather stripping is provided at both the top and bottom edges of the sash, applied in a manner which will maintain a tight joint at these two points, which is not affected by a change of camber in the car, a slight tilting of the sash in the frame, or a warping of the rails of the sash.

In operating the sash the bevel bolts are withdrawn, when the sash is readily raised or lowered by hand, the pressure of the roller bearing always remaining against the sash.

The drop sash in the motorman's window in the cab is fitted



DETAILS OF TRUCK FOR SCHENECTADY CAR.

window a metal bar is applied to the stop casings having a bearing surface at an angle to the inside surface of the sash. At each of the two bottom corners of the sash a lock is placed having a beveled bolt operated by a pivoted lever or finger latch, the bevel bolt being normally held by a spring against the bevel surface of the bar upon the stop casing, thereby wedging the sash firmly against the outside stops at the bottom of the window with a yielding pressure which is self-adjusting to varying conditions, such as shrinking or swelling of the wood, and always maintaining a tight joint at this point, excluding dust and cinders from the car, with the Edwards No. 8 design, in which the balance roller is placed below the sash.

The car bodies are mounted on double trucks built by the American Locomotive Co. at its Schenectady works. These trucks, shown in the accompanying engraving, have a wheel base of 6 ft. 6 in.; the wheels are steel tired, 34 in. in diameter, and were furnished by the Taylor Iron & Steel Co., High Bridge, Pa.

The principal features of the truck will be apparent upon an inspection of the drawing, but several deserve especial mention. The three-pin suspension for the spring plank, which is new for

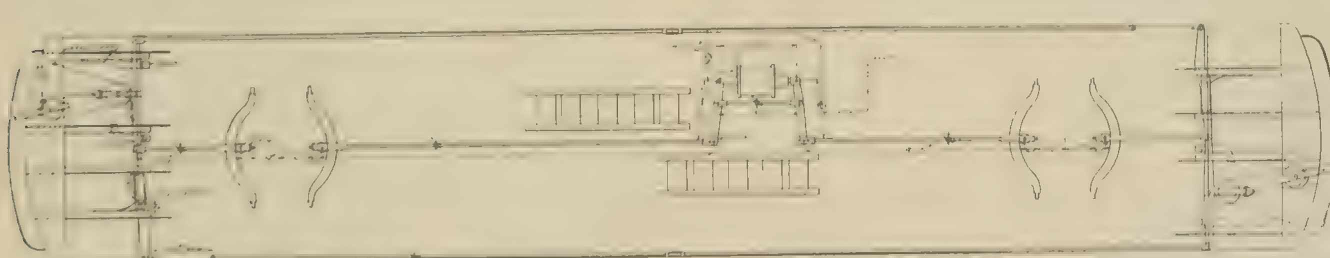


DIAGRAM OF BRAKE RIGGING FOR SCHENECTADY CAR.

and preventing any rattling or play to the sash. The stop bars have recesses near the bottom ends designed to receive the bevel bolts and to lock the sash when in a closed position. The length of the stop bars is determined by the raise of the sash and the corresponding travel of the lock bolt with which they engage.

At each of the two sides of the window a roller bearing is applied to the stop casings a distance above the stop bars, arranged to bear against the two top corners of the sash when the sash is in a closed position, holding it securely against the outside stops at the top of the window with a yielding pressure which is self-adjusting to varying conditions, and maintaining a tight joint at the electric truck work, was adopted with the idea of making the car ride steadier and preventing flange wear caused by the swinging motion of the car.

The style of bolster is also new for this work, being made up of a steel plate flanged into a trough and connected at the top by a channel.

Thrust bearings are provided at the ends of the bolster to take the thrust due to driving in the center pin. The thrust bearing is a part of the side bearing casting and extends above the center pin in such a way that the thrust due to driving is taken off the bolster.

The circle levers are put close to the center pin, so that the rods leading to them can always remain central with the car body when the truck is on a sharp curve. There is a radius bar for taking the side pull of the circle, so that all wear due to side strain is taken up on pins. Moving the circle in close to the center pin also permits braking from both ends of the truck, which is desirable in order to get the three-brake systems patented by the American Locomotive Co. and shown in the diagram. This brake rigging gives additional safety, as there are three independent systems, any of which can be operated if any one, or even two, be disabled.

The electrical equipment is the General Electric type "M" control, with four G. E. 66 motors, each having a rated capacity of 125 h. p. and geared for 70 miles per hour. The motors are oil lubricated by means of wool waste, which is packed in the oil well cast in the frame heads.

The master controllers have "dead man's" handles, and a release of the emergency button also applies the air brakes.

The minor electrical apparatus includes: 2 M. D. lightning arresters, 2 kicking coils, 1 complete set of S. P. R. rheostats, 2 control circuit T-124 rheostats, 2 control cut-out switches, 2 connection boxes for iron pipe, 2 control circuit switches, 6 control circuit fuse blocks.

All cables are protected in iron pipes, making them water and fireproof. The bottom of car is covered with $\frac{1}{8}$-in. transite board, so in case of short circuit there will be no danger from fire.

Besides the apparatus mentioned, these cars have registers made by the Recording Fare Register Co., of New Haven, Conn.; "Providence" fenders and Wilson trolley catchers.

Accidents.

May 21st a Calumet Electric Street Railway Co. car was struck by an Illinois Central R. R. suburban express train at the 73rd St. crossing, Chicago, and three persons were injured, one very severely. The electric car was badly damaged.

May 22nd east and west-bound cars of the Indiana Union Traction Co. collided near Daleville, Ind., and several of the passengers were slightly injured. One car was torn from the trucks and overturned. The other car was derailed and slightly damaged.

May 22nd a Walpole car and an East Dedham St. car of the Boston Elevated Railway Co's. system collided at Roslindale, Mass., and 11 persons were injured. The accident was apparently caused by a misplaced switch.

May 28th a Mt. Lebanon car of the Pittsburg & Charleroi Ry left the track while descending a hill near West Liberty, Pa., and overturned. A woman was killed and seven other passengers were injured.

May 30th two double-truck cars on the Tamaqua & Lansford Street Railway Co's. line collided near Nesquehoning, Pa., and one passenger was fatally injured, while five others were seriously hurt

June 2nd a Camden & Trenton Railway Co. car jumped the track and rolled down an embankment between the two cities and 12 persons were injured. A broken flange was said to have caused the accident.

June 2nd a Rockford (Ill.) & Interurban Railway Co. car "ran away", jumped the track and overturned, damaging the car considerably. There were no passengers, the runaway starting from the car barn.

June 5th two Ithaca (N. Y.) Street Railway Co. cars collided on Stewart Ave., that city, and four persons were injured. The cars were wrecked.

June 6th an East Cass St. car of the Chicago & Joliet Electric Railway Co. was struck by a freight train on the Elgin, Joliet & Eastern R. R., in Joliet, and five persons were injured, including the motorman.

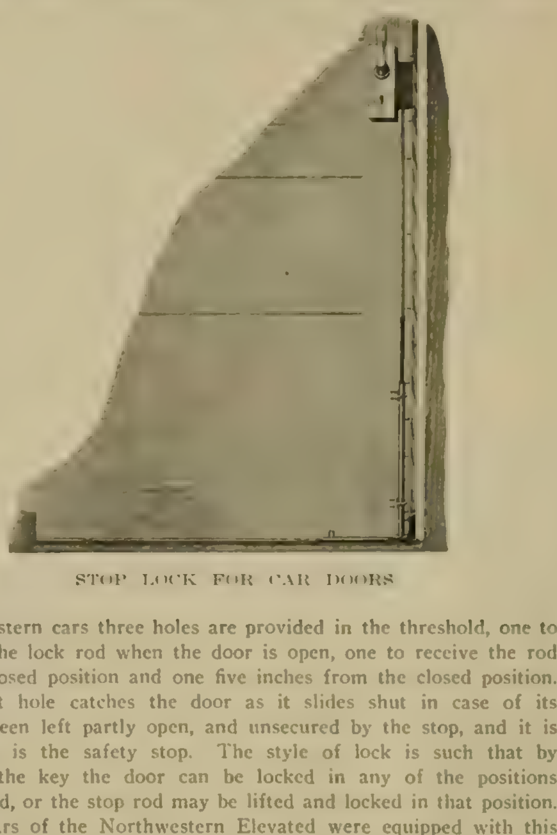
June 9th 27 persons were injured in an accident on the Mason City & Clear Lake Railway Co's. line as they were returning from the state G. A. R. encampment at Mason City, Ia. A trailer jumped the track and overturned.

The president and faculty of Armour Institute of Technology, of Chicago, tendered a reception to the students of the American School of Correspondence on the evening of June 17th. Senator Jonathan P. Dolliver, of Iowa, delivered an address.

Stop Lock for Car Doors.

The device here described was designed by Mr. R. B. Stearns, superintendent of the Northwestern Elevated R. R., Chicago, to obviate a peculiar class of accidents, which, while at first thought may appear trivial, yet in fact often are serious to the injured party and costly to the railway company. A car door, if properly mounted, slides with such ease that it is thrown open or shut when the car passes a curve at more than a moderate speed. With crowded cars and fairly high speeds unwary passengers will be caught with their hands on the door jamb and crushed fingers result. On the Northwestern Elevated in 1902 no less than 39 claims for damages were filed because of personal injuries received in this manner, and the need for overcoming the trouble and the fact that no stop or safety device for sliding doors was on the market, led Mr. Stearns to work out a means of his own. The door may be stopped in an intermediate position when it is desirable to have it partly open for ventilation.

The device is as follows: In the forward edge of the door is cut a mortise, in which is a vertical rod, and a spring which tends to force the rod down. At the top the rod is connected with the door handle by means of suitable dogs, so that turning the handle in either direction lifts the rod. The threshold of the door has holes into which the locking rod is forced by the spring. On the



STOP LOCK FOR CAR DOORS

Northwestern cars three holes are provided in the threshold, one to receive the lock rod when the door is open, one to receive the rod in the closed position and one five inches from the closed position. This last hole catches the door as it slides shut in case of its having been left partly open, and unsecured by the stop, and it is this that is the safety stop. The style of lock is such that by turning the key the door can be locked in any of the positions mentioned, or the stop rod may be lifted and locked in that position.

The cars of the Northwestern Elevated were equipped with this device in the spring of 1903 and during that year only one crushed-hand accident claim was presented, as against 39 the previous year. The Stearns stop-lock has also been used on the new cars built recently for the Chicago & Milwaukee Electric Ry., is to be adopted as standard on the Metropolitan Elevated of Chicago, and is being considered by a large number of other roads.

After this stop-lock had been tested thoroughly in service it was patented and is now being placed on the market by the Wallace Supply Co., No. 56 Fifth Ave., Chicago.

This door stop is shown at the World's Fair on one of the cars built for the Northwestern Elevated R. R. and exhibited by the St. Louis Car Co.

Robbers wrecked a safe in the Clifton Heights (Pa.) barn of the Delaware County & Philadelphia Electric Railway Co. early on the morning of May 31st and secured about $150. A second safe which contained the receipts of the day before withstood an attempt to blow it open.

Rapid Growth of a Railway Supply House.

On May 1st, last, Porter & Berg, Incorporated, moved into its new offices and salesrooms on the second floor of the Plymouth Building, 303-305 Dearborn St., Chicago. The remarkable growth of the business, especially during the year just passed, made it necessary to secure larger and more commodious quarters than those formerly occupied at 309 Dearborn St., where the company has been located since it succeeded to the business of McGill, Porter & Berg five years ago.

At the new location, in addition to the large and well-equipped suite of offices, there has been established a sample room which is one of the most complete of its kind in the country. And, further, a large private office has been fitted up for the exclusive use of customers and street railway men, where all will be cordially welcomed, and which will afford a convenient place to meet for consultation, or to attend to correspondence and other business and personal details without interruption.

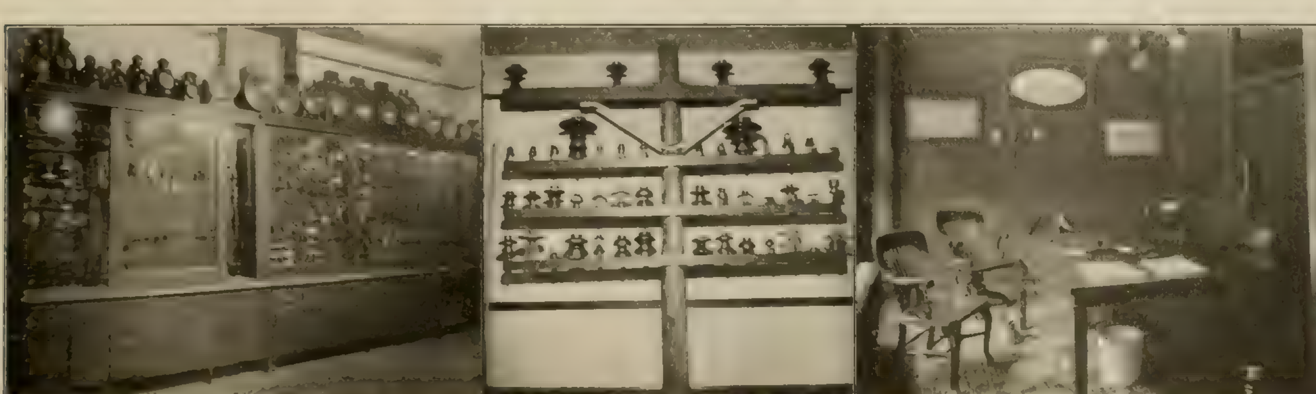
As an instance of this company's rapid growth, it is of interest to note that during the past year its already spacious warehouse facilities at 47 Plymouth Place, Chicago, in the Windsor & Kenfield Building, have been more than doubled to meet the increasing demands upon it. The company carries a large and complete stock at all times, enabling shipments to be made very promptly. Another evidence of substantial growth is the fact that the number of employes engaged in the different departments of the company has been increased fourfold during the past year.

OFFICE OF PORTER & BERG, INC.

The members of the company are very popular and have a wide acquaintance in the electric railway field, where they have established an enviable reputation for enterprise, integrity and courtesy. The officers of Porter & Berg, Incorporated, are: President and treasurer, J. W. Porter; vice-president, Edward R. Mason; secretary, Max A. Berg.

Mr. Porter became a partner in the business in May, 1899, but has been active in the electrical field since 1890, when he was in the erecting department of the Edison General Electric Co. Later he was in the sales department of the Electrical Supply Co., of Chicago, and in 1893 became manager of a central lighting station in Chicago.

Mr. Berg was formerly manager of the railway department of the Electrical Supply Co., Chicago, and in 1896 became associated with the Ohio Brass Co., of Mansfield, O., of which company he was assistant secretary when he resigned some years later to enter the supply business as a member of the firm of McGill, Porter & Berg.



SHOW ROOM. INSULATOR DISPLAY. READING ROOM.

Mr. Mason has had eleven years' experience in the electric railway supply business. He was associated with his father, W. R. Mason, until the Spanish-American war, when he joined the United States Navy. Upon his return home at the close of the war, he took a position with McGill & Pomeroy. When the present company was organized he became its vice-president. He is at the head of the traveling staff and has a large number of customers and friends throughout the central West.

The New York, New Haven & Hartford Railroad Co. has completed plans for its electric branch between Fall River, Mass., and Newport, R. I., the line to be in operation next winter.

It is announced that the New York Central & Hudson River Railroad Co. will reduce its rate of fare wherever its lines are paralleled by electric roads.

Michigan Electric Railway Map.

We reproduce this month a new map showing the electric railway lines in operation, under construction and proposed in Michigan, this map being another of the series which is being compiled by the Arnold Electric Power Station Co., of Chicago. The upper peninsula is not shown, as there is very little in the way of new lines being projected in that part of the state. Of the proposed lines shown the longest is that extending up state from Grand Rapids to Alpena, and south from Grand Rapids to South Bend, Ind. This road will pass through about 200 miles of Michigan farm lands. The first section to be built will be that between Grand Rapids and West Branch. The Benton Harbor & Dowagiac Ry. is that projected by Mr. J. G. McMichael, president of the Atlas Railway Supply Co., of Chicago. The motive power has not been fully decided upon, it being reported that the company may use gasoline motor cars.

The Grand Rapids & Ionia Railway Co. and the Ionia & Owosso Railway Co. were incorporated by the same interests and Mr. E. H. Hopkins, of New York, is president. It is expected to begin construction on the former in July and on the latter by September 1st. The Farnham third-rail system will be used. The same interests recently formed the Jackson & Lansing Railway Co., also. The Jackson & Ft. Wayne Interurban Railway Co., as stated in the "Review" for April, will build the section between Ft. Wayne and Waterloo, Ind., this season. The Grand Rapids & Saginaw company was promoted by Mr. Marcus Pollasky, of Detroit, and the St. Louis Construction Co. has been organized to build the line


ELECTRIC RAILWAYS IN MICHIGAN
IN OPERATION
UNDER CONSTRUCTION
PROPOSED
CITY SYSTEMS
POPULATION
ANN ARBOR 15000
PORT HURON 20000
JACKSON 25000
SAGINAW 42000
SCALE OF MILES
9 Grand Rapids and Ionia Ry Co
10 Grand Rapids and Southern Michigan Trac Co
11 Grand Rapids Grand Haven & Muskegon Ry Co
12 Grand Rapids Holland & Lake Michigan R R Co
13 Ionia & Owosso Ry Co
14 Jackson & Battle Creek Trac Co
15 Jackson & Lansing Ry Co
16 Jackson Ann Arbor & Detroit Trac Co
17 Kalamazoo & Lake Michigan Elec Co
18 Lansing St Johns & St Louis Ry Co
20 Michigan & Indiana Trac Co
21 Michigan Trac Co
22 Ohio & Michigan Trac Co
23 Ohio Northern Trac Co
24 Owosso & Corunna Elec Co
25 Rapid Railway Co
26 Saginaw Valley Trac Co
27 South Bend & Southern Michigan Trac Co
28 Toledo & Jackson Elec Ry Co
29 Toledo & Western Ry Co
30 Traverse City & Peninsula Ry Co
31 West Michigan Interurban Ry Co
32 Grand Rapids Elec Ry Co
33 Grand Rapids & Saginaw Elec Ry Co
34 Jackson & Fort Wayne Inter Ry Co
35 Toledo & Michigan Elec Ry Co
COMPILED BY
ARNOLD ELECTRIC POWER STATION CO
ENGINEERS CONSTRUCTORS
1539 MARQUETTE BLDG
CHICAGO
MAY 1904

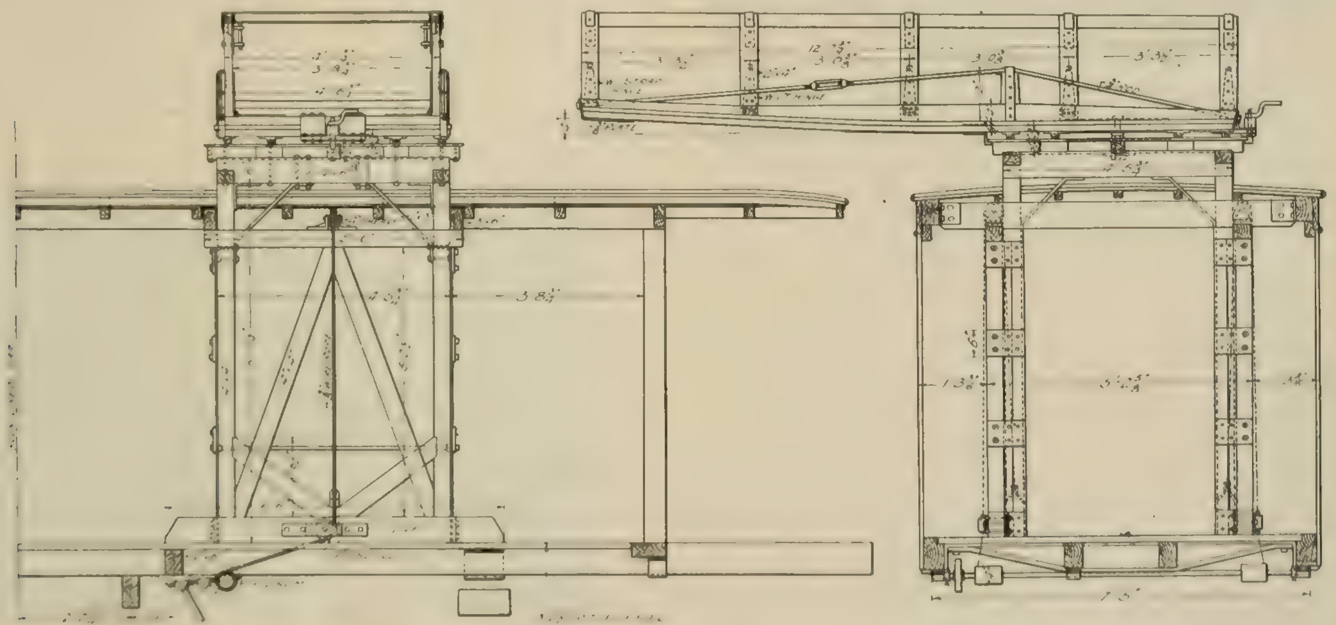
Tower Cars of the Brooklyn Heights Railroad.

The Brooklyn Heights Railroad Co. recently built in its 52d St. shops two tower cars for the use of the line department, one of which is illustrated herewith. Both of these cars are similar in all respects, and we are indebted to Mr. R. C. Taylor, mechanical engineer of the company, for the following description. These cars resemble in most features the box cars commonly used on electric railways. The bodies are 25 ft. x 7 ft. 9 in. and are heavily framed of wood with Howe trusses built into the sides, and two heavy truss rods are placed beneath the sills and hooked over the steel bolster plates. The side and upper framing of these cars is particularly heavy and stiff. The platforms are 4 ft. long and the angle buffers, inside-hung side and end doors, 4 ft. and 2 ft. 6 in wide, small side windows and other details are of ordinary construction and do not call for special comment. The roof construction, however, is novel. Upon 5 x 2¼-in. carlines spaced 21 in. apart are first laid a diagonal layer of ⅝-in. tongued and grooved boards. Upon these in a bed of tar, ⅛ in. thick, are laid ⅞-in. tongued and grooved boards at right angles to the first layer. The rise of the roof is only two inches and the construction described extends over the platform, being supported there by heavy pipe stanchions, thus forming a large working platform which is very strong and not liable to leak or deflect as an ordinary car roof will if walked upon. The trucks are placed at 18-ft. centers and are old trail trucks from elevated cars strengthened and adapted for motor service.

The tower is placed with its center 6 ft. from the center of the car and 3 ft. from one bolster. There are four posts resting on sills placed on top of the flooring, anchored to joists spanning the plate rails. These are diagonally braced lengthwise of the car and each post carries a vertical channel about 5 x 3 in., built up of 3 x 3 x ⅜ angles, in which the tower legs move. These legs are 4 x 4 in. and form a square about 4 ft. 6 in. and are braced strongly together in a longitudinal direction, but the pairs of legs are not connected at the bottom and have no bracing in a transverse plane. This gives a perfectly free passage through the car regardless of the position of the tower, a valuable feature seldom, if ever, found in tower cars. Strength, however, is not sacrificed to gain this advantage as the channels hold the tower legs securely against transverse motion and knee braces between the tower caps and legs prevent racking. Four timbers 4 x 6 in. framed together, rest on the tower legs and are knee-braced to them in all directions. This square of timbers supports at eight points the "swivelling" platform and a forging at the intersection of two lighter cross timbers holds the center pin. The tower is hoisted by hand from the outside of the car, using two crank handles applied to the end of a shaft extending clear across the car. Two pinions on this shaft drive, through trains of gearing placed on the tower posts, shafts on which the hoisting chains wind. Each chain, after passing over a sheave near the roof, is attached to the cross piece at the bottom of the tower leg and a pawl working on a ratchet wheel keyed to the first shaft holds the tower in its raised position. To lower the tower the pawl is disengaged by a handle on each side of the car and the cranks are allowed to revolve freely, no brake having been found necessary. The tower has a vertical travel of 4 ft. 9 in., so that the floor of the platform is at a height of 16 ft. above the track level when it is in its highest position. The clearance height above the rail when the tower is lowered is 12 ft. 3 in.

TOWER CAR, BROOKLYN HEIGHTS RAILROAD CO.

The working platform is 12 ft. 7 in. long x 4 ft. 6 in. wide, and when swung out extends 10 ft. 3 in. from the center line of track. Its construction is light and strong, consisting of three 4-in. x 1½-in. longitudinal pieces with cross pieces of the same size at the ends and a ¾-in. truss rod on each side resting on a 12-in. king-post. Railings 2 ft. high, hinged to fold down when not in use, are provided on the sides. Eight small rollers on the bottom of the platform run on a fifth wheel of 2½ x ½-in. steel on top of the tower and take the weight, while a center pin prevents lateral displacement and a stout clamp on a timber placed transversely on top of the floor at the rear end grips the fifth wheel tightly and prevents tilting or accidental rotation. No mechanical means are provided for rotating the platform as one man can move it easily by hand. These cars, which have been in successful operation for a few months were designed jointly by the line and mechanical departments of the Brooklyn Heights Railroad Co., the design of the "swivelling" platform being due to the former department while the car body and tower were designed and the plans drawn by the mechanical department.



ELEVATION OF FRAMING OF BROOKLYN HEIGHTS TOWER CAR.

The W. R. Garton Co., Chicago.

The development of the business of the W. R. Garton Co. [illegible] has been almost phenomenal and the brief resume of the beginning, progress and present condition of the company given herewith points to the substantial achievement which has been wrought by energy and perseverance. W. R. Garton began business as manufacturers' agent Feb. 1, 189[illegible], with headquarters in the Ashland Block, Chicago. May 1st of the same year a partnership was entered into between Mr. Garton and R. P. Lee, and having secured many important agencies, they removed to the Manhattan Building, No. 315 Dearborn St. The business grew so rapidly that May 1, 1901, larger quarters being necessary, they removed to Nos. 118-132 West Jackson Boulevard, in the center of the "electrical district," where the company is at present located.

At that time the company had approximately 2,000 sq. ft. of stock-room space and large general and private offices. Within the past year and a half, however, this space has been added to until the stock rooms cover an area of about 5,000 ft., and although the office area has been greatly increased, the company is now adding to it.

The special feature of the W. R. Garton Co's. business—electric street railway and mining supplies—has shown a wonderful increase from the start, each year's returns being more than 100 per cent

OFFICE OF W. R. GARTON CO.

greater than those of the previous year. At first the company acted as manufacturers' agent only, but as the trade developed it was found necessary to carry a stock and handle many articles in addition to the earlier lines, and in a short time it was deemed advisable to manufacture certain articles which were not produced by the manufacturers the company represented. Within the past few years the company has developed many specialties of its own and is constantly bringing out new lines.

The W. R. Garton Co. represents a very large number of the best known manufacturers in the country. Some of these agencies it has had several years, and it has conducted the business in a manner which is very pleasing to the companies. The principal manufacturers which it represents are the following:

The Electric Railway Equipment Co., of Cincinanti, O., manufacturer of overhead material, brackets, tubular poles and a full line of general and railway construction materials.

The Massachusetts Chemical Co., of Boston, Mass., "Armalac," "Enamelac," and a full line of friction and rubber tapes and other insulating compounds, varnishes and kindred products.

The Eureka Tempered Copper Works, of North East, Pa., all kinds of brass and copper products, including drop forged, tempered copper and assembled commutator bars, motor bearings, trolley wheels, etc. A unique form of rail bond is one of the products of the Eureka company, which the Garton company is beginning to furnish. These bonds are placed in the rails by means of compressors furnished by the company, the bonds being both of the ribbon and stranded wire type. The company also makes solder bonds.

The Van Dorn & Dutton Co., of Cleveland, O., gears and pinions, track scrapers, armature lifts, etc.

The Van Dorn-Elliott Co., of Cleveland, O., armature and field coils and kindred products. This company also repairs and rewinds armatures and fields.

C. S. Knowles, of Boston Mass., glass and porcelain insulators, high-tension transmission insulators being a specialty

The Lea Electric Manufacturing Co., the Northall arc lamp.

The Trolley Supply Co., of Canton, O., Knutson trolley retriever.

The Condit Electrical Manufacturing Co., of Boston, Mass., Elden circuit breaker.

There are also carried in stock large quantities of the Garton

SHIPPING ROOM, W. R. GARTON CO.

lightning arresters. Specialties of this company include the following articles: The "America" incandescent lamp; "Columbia" friction tape and "Velva Fara" rubber tape, both the company's own products; a complete stock of trolley poles, wheels, harps, etc.; all kinds of insulating material, and also a full line of special import armature twines and banding wires of bronze and steel; another very recent product of this company is its "Adamantine" trolley bushing, which is being sold in very large quantities; the company is supplying the trade with the best brands of bearing metals for rebabbitting motor bearings, the metal being fully guaranteed; for railroad construction work the company carries a full line of tools; also motor and generator carbon brushes, car signs, arc and incandescent headlights, track drills, all kinds of silk, linen and cotton tape, cotton hose, car gongs, brake handles, trolley bases, car jacks, car fixtures, sockets, shades, rubber covered wire, car cables, switchboard cables, etc. The company has recently arranged for a full

STOCK ROOM, W. R. GARTON CO.

line of trolley pole paint, also. The W. R. Garton Co. also controls the entire output of the Brubaker knife switch.

It is obvious that careful management is necessary in connection with a business of the magnitude of that herewith outlined and the system of the Garton establishment is all that could be desired. Everything is handled with such precision that orders are very promptly shipped and mistakes are rare. To prompt shipments, in fact, is attributed in a large measure the success which has attended the company's efforts to serve the railway fraternity.

Steam Turbines.

The present interest in the development of the steam turbine is evidenced by the fact that four papers dealing with this type of prime mover were read before the Chicago meeting of the American Society of Mechanical Engineers early in June, and a report on the same subject was submitted to the National Electric Light Association at the Boston convention on May 25th. The papers read before the Chicago meeting were as follows: "Some Theoretical and Practical Considerations in Steam Turbine Work," by Francis Hodgkinson; "The De Laval Steam Turbine," by E. S. Lea; "The Steam Turbine in Modern Engineering," by W. L. R. Emmet; "Different Applications of Steam Turbines," by Prof. A. Rateau.

Mr. Hodgkinson defined the ideal turbine element as a steam nozzle directing a tangential jet of fluid upon a bucket wheel of the Pelton type, this type or bucket being selected because it is capable of giving a complete reversal to the jet so that the spent fluid may issue from the jet without any velocity. After briefly reviewing the various types of turbines on the market the author dwelt particularly on the Parsons type of parallel flow turbine, the general features of which were described and illustrated in the "Review" for Feb. 15, 1901, p. 98, and in the "Daily Review" Oct. 11, 1902, p. 723.

An important feature of the parallel flow turbine is that the entire annulus between the rotor and stator is filled with working steam. This permits the use of large axial clearances between moving and stationary blades without loss of efficiency. In practice this is never less than ⅛ in. and in large blades it is as much as 1 in.

In any type of turbine it is necessary to provide glands at the ends of the castings to prevent the escape of steam or the influx of air into the turbine at the point of entrance of the shaft. Air leakage is particularly detrimental in maintaining a high vacuum. In the later type of Westinghouse-Parsons turbines an arrangement of water sealed glands has been introduced which require no lubrication and which make it impossible for any oil to escape from the bearings into the steam spaces. The regulation of these turbines is effected by means of a poppet valve which is operated by the governor. This valve is continually opening and closing at constant intervals, the periods of which are proportional to the speed of the turbine. At light loads the valve opens for a very short period and remains closed during the greater part of the interval. At full load when continuous full pressure is obtained in the high pressure end of the turbine the valve does not reach its seat at all but merely vibrates without sensibly reducing the steam pressure. On overloads an auxiliary valve opens and admits steam as required to a later stage in the turbine where the working steam areas are greater, thus increasing the power of the turbine. With this form of governor the speed regulation may be kept within 2 per cent between friction load and full load. Full loads or overloads may be thrown entirely on or off without causing more disturbance than a momentary surge of speed of four or five per cent. No advantage has been observed due to the use of a reheater with these turbines.

In the course of regular operation of power stations it is not unusual that wet steam comes over from the boilers and in several instances slugs of water coming over from the boilers have been known to bring the turbine almost to a stand-still, but without any ultimate damage resulting. When the water passes over to the condenser the turbine again regains its speed. The effect on the economy of entrained moisture in the steam has been found to increase the steam consumption to an amount about twice the percentage of moisture in the steam, that is, 2 per cent of moisture will decrease the economy about 4 per cent. For the lubrication of these machines a small pump driven from a worm gear upon the shaft circulates oil through a closed system including the pump, oil cooler, bearings and reservoir. It has been found that these turbines ordinarily consume about ¼ gallon of high grade engine oil per kilowatt capacity per year, or a 400-kw. turbine will average about 100 gallons of oil per year.

The author then gave the results of a large number of tests showing the results of operation of turbines of all sizes and under various conditions of operation. These results were platted in a number of curves. A number of points in regard to turbine power plant design were also considered. With steam turbines practically no foundations are necessary, merely something to hold the dead weight of the machine. Foundation bolts are never used, except on shipboard, and the operation of the machines on light flooring is entirely satisfactory thus permitting them to be placed on upper floors of buildings and locating the condensing plant immediately below the turbine. The author believes that the surface condensers will be more frequently used in connection with turbines than any other type if only on account of the advantage of absolutely clean feed water. In the case of a 5,500-kw. turbine with a maximum overload capacity of 13,000 h. p. the floor space occupied, including the generator, is 47 ft. 3 in. by 16 ft. On this basis we have over 17 h. p. to a square foot including the generator. The speed is 750 r. p. m. There are at present in operation and in the course of erection in this country, 43 turbines of the Westinghouse-Parsons type with a total capacity of approximately 27,000 kw. and there are under construction at the company's shops a number of machines up to a maximum capacity of 5,500 kw. aggregating 69,400 kw. The output of another builder has reached a total of 111 turbines aggregating 96,400 kw., showing that the position of the steam turbine for general power work is permanently established.

The paper by Mr. Lea on the De Laval steam turbine described the fundamental principles of this type as well as a number of details of construction. The author states that contrary to popular beliefs there are no reasons either theoretical or practical to prevent the building of a safe turbine wheel with a peripheral velocity as high as 2,100 ft. per second. Only reasons of economy have put a limit to it. In the turbines that have been built the actual peripheral velocity varies between 1,400 ft. per second in the larger sizes and about 500 ft. per second in the smaller sizes. The diameters of the turbine wheels are such in relation to the given peripheral velocities that the speeds run from 10,600 r. p. m. for the largest size to 30,000 r. p. m. for the smallest size. These speeds are reduced approximately 10 to 1 by helical gearing, giving driving shaft speeds of 900 to 3,000 r. p. m. A single gear wheel is provided in the smaller types and in the larger sizes they are double, the latter arrangement permitting the gear pressure on one side of the pinion to balance the pressure on the other side thus eliminating the pressure in the pinion bearings. In spite of speed regulating mechanisms and safety stops any kind of motor may race owing to possible derangement, and it is therefore necessary to provide against serious damage under these conditions. This is accomplished in the De Laval turbine by reducing the thickness of the wheel close to the periphery which decreases the strength at this point. At normal speed the factor of safety at this point of the wheel is about 5, consequently the wheel will burst here at about double its normal speed so that the rim holding the buckets will break into small pieces, which are unable to do any damage to the wheel case. This has been proved by exhaustive tests, and it has been found that turbine wheels without this decrease in section when speeded up to the bursting point would break off in such large sections that they have been driven through an experimental cast steel wheel case with walls 2 in. thick.

The speed regulation of the De Laval turbines consists of a common centrifugal governor actuating a throttle valve in the steam supply line. With this the pressure can be closely controlled but not entirely shut off. In condensing turbines, however, operating at a very high vacuum, even if the steam is throttled considerably below the atmospheric pressure the remaining pressure may be sufficient at no load to increase the speed above normal. To prevent this speed increase there is a small valve which is directly actuated by the governor only after the valve in the steam line has been shut off. This valve either admits air into the wheel case or into the exhaust line of the turbine. This air more or less shuts off communication between the wheel case and the condenser and checks the expansion of the steam in the nozzles, and altogether with the steam throttle valve holds the speed within normal limits. For the high speed bearings ring oilers have not been found satisfactory and wick lubrication has proved the most reliable. The author stated that in addition to the heating of bearings which was occasionally due to faulty workmanship but more often to failure in properly tending to the oiling devices there had been more or less trouble with the buckets. Sometimes one or more buckets had broken and come out of the turbine wheel without doing any

further damage. The cause of the breaking of buckets is not accurately known. The buckets are also subject to more or less wear, due to the action of the steam. In some cases the buckets have worn out in a year and in other cases the wear has been very slight even after four or five years. In tests made on a turbine of 100 h. p. where the buckets had been worn away about 1-16 in. the steam consumption was about 5 per cent higher than with new buckets. The wheels are designed, however, so that the insertion of a new set of buckets can be easily made at small cost. The most common field of usefulness of the De Laval steam turbine has been with direct connected electrical units, and they are also particularly suitable in connection with centrifugal pumps, as well as with blowers for all pressures above 4 in. of water. The paper concluded with a report of a number of tests of steam turbines of various sizes.

Mr. Emmet's paper dealt principally with the Curtis turbine, the design of which involved a moderate number of simple parts running at moderate speed. The first of these machines was built with a horizontal shaft and two stages, with groups of wheels with separate castings. The success of this machine led to the undertaking of the work on a larger scale and a number of improvements in the design were adopted. The later machines are built with vertical shafts; the total weight of the revolving part is taken by a step bearing at the foot of the shaft, the shaft being steadied and aligned by three bearings, one at the top of the generator, another near the foot of the shaft and a third between the generator and turbine. Some of the advantages of the vertical shaft type are as follows:

The relative positions of revolving and stationary parts are definitely fixed by the set bearings.

The stationary part is symmetrical, easily machined and free from distortions by heat.

The shaft bearings are relieved from all strain and friction is practically eliminated.

The shaft is free from deflection and can be made of any size without reference to bearings which can be placed where convenient and operated with desirable surface speeds.

A very short shaft may be used and consequently the longitudinal spacing of moving and stationary parts is very little affected by temperature differences.

The turbine structure affords support and foundation for the generator.

The cost of foundations is small and much floor space is saved.

Failure of lubrication cannot injure the shaft or other expensive parts.

A new feature of the design is the arrangement of valves. The turbine is governed by the successive opening of steam operated valves, which are independent of each other and which are all controlled by the centrifugal governor. With this arrangement the speed control is not dependent upon the successful operation of all of the valves and in the event of trouble with one valve the governor automatically opens another to take its place.

The step bearing consists of two cast iron blocks, one carried by the end of the shaft and the other held firmly in a horizontal position and arranged to be adjusted up or down by a powerful screw. The lower block is recessed to about half its diameter and into this recess oil is forced with sufficient pressure to balance the weight of the whole revolving element. In some cases the step bearings have been operated with water instead of oil, in which case no packing is necessary, the water being allowed to pass into the base. In some of the latest designs water will be used exclusively and the lower surface of the step bearing made of wood. On the newer designs a powerful brake bearing is supplied on the lower surface of the chilled iron ring, carried by the lower wheel. This brake can be operated from the outside and can take the whole weight of the revolving part in case the step bearing support should fail. The brake shoes are set about .01 in. below the brake ring. Another important function of this brake is to stop the machine when desired. One of the 5,000-kw. vertical shaft machines will run for four or five hours after the steam has been shut off unless load is put upon it or a brake is applied.

Mr. Emmet's paper concluded with data on a test of the first of the new machines which has but recently been completed. The capacity of this machine is 2,000-kw. and it operates a 6,600-volt, 25 cycle generator at a speed of 750 r. p. m. At full load this machine consumed 15.3 lb. of steam per kw. h.

The paper by Prof. Rateau opened with a brief comparison of the different types of steam turbines which have been developed, after which the Rateau turbine was described in some detail. This turbine is of the multi-cellular type consisting of a certain number of elements, each element comprising one distributor and one moving wheel. The expansion of the steam is fully carried out in the distributor and the steam therefore acts by its velocity and not by its pressure. An interesting characteristic of this type is the possibility which it allows of leaving very considerable play between the fixed parts and the moving parts and this greatly facilitates construction and obviates the chances of dangerous friction. Besides this the wheels revolve in a chamber where the pressure is uniform and there is therefore no longitudinal thrust upon the moving parts. Also in this type the steam may be directed upon a limited portion of the circumference only. The moving wheels are formed of disks of sheet steel and upon the periphery of these disks are riveted vanes of cylindrical form. A steel band riveted to the periphery maintains the correct spacing of these vanes and gives rigidity to the construction. These moving wheels turn between circular diaphragms provided with distributing vanes, which enter circumferentially into grooves formed in the interior of the turbine case. Between two adjoining diaphragms there is therefore produced a cell, or very flat chamber in which the moving wheel revolves. The shaft passes through the diaphragms in collars of anti-friction metal. In the first diaphragm which the steam passes through the distributing vanes are placed only on a part of the circumference. Partial injection of the steam is therefore obtained and thus the velocity of the steam is better utilized. Moreover, to produce the same effect the useful part of each distributor is set with an angular advance on the preceding section, so that the steam leaving one moving wheel enters the following distributor and never encounters solid wall, which would produce a loss of kinetic energy. For the last wheel the distributing vanes must be set upon the whole circumference of the diaphragm and owing to the expansion of the steam, the radius must be increased. The bearings of these turbines are external and by means of a special system of spring packing they are kept perfectly tight so that no oil is carried by the exhaust steam to the condenser. The speed of rotation is controlled by a centrifugal governor which controls the pressure of steam entering the turbine.

In the case of installations where exhaust steam must be used it is often desirable to supply the turbine temporarily with steam at high pressure when the primary machine is stopped or is furnishing less steam than is necessary for the turbines. For such purposes the author has designed a turbine of the mixed type which can be supplied either simultaneously or separately by steam at high pressure and by steam at low pressure without any lowering of the efficiency of the machine. This turbine is constructed in two parts, one for high pressure steam and one for low pressure steam. The steam at high pressure having done work in the first portion will pass to the second portion which may be fed either by steam coming from the accumulator or by the exhaust from the first portion. The admission of high pressure steam to the first portion is obtained automatically by means of a special regulator which allows steam from the boilers to pass through the first portion as soon as the pressure in the accumulator falls below a given value.

After giving some calculations on the efficiency of turbines Prof. Rateau described a number of plants in which these turbines have been used in connection with direct and alternating current generators, torpedo boats and other vessels and pumps of different kinds besides fans and blowers. He considers one of the most interesting and promising applications of steam turbines is the employment of steam at low pressure, particularly exhaust steam coming from engines working intermittently. The author has given special attention to this problem and has obtained satisfactory results by means of his regenerative accumulator of steam combined with low pressure turbines coupled directly to dynamos, centrifugal pumps, fans, etc. The regenerative accumulator is intended to regulate the intermittent flow of steam before it passes to the turbine and it consists essentially of a vessel contain-

ing solid and liquid materials which play the part of a fly-wheel for heat. The steam collects and is condensed as it arrives in large quantities in the apparatus and is again vaporized during the time when the exhaust of the principal engine diminishes or ceases. This method was applied for the first time at Bruay, where it has worked most satisfactorily since August, 1902.

The report of the committee on steam turbines made to the National Electric Light Association at Boston, May 25th, is signed by W. C. L. Elgin, F. Sargent and A. C. Dunham. After reviewing the different styles of turbines on the market the report states as follows in regard to the subject of wearing of buckets:

Your committee has endeavored to obtain information regarding the wearing of the buckets. It is acknowledged by the manufacturers that the buckets do wear. We have been, however, unable to find any case in which the wear of the buckets is a serious matter. It would appear that the excessive wear is due to two causes; first, defective metal, and second, to moisture in the steam. We do not believe, however, that the wearing of the buckets will be a serious item of cost of maintenance and the buckets can be renewed in all the types of turbines.

All of the manufacturers of turbines advocate the use of the highest superheat of steam, the reason being the apparent greater economy of the turbine. The objections to using highly superheated steam are the difficulties of operating superheaters for high superheat and the additional expense involved in the cost of installing and operating the plant. It would appear from our investigations that the gain in superheat in turbines is almost parallel with that of a steam engine, and there is a very decided advantage in using superheat even as low as 60°; from 60° to 150° can usually be obtained without separate superheaters. This insures dry steam in the turbine and obviates the cutting of the buckets due to moisture.

Generators for turbines have been specially designed by the large manufacturing companies. In certain size units the economical speed of the turbine imposed conditions which were very severe and apparently at variance with an efficient generator. Types of generators designed for reciprocating engines are not suitable for this purpose. The difficulties which had to be overcome in the design of a turbine generator were: First, mechanical stresses set up by the high speed of the revolving parts. Second, providing suitable space for the conductors and the insulation and preventing their movement or rubbing against each other. Third, the ventilation of the machine. The conditions change so materially with the various sizes of units that a number of different designs have been tried. The problem apparently was simpler in the design of the alternating current generator than in the direct current generator as the field could be made the revolving element. The principal difficulty in the design of direct current generators was the inherent structural weakness of the commutator when operating at high speed. The Westinghouse company has developed a revolving field type of alternating current generator of unique mechanical construction which very satisfactorily fulfills the requirements of Parsons turbines. It has also developed a direct current generator for the smaller sizes, the commutator used being grooved in order that a greater surface may be obtained with a minimum length of bar. One of these machines with the grooved commutator was in operation when your committee visited Pittsburg, there being no sparking of the brushes, and the commutator was in excellent condition and apparently the machine was giving very satisfactory results.

The General Electric Co. has constructed a revolving field type of alternating current generator of good mechanical construction. The generator problem of Curtis turbines is simplified on account of the slower speeds of the turbine. In the direct current generator the same difficulty is present in the commutator and the company has designed a commutator with an insulated wire binding around the center of the bars. It would appear that there is difficulty in obtaining direct current generators except in the smaller sizes to operate on lower voltages than 220 volts on account of the difficulty of commutation of a greater output of current with a reduction in voltage with the small practical length of bar. For 500 volts and over the commutator construction can be made satisfactory.

The advantages of turbines were summed up in the committee report as follows:

Higher efficiency.

Lower first cost.

Minimum amount of labor.

Lower depreciation and maintenance.

Small amount of oil required.

Freedom from vibration.

Lower cost of buildings and foundations.

Uniform rotation, which is especially desirable for operating alternating current generators in parallel.

The machine can be started as quickly as a reciprocating engine.

Can be governed as closely as the steam engine.

Full load can be thrown on or off instantaneously without in any way endangering the turbine.

Condensed steam is free from oil so that the water can be returned to the boilers, this being especially valuable where bad feed water is used.

Simplicity of packing.

Small number of bearings.

All parts can be made to gage.

Minimum amount of fittings and easy to renew the parts.

Operates equally well condensing or non-condensing.

Freedom from break-downs owing to water in the steam.

Relatively small size of all parts, insuring more perfect material.

High economies at light load.

Good regulation of generators.

The depreciation of the turbine has not so far been fully determined; we feel confident, however, it will be less than that of the reciprocating engine. Those who have had the turbine in use for some time strongly endorse its operation and efficiency and the interruptions which they state they have had were due to mechanical defects which were easily remedied. The time given for erecting turbines in sizes varying from 400 to 1,500 kw. is from two to four weeks, depending upon the facilities for handling the heavy parts in each case during erection.

In regard to the operation of the step bearings of the Curtis turbine there has been no objection from the users and we have been unable to locate a case in which it has given trouble. We did not receive any unfavorable replies from the users regarding the operation of the turbine or any of its parts.

New Power Plant for Everett Ry.

The Everett (Wash.) Railway & Electric Co. is building a power plant to generate more than 15,000 h. p. at Lake Isabel, on the Great Northern Ry., 35 miles east of Everett. The plant will be unique in that it will have the greatest head of water used for like purpose in the United States. A special steel pipe 32 in. in diameter, and decreasing to 22 in. near the nozzle, will be used, and the intake will be 30 ft. below the surface of the lake. The pipe will be carried 12,000 ft., the fall in that distance being 2,500 ft. The diameter of the nozzle will be ⅝ in. The plant will cost $600,000 and will furnish power for the street railways and factories of Everett. In Switzerland there is a plant with a 3,700-ft. head of water and in California there is one of 1,900 ft.

Through Service Between Cleveland and Erie.

On May 24th, preliminary to the discussion of a plan for establishing a through trolley service between Cleveland, O., and Erie, Pa., Messrs. H. A. Everett and Charles W. Wason, of the Cleveland, Painesville & Eastern Railroad Co., and Messrs. Thomas McGovern and W. F. Stanley, of the Pennsylvania & Ohio Railway Co., accompanied by other prominent electric railway men, made a tour of inspection in Mr. Everett's private car "Josephine." Mr. C. E. Flynn, vice-president of the Conneaut & Erie Traction Co., assumed charge of the party during the trip over that company's system. It is thought that the plan will be consummated early this summer, and next year it is expected to operate through to Buffalo, N. Y.

The Rockford & Freeport Electric Railway Co. has established a new park known as Forest Park, three miles from Freeport, Ill.

Hooven-Owens-Rentschler Vertical Engine.

The accompanying illustration is a view of a new design of vertical engine built by the Hooven-Owens-Rentschler Co., of Hamilton, O. The engine illustrated is shown at the World's Fair, being a part of the Exhibitors' Power Plant, located in Machinery Hall. This unit has cylinders 34 and 68 x 54 in. and is direct connected to a National Electric generator of 1,500 kw. capacity. The company will build these engines in sizes from 16 and 32 x 36 in to 48 and 96 x 60 in. cylinder dimensions for all medium speeds and any desired steam pressure.

The principal features of the design are thus described in the company's recently published catalog:

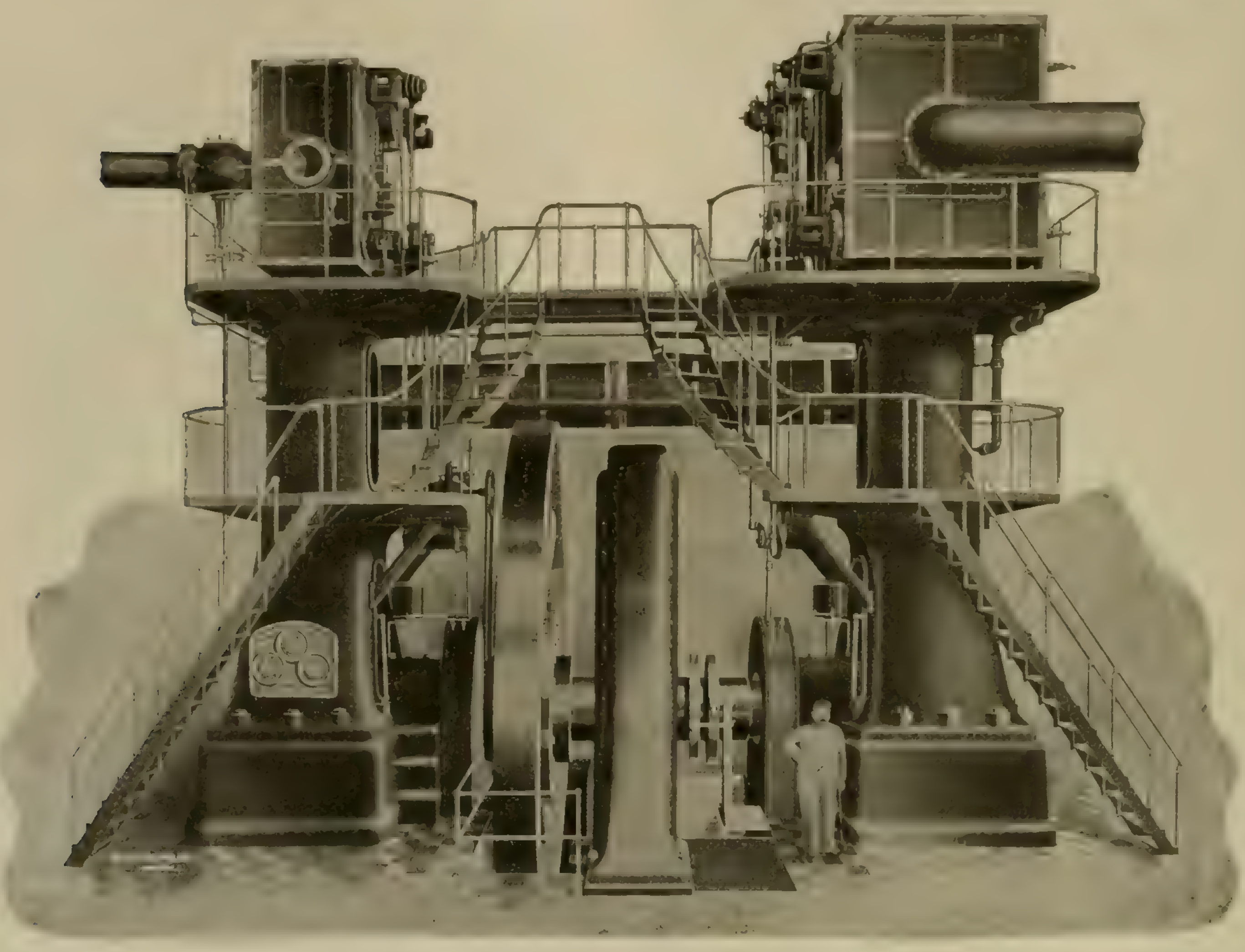
The cylinders are made of close-grained charcoal iron, as hard as is practical to machine them. The exhaust chambers are separated from the cylinder walls by an air space, and the arrangement is such that there is a 2-in. space between the cylinder walls and lagging for non-conducting covering; the lagging is of sheet steel. The valves are located in the barrels to avoid the inconvenience of having to disconnect the valve gear when the heads are removed. The valves are placed in such a manner, however, as to make the clearance about the same as if they were placed in the heads by bringing the exhaust valves partly within the cylinder walls, although at no time do the valves enter the space swept by the piston, while the piston is allowed to sweep past the ports. On the steam valve side the ports are so arranged that the incoming steam strikes the piston squarely on the end, thus preventing any side shock or pound common to the vertical type of engine. Both steam and exhaust valves are double ported and have a very short travel, and are cored and made as light as possible.

The pistons are cored and made as light as is consistent with safety. They have a follower ring and one sectional ring, which is pressed out by spiral springs held in place by T-headed brass bolts. The pistons are forced on a taper and locked with a jam nut and keeper.

The crosshead is of steel, with cast iron slippers lined with the phosphor babbitt, peened in, bored and scraped to fit. Each slipper has a wedge adjustment, which is entirely independent, hence the position of the slipper is not changed by its movement. The slippers are fastened to the crosshead by means of several steel bolts, thus relieving the wedge bolts of any extra strain, and are so arranged that they may be easily removed. The piston rods are fastened to the crosshead by thread, jam nut and keeper. The connecting rod is of the solid end pattern; the boxes are of bronze.

The valve gear differs somewhat from the company's regular type. The steam and exhaust valves are actuated by separate eccentrics, direct, without wrist plates. The necessary motion is obtained by the use of levers and links on each bonnet separately, thus greatly reducing the strains. The dash pots, which are hung from the bonnets and are close to the cylinder, make a very compact and self-contained arrangement, and are of the company's new noiseless pattern, with the weights of the moving parts greatly decreased, being adapted for much higher speeds than usual. Both steam and exhaust cam rods have efficient unhooking devices, so that the valve gear can be worked by hand to facilitate starting and warming up.

The dash pot levers are placed on the valve stems within the opening of the bonnet, hence are well supported on both sides to reduce wear. The releasing gear hooks and latch block trip plates have eight reversible wearing edges. The links have bronze con-



HOOVEN-OWENS-RENTSCHLER VERTICAL ENGINE.

nections with key adjustments. The weight of all reciprocating parts has been carefully proportioned so as to make the forces on the pins as uniform as possible.

The bed plate is of the box section type, deep, massive and strongly webbed, with liberal bearing surface on the foundation. It is cast in one piece and is carried around the crank at full height, forming a deep crank pit to retain oil. The main bearing portion is bored and faced to receive the bottom box, which is of shell type, so arranged that it can be removed by raising the shaft enough to remove the weight from the box. The box is designed for water circulation.

The wheel is made in eight segments, a section of the rim and one arm to each segment. These segments are carefully planed and fitted at the joints and are bolted to the hub with turned steel bolts, holes being reamed for a driving fit. The rim is clamped together with steel arrow-headed links which are shrunk in place. The hub is in two separate disks forced upon the shaft, and the disks are drilled, reamed and bolted to the arms with turned steel bolts.

The "A" frame is cast in two pieces, strongly webbed, and is planed and fitted together and bolted with reamed fitting turned steel bolts. Its lower portion is of the box or rectangular section, which gradually changes to a circular section as it reaches the top, which gives very pleasing as well as very strong lines. The openings on the sides are especially designed to receive oil shields which entirely enclose this part of the engine.

The guide barrel is circular in form, slightly flattened on the sides where the openings come, which are also designed for perfect fitting oil shields and doors. This portion of the frame is also strongly webbed. The guides are separated from the walls of the barrel by an air space, and are bored from a common center. The barrel is faced at both ends at the same setting, to insure perfect alignment.

The governor is of the company's regular high-speed, center-weighted, flyball type, with motor and micrometer attachment for changing speed from the switchboard to regulate for throwing the generator in parallel. The governor is placed on the first gallery platform and is easily accessible. Both cylinders are under control of the governor. The range of cut-off is from 0 to three-quarter stroke.

The main bearings are lubricated by a continuous stream of oil, which is furnished by an oil pump driven from the eccentric. The oil is pumped from a tank beneath the floor to two receivers which are located over each main bearing cap. From here it flows by gravity to all parts of the journal. The bottom box of the journal is cored out and arranged for water circulation. The eccentrics, crosshead slippers, crosshead and crank pins are oiled from a gravity feed system by multiple sight-feed tanks located on the upper part of the engine. The crosshead slippers have wipers on the bottom end, which dip into reservoirs at the bottom end of stroke, insuring perfect lubrication of the guides. All the valve gears, rocker arms, etc., are lubricated by grease cups. The engine is thoroughly furnished with oil guards and shields to prevent oil from being thrown on the floor. The eccentrics are entirely enclosed to prevent oil creeping along the shaft and coming in contact with the wheel and generator.

The arrangement of stairways, galleries and platforms is such as to make all parts of the engine accessible, and it is nicely set off with brass hand railing and polished stanchions.

The engine herewith described weighs 120,000 lb.; speed, 83 r. p. m.; main bearings, 25 in. diameter by 42 in. long; shaft in wheel and generator, 30 in. diameter; crank pin, 11 in. diameter by 11 in. [illegible]; wheel 22 ft. diameter.

Sturtevant Improved Hand Blowers.

The B. F. Sturtevant Co., of Boston, Mass., has for a number of years made hand blowers which have been used in connection with forges as substitutes for the bellows. A short time ago the company brought out a new design of hand blower which is designated as style B, to distinguish it from the old blower which was known as style A. These blowers are not only adapted to forge blowing, but they can readily be applied as portable ventilating apparatus. They are simple in design, strong, compact and easy and economi- [illegible]

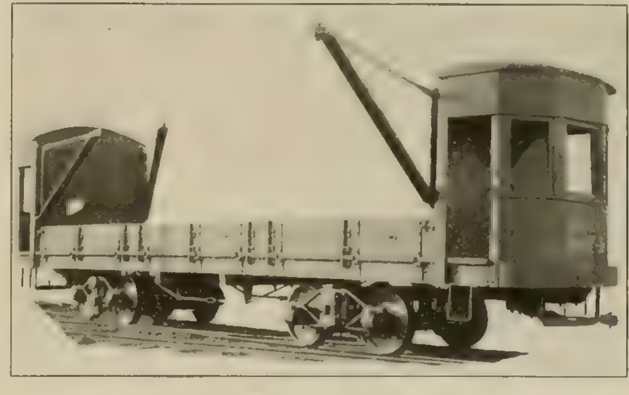
The blower is adjustable on the shaft and thus its outlet may be set to discharge in any direction, and it may be connected with the forge tuyere by means of galvanized iron piping. The blower is of cast iron, has a steel shaft running in babbitted boxes and a fan wheel of galvanized steel solidly riveted to a composition hub with extending arms. The frame is so arranged that the slackness of the belt driving the blower may be taken up; there are holes in the feet so the blower may be secured to the floor.

These hand blowers are made in two sizes. Style B-1 is 18 in. long and 48 in. high; the driving wheel is 24 in. in diameter, the blower outlet is 3½ in. in diameter and the outfit weighs 135 lb. Style B-2 has a 24-in. driving wheel, the blower outlet is 4¾ in. in diameter, and the complete outfit weighs 155 lb.

Philadelphia Rapid Transit Co's. Crane Car.

We illustrate herewith a gondola construction, or crane car used by the Philadelphia Rapid Transit Co., and which was built by the Middletown Car Works, Inc., of Middletown, Pa. It was designed by the railway company and is intended especially to handle rails, although it is suitable for handling any material. The car is about 38 ft. long and its extreme width is 8 ft. At each end is a cab 4 ft. in depth, the top of the roof being 11 ft. 11 in. above the rail.

Attached to each of the four inside corners of the cab, overhanging the car floor, is a steel swinging crane. The framing of the cab is well braced. The corner posts which directly support the



PHILADELPHIA CRANE CAR.

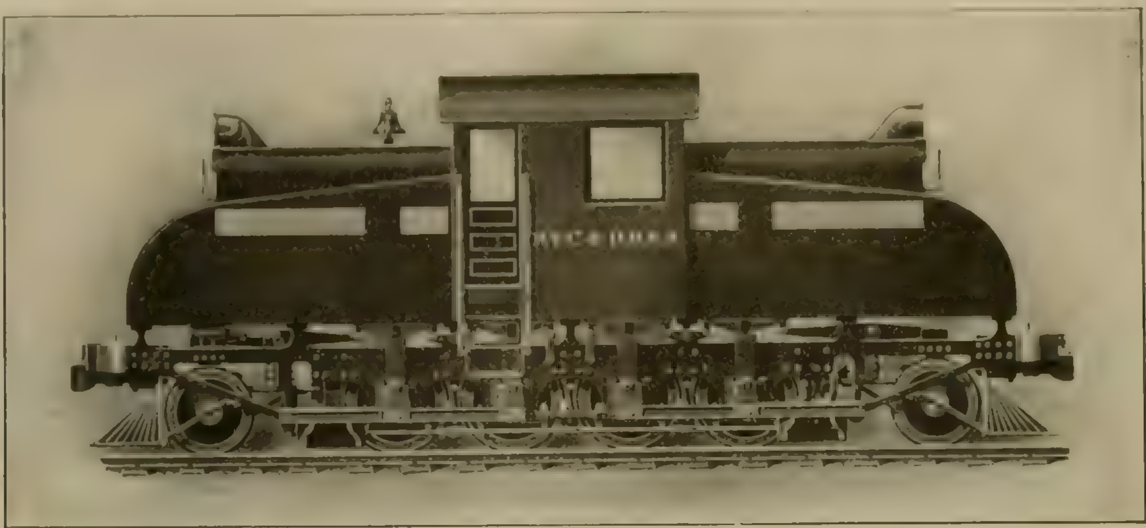
cranes are of 6 x 6 x ⅜-in. angle iron and the back wall of the cab is strengthened by two diagonal braces of 4 x 4 x ⅜-in. angle iron, fastened at the center by a ¼-in. iron plate. The side posts of the cab are of 4 x 4 x ⅜-in. angle iron, and these are attached to the corner posts which support the cranes by two diagonal braces above each cab door, the braces being of 2½ x 4-in. angle iron. The end posts are of 3 x 3 x ¼-in. angle iron.

There are six longitudinal sills in the floor framing, the side sills being 10-in. I-beams, 35 ft. long, reinforced on the inside by pine sills. The flooring of the car is of 2-in. plank and the floor frame is strengthened by 1-in. iron rods running from end to end, while the two under trusses are of 1¼-in. iron rods. The sides of the car are composed of six dump doors, 18 in. high, hinged, and held upright by bolts which drop into sockets at the bottom, with the exception of the end doors, which are bolted at the side. The doors facilitate the handling of dumpable material and increase the capacity of the car over that of an ordinary flat car. The side doors are of 2-in. plank. All the iron work is securely bolted and riveted and the simplicity of construction, as well as the strength of the car and its utility, is apparent. It will be seen that there is a door at each side of the cab and handles and steps are provided. There are three windows in each cab, also.

The government has appropriated $100,000 for experimenting with carrying the mails underground in Chicago in the tunnels of the Illinois Tunnel Co's. system, which was described in the "Review" for April. As quickly as possible the portion of the tunnel lying between the La Salle St. and Union stations will be equipped with suitable cars, and it is thought that by the middle of July the experiment may be begun.

Electric Locomotive for New York Central.

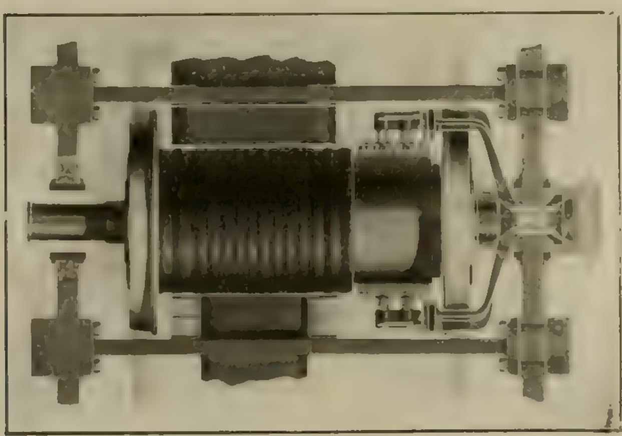
The accompanying illustrations show a general and detailed view of the new electric locomotives which are being built for the New York Central & Hudson River Railroad Co. These differ [illegible] in their electrical features from any electric locomotive heretofore built, and they are being made jointly by the General Electric Co.



ELECTRIC LOCOMOTIVE FOR NEW YORK CENTRAL.

and the American Locomotive Co. The motors are bipolar and are gearless, the magnetic circuit, the field windings and the poles being part of the locomotive frame and spring supported. The pole pieces are laminated and are vertically tangential to the armature, thus permittting the vertical movement of the locomotive frame and attached poles without affecting the armature air gap. The combined weight of the armature, axles and wheels is less than that of the rotating parts of many steam locomotives, and there is, of course, a perfect balance due to the absence of reciprocating parts. These machines were designed in accordance to specifications prepared by the Electric Traction Commission of the railroad, consisting of Messrs. W. J. Wilgus, John F. Deems, B. J. Arnold, Frank J. Sprague and George Gibbs. The secretary to the commission is Mr Edwin B. Katte, electrical engineer of the railroad company.

The specifications for these locomotives stipulated that they should be capable of making two regular successive trips of one hour each



SUSPENSION OF MOTOR ON TRUCK.

between Grand Central Station and Croton with a total train weight of 550 tons, a single stop in each direction and a lay-over not to exceed twenty minutes. In addition to this it was provided that a similar schedule should be maintained with somewhat lighter trains making more frequent stops. Finally, it was provided that with a total train weight of 435 tons, the electric locomotive should be able to run from Grand Central Station to Croton without stop in [illegible] be able to keep up [illegible] the equivalent of the present timing of the Empire State Express, though the latter has a somewhat lighter train.

The new locomotive will be 37 ft. in length over all and will have four pairs of motor wheels and two pairs of pony truck wheels. The diameter of the driving wheels is 44 in. and the driving axles are 8½ in. in diameter. Its total weight will be proximately 190,000 lb. The frame is of cast steel, the side and end frames being bolted at machine surfaces and stiffened by cast steel cross transoms. The journal boxes and axles have sufficient lateral play to pass easily over curves of 230 ft. radius. The superstructure is designed to offer a small resistance to the wind and the cab affords a clear view of the track. The superstructure is entirely of sheet steel with angle iron frames.

The motor equipment consists of four 600-volt direct current gearless motors, each of 550 h. p. capacity, making the normal rating of the locomotive 2,200 h. p. The maximum rating will be about 2,800 h. p., or 50 per cent more than that of the largest steam passenger locomotive in service. The armature will be mounted on a quill directly on the axle and is of the iron-clad type with series drum winding. The commutator will also be supported on the quill. The brush holders are of cast bronze and will be mounted on insulated supports attached to the spring saddle over the journal. The magnetic circuit will be made through the side and end framing of the machine instead of through the usual box casting. The Sprague-General Electric multiple unit control system will be used, provided with a check on the rate of acceleration which the engineer cannot exceed. The locomotive will also be provided with the usual accessories, including electric air compressor, whistles and a bell, electro-pneumatic sander and electric headlights. The cab will be heated by electric heaters.

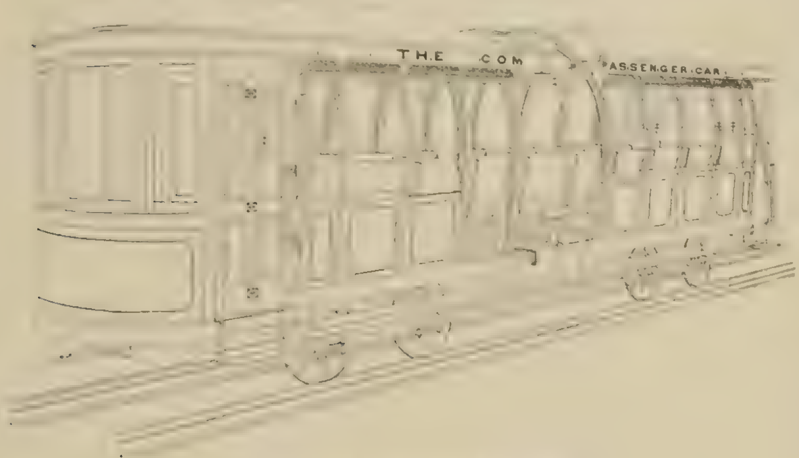
Ties for Electric Lines.

A considerable number of electric railways make use of a cedar tie that is a trifle smaller in dimensions than the standard specified on steam railroads. The quality is the same as the larger tie, but the smaller size and lighter weight enable the cedar dealer to deliver such ties at a greater distance from the purchasing points and at a reasonable price. When installed where the traffic conditions permit the use of a slightly smaller tie it has given satisfaction. The Maltby Lumber Co., of Bay City, Mich., has its smaller ties for electric railways in stock at its various yards and presents them as reliable in all respects, this material having an established record for 13 to 18 years' service in the track.

The Shamokin & Edgewood Electric Railway Co., of Shamokin, Pa., has increased the wages of motormen and conductors from 14 to 15 cents per hour.

The Comfort Passenger Car.

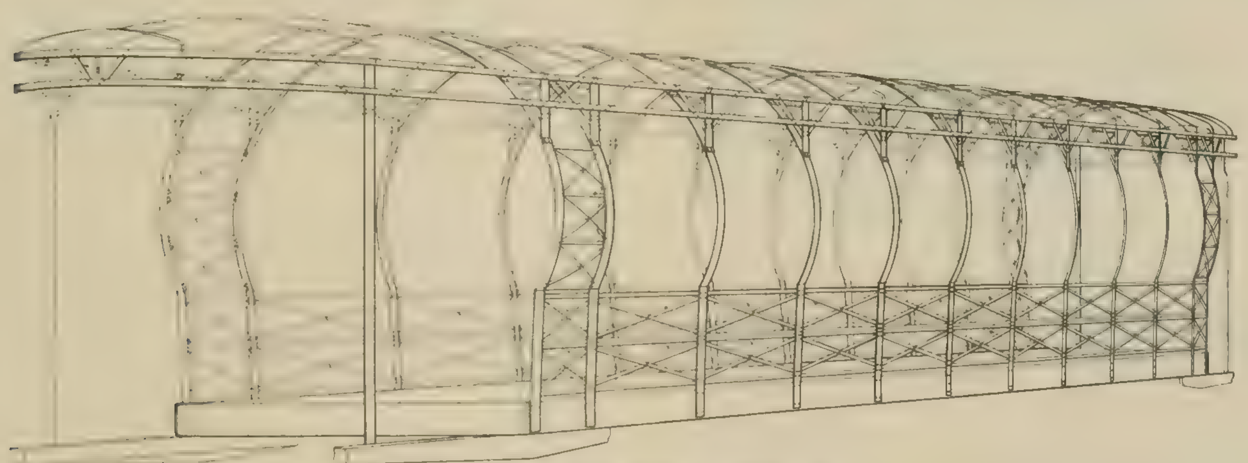
The views presented herewith illustrate the "Comfort" passenger car, suitable for all seasons, which has been designed by Herman Romunder, of Milwaukee, Wis. In this type of car is presented a construction that in one car body meets all the requirements of traction companies for a convertible car, and one that can be changed from an open or summer car to a closed or winter car in from two to five minutes, and while in motion, it being as well



ROMUNDER CONVERTIBLE CAR

a semi-convertible and a closed car. One of the illustrations shows the sides with diagonal bracing, which is used for permanently closed cars. This bracing is omitted in cars of the convertible type.

The characteristic features of construction of the "Comfort" passenger car are side sections consisting of two parts, a large curved window and a flexible panel underneath it, movable between



FRAMING OF ROMUNDER CLOSED CAR

vertical side posts or ribs, the posts being made of a T-shaped steel rib covered with wood containing the necessary grooves in which the side sections slide. These posts are reversible and interchangeable, and the car, owing to the steel frame construction, can therefore be made of any desired width.

The lower part of these side posts up to the line of the windows is straight, the upper portion being bent in the arc of a circle to accommodate the curved windows, both open and closed. Sufficient floor area is obtained for seats and aisles, as well as abundant space in the upper part of the car.

The large windows are of one sheet of curved glass held in steel frames which provide an absolutely rigid curved window sash. This type of window makes it an ideal observation car.

The flexible panels below the windows are composed of two plates of veneered wood, each consisting of three layers of veneer with reversed grain and united by a waterproof gluing composition, both plates being held together by lateral slats. The air space thus provided between the veneer plates serves to keep out cold, wet and draft; the panel is of the usual thickness, yet light in weight; owing to the reversed grain of the adjoining veneer layers in the veneer plates it has great strength, durability and lateral stiffness, and at the same time is sufficiently elastic and flexible so that it may be easily raised and lowered in the lower straight and upper curved grooves of the side posts. At its upper end the flexible panel is provided with a regular window sill which serves as an arm rest.

When the windows and flexible panels are closed down the car is perfectly tight on all sides. Any or all the windows may be raised without disturbing the flexible panels, it thus becoming an ordinary closed car with open windows. When the flexible panels are raised into the roof the car becomes an open car.

The roof is constructed of the same materials as the flexible panels, is lighter in weight than the usual roof construction, and is strong and durable and impervious to moisture and atmospheric influences.

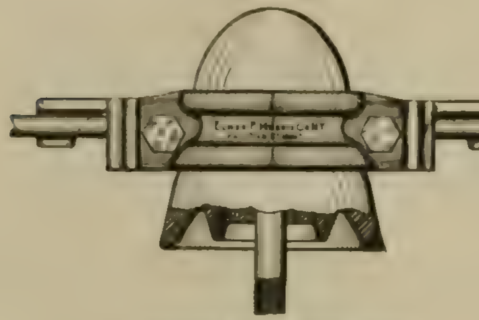
Another striking feature of this car is the system of ventilation, whereby the monitor roof is done away with, thus making the car six inches higher than the ordinary car. It is also three inches lower outside. The ventilation is accomplished by means of an air space formed between the overhanging outer roof, supported by the curved rafters and side posts and the inner veneered ceiling. Perforated curved metal sheets or screens placed between the side posts above the window line admit the outside air to this air space, after which it enters the interior of the car through openings in the ceiling, which when required can be closed partly or entirely by panel sashes. By reason of this arrangement the outside air on entering the air space must rise up to these openings in the car ceiling, and through same into the interior of the car, and, consequently, it is tempered somewhat in cold weather before reaching the interior of the car. A maximum of ventilation is afforded and all impurities, dust, soot and cinders are deposited during the upward course of the air and only pure air can enter the car.

The conductors and motormen of the Tri-City Railway Co., of Davenport, Ia., have just completed the erection of a club house on Vandruff Island in Rock River, immediately south of Black Hawk Watch Tower, to be used by them and their families as a pleasure resort. The fishing is exceptionally good at that point. The employes formed a club for the purpose.

In Los Angeles June 7th Judge Chambers overruled the demurrer in the case of the Pacific Electric Railway Co., charged with violating a city ordinance by failing to sprinkle the streets occupied by its tracks. The defendant claimed that the facts set forth in the complaint did not constitute a public offense, but the court ruled otherwise. A plea of not guilty was entered by the company,

High-Tension Line Material.

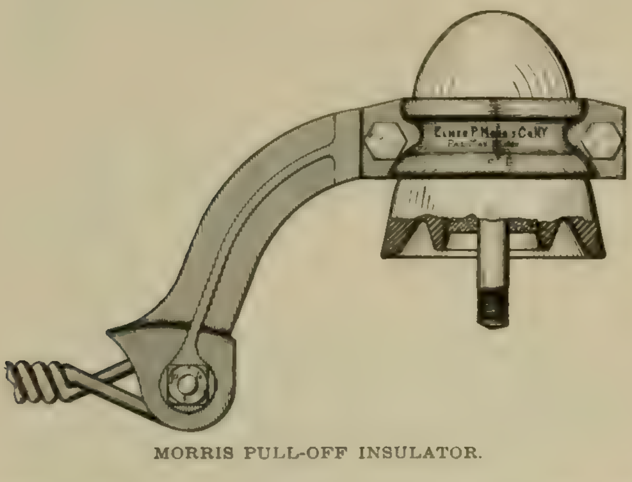
The accompanying illustrations show types of new high tension line material recently put upon the market by the Elmer P. Morris Co. The great difficulty, if not impossibility, of securing a composition which will withstand the disintegrating effects of the alternating current led to adoption in the material illustrated of a design



MORRIS LINE INSULATOR.

permitting the use of porcelain insulators throughout. There has been kept in view the object of making the size as small as possible consistent with strength and durability. Porcelain spools are used, thoroughly protected from the weather, and these give an additional insulating effect to the hanger.

The company guarantees these insulators as safe for a working pressure of 8,500 volts for the single type of straight line work, and the method of enclosing the porcelain insulators in the arms gives additional safety, as this construction will withstand the ordinary hard usage in service. These goods are of special interest at the



MORRIS PULL-OFF INSULATOR.

present time, owing to the introduction of alternating current street car motors and a consequent demand for insulating material capable of withstanding high voltage alternating currents.

Durability of Graphite Paint.

The recent fire in Baltimore afforded an excellent opportunity in the case of the Union Trust Building to test in actual practice the paint employed to protect steel in buildings. This building was erected in 1897-98, and although it was exposed to most severe heat during the fire, the steel framework was preserved intact. Much of the terra cotta fell away leaving the frame exposed, and where it was so exposed it was noted that there were practically no signs of rust, and the paint was as effective and glossy as when applied six years ago. It was painted with what is known as "No. 30 Superior Graphite" paint, which was manufactured by the Detroit Graphite Manufacturing Co., Detroit, Mich. The steel work of the building in question was painted once in the shop and twice after erection.

Crane Patent Pop Safety Valve.

To meet a constantly increasing demand for Crane patent pop safety valves the Crane Co., of Chicago, has increased the capacity of the departments employed in manufacturing these goods. The construction of these valves embodies a self adjusting feature which automatically regulates the pop of the valve and maintains the least waste of steam between the opening and closing points, there being no necessity of readjusting to regulate the pop on changes in the set pressure.

This is accomplished by means of a self-adjusting auxiliary valve and spring, which are entirely independent of the main valve and spring. The steam in the pop chamber finds a passage through holes or ports into an annular space provided in the auxiliary valve or disk, and by reason of the light auxiliary spring this pressure lifts the auxiliary valve and allows the steam in the pop chamber to gradually escape, thus permitting a greater range in setting pressures with the least waste of steam and at the same time supplying a cushion or balancing medium, thereby preventing shattering or hammering, and affording the easiest possible action in closing. This feature, it is pointed out, is embodied in no other make of valve, and unlike other pop valves, in changing set pressures within reasonable limits of the spring capacity, all that is necessary is to turn the screw pressure plug on the top of the valve.

The Crane encased spring valves are constructed with a casing or chamber enclosing both springs, protecting them against the action of the steam. This form of valve is particularly useful and even necessary where a number of valves may be connected to one main exhaust or discharge pipe. The Crane pop valves have bevel seats made of composition, or with solid nickel bushing, as required. The cam lever is capable of lifting the valve off its seat one-eighth the diameter of the valve opening, whether or not there is pressure on the boiler. The cam lever may also be thrown over far enough to lock the valve open.

The cap is made with handles or cross bars and fastened to the stem by a key pin, the stem being securely attached to the main or wing valve, and having a square section operating in a square socket, or recess, it affords a means of turning the valve on its seat, thereby removing any incrustation or saline matter that may accumulate. A self-adjusting pop regulator automatically controls and maintains a minimum waste of steam between the opening and closing points. The enclosed springs are made of the best steel and with self-adjusting spring disks. The valves can be taken apart without removal from the boiler and without disturbing the outlet pipe. All parts have been carefully designed and strongly proportioned, and properly adjusted and fitted with correspondingly strong springs are suitable for pressures up to 250 lb. Special valves for higher pressures are made to order. The valves are furnished locked up to prevent tampering with them.

Evaporative Test on the Green Economizer.

An evaporative test of the boilers in the station of the Old Colony Street Railway Co., at Newport, R. I., with the Green economizer first in service and then off, was recently made by Mr. George H. Barrus, from whose report the following statements are taken. This steam plant consists of four 350-h. p. water-tube boilers made by the Aultman & Taylor Machinery Co. and three 500-kw. Curtis steam turbines. The economizer has 384 tubes and is placed in the rear of the main flue, the dampers being so arranged as to deflect the gases from the boilers, either through the economizer or direct to the chimney as may be desired. The area of heating surface of the economizer is about 4,608 sq. ft. and the scrapers are operated by a 2-h. p. electric motor. The tubes were cleaned both inside and outside a short time previous to the test. The tests were made under the working conditions of the plant and covered a period of 24 hours. The results of the tests, showing the saving of fuel due to the use of the economizer, and reduced to the same quantity of water evaporated and to the same initial temperature entering the economizer, are as follows:

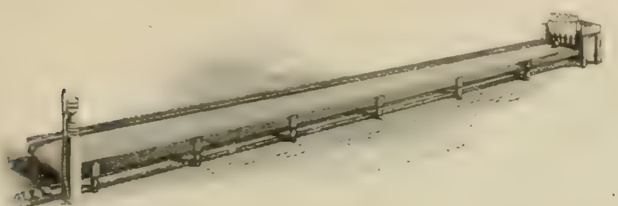
Weight of dry coal consumed in 24 hours with economizer on, 30,709 lb.; weight of dry coal consumed in 24 hours with economizer off, 35,060 lb.; saving due to economizer for 24 hours' run when evaporating 302,212 lb. of water from 103°, 4,351 lb.; percentage of saving due to economizer, 12.4.

Box Ball a Fine Park Attraction.

We present herewith an illustration of a box ball alley which is strongly recommended to street railways especially as a park attraction. Box ball is a novel game which was invented in 1902. It is similar to ten pins, but has distinctive features which cause it to be regarded as one of the most popular and fascinating forms of entertainment and exercise. It comprises an alley, five pins and the balls with which to play. The alley is regularly 30 ft. long and 3 ft. wide over all, but it can be furnished in any desired length. The rolling surface at the front end is 12 in. high from the floor, elevating to 16 in. at the rear. The alley is solidly built and will not easily get out of repair. It is beautifully finished and very attractive.

The bed is made of strips, ⅞ x 1¾ in., glued and nailed, and worked to a true surface. It is secured to heavy battens running crosswise, which makes it very rigid. The bed is completely covered by a composition of cork and rubber 5/16 in. thick and this, together with the manner of construction, greatly eliminates the noise and the balls roll more perfectly than on a wood surface. This covering is very durable, but it can be renewed at any time at a cost of about 30 cents per square foot, including the cost of putting it on.

Box ball contains many of the desirable features of bowling and it can be installed at about one-third the cost of a good bowling alley. It is portable and can be transferred from place to place



BOX BALL ALLEY.

without injury, hence it is suggested that after operating the alley in the street railway park during the summer it can be removed to a business room and operated through the winter, and in this way it will earn money all the year.

One of the obvious advantages of the box ball alley lies in the fact that it can be operated without the expense of a helper to set up pins and return the balls. The name "box ball" was suggested by the use of a box device containing muffler curtains which noiselessly receives the balls and returns them to the player by gravitation through a chute placed under the bed of the alley. This method saves much time, as well as expense.

The earning capacity of the alley at 5 cents per player for a 10-frame game is $1.40 an hour, which is equal to almost three times the earning capacity of a single bowling alley.

Box ball is in use in many Y. M. C. A. rooms, clubs, hotels, health resorts, etc. The game produces the requisite amount of physical exercise without causing undue fatigue, the balls weighing but 2¼ lb. apiece. Ladies and children find it a game which they can play easily.

Box ball alleys are made by the American Box Ball Co., 1140 Shelby St., Indianapolis, Ind., and the company states that it can ship any reasonable order the day it is received. The alley can be placed in operation by a workman of ordinary ability inside of four hours.

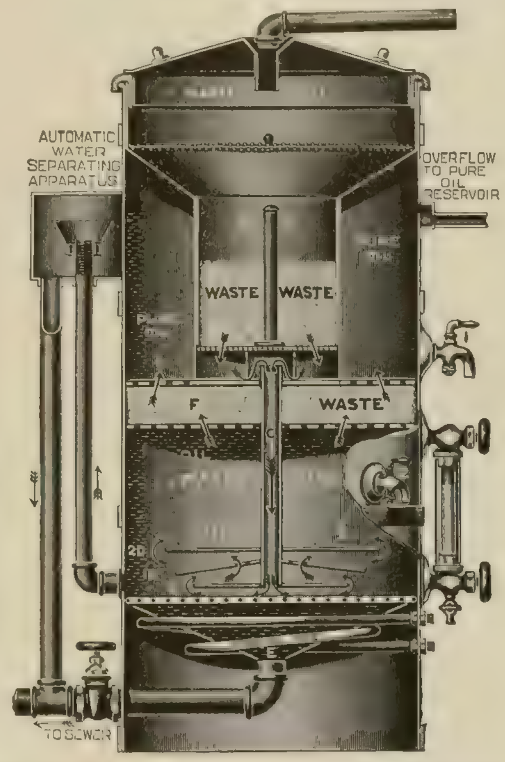
Satisfactory Emergency Brake Tests.

A short time ago the Emergency Car Brake Co., of Cumberland, Md., which manufactures the Fresh emergency brake, installed its brakes on cars of the Ft. Wayne & Wabash Valley Traction Co. for trial at La Fayette and Wabash, Ind. At both places there are heavy grades at railroad crossings and there had been considerable difficulty in holding cars on these grades. It is stated that with the emergency brake the cars were under complete control under the most difficult conditions of track and the tests were eminently satisfactory to the railway company. The Emergency Car Brake Co. is equipping a 40-ton, 60-ft. interurban car at Canton, O., for the Canton Akron Ry. for a 60 days' test.

Saving Cylinder Oil.

The accompanying illustration shows the Burt Manufacturing Co's. style B oil filter which is designed to take the condensation from the oil separators and exhaust heads, automatically separate the oil from the water and purify the oil at the same time, the pure oil going into the pure oil reservoir and the water running from the drip into the sewer.

The oil and water are poured in the top of the filter and then pass into chamber B through the layer of waste which collects all the heavier impurities of the oil; from thence through the perforated bottom of chamber B in the direction shown by the arrows into tube C, and from here to filter plate D, where the increased weight of the water has a tendency to keep the oil back in tube C. The pressure of oil in chamber B forces it down and spreads it out over plate D in a very thin film, which constantly changes sur-



STYLE B OIL FILTER—BURT MANUFACTURING CO.

face and grows thinner as it travels from the center to the circumference of the plate, thus exposing every particle of waste oil to the action of the water. It then flows upon plates D′ and D″, going through the same process in each case. When the oil leaves the filter plate D″ it is in a finely divided state of separation and thoroughly mixed with water, which washes it out and from which it separates by gravity all the remaining impurities which settle in chamber E and which can be removed by opening the gate valve at the bottom of the filter, which action drains off all the water and dirt. From plate D″ the oil filters through the stratum of filtering material F and from there it rises to the pure oil chamber and flows to the oil reservoir.

The water is automatically separated after it passes down the tube C and reaches the bottom plate, as the oil being lighter than water rises when it reaches the bottom of the filter, and the surplus water passes into the tube, which leads to the automatic water separating device. Before the introduction of the style B oil filter all cylinder oil went to waste.

This filter is made in sizes of from 3 to 500 gallons daily capacity. It is in use by the National Cash Register Co., the U. S. Steel Corporation, Westinghouse Air Brake Co., Allegheny County Light Co., Edison Electric Light Co., and at many other large plants. Burt Manufacturing Co. filters have been adopted by nine foreign governments. The company's works are at Akron, O.

June 21st highwaymen shot and robbed the conductor and robbed two passengers on a United Railways car near Baltimore.

The M. P. Lightning Arrester.

The Westinghouse Electric & Manufacturing Co. has placed upon the market a new lightning arrester which will be known as the "M. P." lightning arrester. This device is the result of experiments conducted by Mr. P. H. Thomas, extending over several years, both in the laboratory and under service conditions.

Two general principles underlie the successful operation of this arrester: 1. There is a minimum voltage, below which an arc cannot be maintained across an air gap, no matter how small that gap may be. 2. Under proper conditions a static discharge will distribute itself over a great number of parallel paths, so that the amount passing over any one path will be very small, producing practically no heating or disintegrating effect.

The arrester takes its name, "M. P." (multi-path), from this second principle.

The arrester consists essentially of a specially prepared block of carbon, in which the area offered for discharges is very great as compared to the length of path through which the discharges pass. In this block there are a great number of separate conducting paths, and the discharge passing through the block divides, and takes simultaneously many different ones. Each of these paths is broken up by a large number of minute air gaps, so that the voltage across each gap is very small and the line voltage cannot maintain an arc across them. The arrester is non-arcing, since the line current does not follow the static discharge.

In series with the carbon is a small air gap rigidly maintained between two metal surfaces. This air gap keeps the arrester insulated from the line, except at the instant of a discharge. The active parts of the arrester are enclosed in a cast-iron box which is filled with a waterproof compound.

The arrester may be used either indoors or outside, and may be located in practically any position desired. The weight is small and it has no moving parts.

The advantages claimed for this device are summed up as follows: It has low resistance to static discharges, is non-arcing, has no moving parts and is of fireproof construction; it is of light weight, is of neat appearance, is easily installed and is simple and compact.

Automatic Gate for Railway Cars.

A device recently invented by Mr. Urban A. Walter, of Toledo, O., consists of an automatic gate for street, interurban and elevated railway cars. The chief features of this gate, for which patents have been applied, are arrangements whereby the gate unlocks and opens automatically when the car comes to a stop and whereby it closes and locks automatically and simultaneously with the starting of the car. In a general way it may be stated that the invention consists of the combination of a platform gate with a power device for opening and closing, and an automatic device which actuates the power device when the car comes to a stop and when it starts. The automatic device consists of a suitable frame containing the necessary gearing, one end of the frame being pivotally connected to the truck frame and the other end containing a wheel which runs on top of one of the track rails. The wheel is held into a contact with the rail by means of a spring between the truck frame and a lug on the casting. This wheel, running on the track, actuates by means of a train of gearing a flat disk wheel, on one side of which is mounted a pair of fly ball governors. The motion of these governors makes and breaks an electric circuit which operates the gates. When the car is moving and the governors are thrown open to their widest position the circuit for the gate is opened, but when the car stops the governor closes and completes the circuit, which is grounded to the rail through a pair of magnets.

The gates are built of pipe and are hinged so as to fold up in a vertical plane when opened. In opening the horizontal bars of the gate describe a quarter circle and a chain running over a quadrant of a circle fastened on the end of one of the bars is held at its other end by the tension of a spring, which nearly balances the weight of the gate in opening and closing. The lower end of the rod, which is a continuation of the chain, passes through the spring and carries on its lower end an armature, beneath which, at a short distance, is located a horse-shoe magnet. The current for operating this is closed and broken by the automatic device previously described. When the car comes to a standstill the motion of the governor grounds the circuit through the magnet to the rail and the pull of the magnet, in addition to that of the spring, draws down the chain and lifts the gate open. On the other hand, when the car starts and the motion of the governor breaks this circuit, the magnet releases the armature and the gate falls into its closed position.

Wabash R. R. World's Fair Terminal.

The Wabash R. R's. World's Fair terminal, which we illustrate herewith, is located directly in front of the main entrance to the Fair. In the arrangement of the tracks due provision has been made for handling the local, the through and the excursion business on rapid schedules, each independently of the others, and every precaution is observed for safety. The St. Louis Transit Co's. terminal loop is located north of all the Wabash tracks and street car passengers reach the main entrance to the Fair on a broad plaza passing under the Wabash tracks, thus avoiding grade crossing dangers.

The two tracks nearest Lindell Ave. are used for the shuttle or local trains, which run between the Union Station and the Fair grounds. These tracks lead into the through main tracks just

WABASH TERMINAL BUILDING, ST. LOUIS.

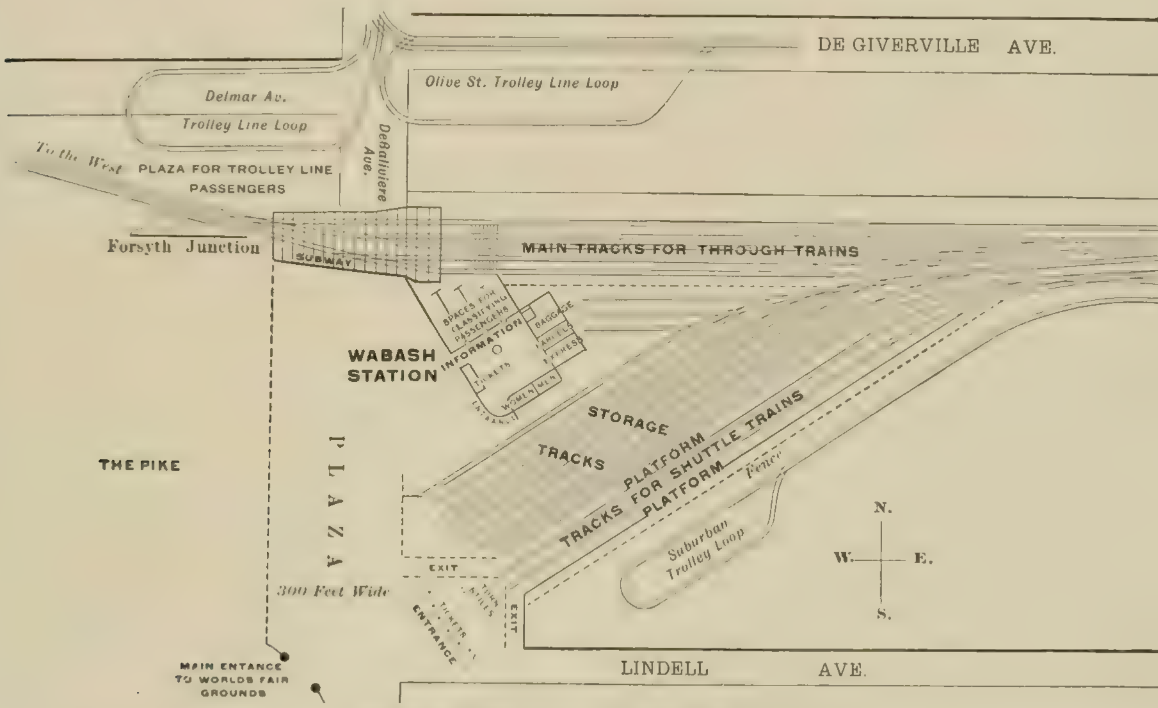
west of Union Ave., and the main tracks have automatic electric block signals every 1,200 ft. from Page Ave. to the Union Station. The cars for this shuttle train service, which was inaugurated April 30th, were especially constructed by the American Car & Foundry Co. They are 50 ft. long inside, 8 ft. 9 in. wide and 8 ft. 9¾ in. high. They have steel underframes and below the floor line are of standard freight car construction. The seats are arranged across the car, giving a seating capacity for 92 passengers, the entire capacity of each car being 120 persons. The doors are on the sides and run on rails outside the car and those on one side are opened simultaneously by a rod and lever at one end of the car. The trains comprise 8 and 10 cars and it is possible to handle about 25,000 passengers an hour with these trains.

The shuttle trains can be unloaded very quickly, as they have no steps, the floor of the cars being on a level with the platforms alongside the tracks. Passengers are unloaded on the platforms outside of the two tracks, and are loaded from a platform between the tracks, the entrance to this center platform being between turnstiles, where passengers are required to deposit their tickets before being admitted.

The tracks immediately north of the shuttle train tracks are used for storing shuttle trains during the dull hours of the day and also for storing special trains and private cars. The five main or through tracks are used for the through and excursion trains. There are platforms between these tracks and passengers do not have to cross the tracks, but descend from the platform

by a short flight of stairs to the subway under the tracks at De Baliviere Ave. The arrangement is such that local trains may be run over the through tracks to Page Ave. and thence by the Terminal belt road and a large number of passengers per hour ,can be handled that way. Excursion trains from the East are run via the Merchants Bridge and the Terminal belt to Page Ave., and thence to the Fair grounds, and also via the Eads Bridge and Mill Creek Valley road.

Immediately south of the main tracks and fronting on the plaza is the Wabash terminal station, also illustrated herewith, the structure costing $50,000. It is a commodious depot, consisting of a waiting room 100 ft. square, with an information bureau in the center, and all the usual toilet rooms, ticket offices, parcel and baggage rooms and an express office. On the north side of the station and adjoining the main waiting room are four classification compartments which comprise a unique feature. For instance, at a certain hour there will be scheduled a westbound through or excursion train. A sign is displayed over the entrance to one of these compartments indicating the track from which the train will depart, and passengers holding tickets for that train are admitted to that compartment, no other persons being allowed to enter. When the train is announced the gate from that compartment is opened and passengers proceed to the platform and thence to their train. By this means all crowding is avoided and passengers cannot board the wrong train.



WABASH TERMINALS AT WORLD'S FAIR.

Advertising Literature.

THE SPRAGUE ELECTRIC CO., New York City, has issued Bulletin No. 219 (superseding No. 206), on "Round Type Motors, Direct Current."

THE JEFFREY MANUFACTURING CO., of Columbus, O., has issued Bulletin No. 8 on "Electric Locomotives for Gathering Purposes." By C. E. Waxbom.

THE BULLOCK ELECTRIC MANUFACTURING CO., Cincinnati, O., has issued Bulletin No. 1,026 (superseding Nos. 1,012 and 1,013), "Multipolar Motors and Generators, Type H and HI (Belted)."

THE R. D. NUTTALL CO., Pittsburg, Pa., has issued a list of hobs, any of which it is prepared to employ (without extra charge) in the manufacture of worm gears when the specifications permit. The list contains only hobs in stock, but the company states that it is in a position to manufacture any hob called for in specification.

THE ARNOLD ELECTRIC POWER STATION CO., Chicago, has issued Bulletin No. 8, "The Omaha Shops of the Union Pacific Railroad," and Bulletin No. 9, "The Baring Cross Shops of the St. Louis, Iron Mountain & Southern Railway."

THE CROCKER-WHEELER CO., Ampere, N. J., has issued Bulletin No. 45, "The Government Printing Office; the Electrical Equipment of the Largest Printing Office in the World," being an abstract from a series of articles by T. C. Martin, editor of the Electrical World and Engineer.

THE PROUTY-PIERCE LOCOMOTIVE MANUFACTURING CO., 665 Adams St., Kansas City, Kan., has issued a 12-page catalog, 6x9 in., illustrated, treating of passenger gasoline locomotives, gasoline combination interurban cars, gasoline locomotives and mine and yard locomotives. This company makes gasoline locomotives exclusively.

THE H. W. JOHNS-MANVILLE CO., 100 William St., New York, has issued a little folder, entitled "The 'Log' of the 'Polaris,'" which contains a fac simile letter from Mr. Alfred S. Franklin, of New York, in which that gentleman states that the company's "Mobilene" sheet packing which he used on his launch "Polaris" a whole season gave perfect satisfaction, whereas all other packings which he had used failed.

THE GOHEEN MANUFACTURING CO., of Canton, O., is mailing a card advertising "Galvanum" which is manufactured exclusively by this company for the protection of galvanized iron work. "Galvanum" is used by the United States government and the post card in question is illustrated by views showing the power house and machine shops at the navy yard at New Orleans, La., upon which "Galvanum" has been used.

THE CONSOLIDATED CAR HEATING CO., Albany, N. Y., has issued Catalog No. 7, treating of hot water heaters for electric railway cars. The catalog describes and illustrates fully the "Consolidated" heater No. 198 and its parts. This heater was designed to meet the demand of interurban railroads desiring a compact, economical and efficient hot water heater.

THE MAYER & ENGLUND CO., of Philadelphia, in the Keystone Traveller for May announces that the entire system of the Trenton (N. J.) Street Railway Co. has been equipped with "Philadelphia" fenders and that they are a little different from the regular "Philadelphia" fenders, in respect that they are equipped with flexible steel wire nets instead of rope nets.

THE STANDARD VITRIFIED CONDUIT CO., 39-41 Cortlandt St., New York, B. S. Barnard, manager, has issued a four-page folder illustrating the company's products, which include

single and multiple duct conduits and the Manhattan third-rail insulator. On the cover of the folder is an illustration showing Standard conduit in process of installation at the power house of the Niagara Falls Power Co.

THE WESTINGHOUSE COMPANIES' Map of St. Louis and the 1904 World's Fair Grounds is the title of a folder which was recently issued, indicating points of interest in the city of St. Louis and pointing out some Westinghouse features of the Louisiana Purchase Exposition, enumerating the principal Westinghouse exhibits, together with their locations, etc. The folder contains two colored maps, one of the city itself and the other showing the World's Fair grounds, each map being accompanied by a handy index. Some typical Westinghouse installations in St. Louis are given, also.

THE GREEN ENGINEERING CO., of Chicago, has recently published its Catalog "D," descriptive of the Green traveling link grates, and illustrating a number of the important installations recently made by it. These amount in the aggregate to over a half million horse power. The company has patented a flat igniting "arch," which is made up of blocks suspended from cast iron bars, which are in turn fastened to channels extending transversely across the gate. The bars are spaced parallel and the blocks are so shaped as to slip in between them, grooves in the sides of the blocks engaging the lower flanges on the iron bars. This gives a perfectly flat igniting arch and insures uniform combustion. In this catalog are also given tables showing the analysis of Ohio coals by counties and seams, and of Illinois and Pennsylvania coals by counties. These tables will be found most convenient and valuable for reference.

THE JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J., has issued the eighth edition (revised) of its publication entitled "Graphite as a Lubricant Scientifically and Practically Considered; Notes Upon Its Manifold Usefulness as an Accessory for Engineers." It contains 52 pages, 5½x8 in., and is nicely printed. It is illustrated. The chapters treat of the following subjects: Friction and Lubrication; Graphite; Scientific Opinions and Tests; Practical Experience with Dixon's Graphite; Ways of Feeding Graphite; The Sphere of a Graphite Bearing Metal; Dixon's Pure Flake Graphite. The company has incorporated a new feature in its monthly paper called Graphite, it being a London page whereon will appear items of interest relating to the Dixon business in England. Two pamphlets just issued by the company treat of "Dixon's Ticonderoga Graphite Grease" and "Dixon's Graphite Cup Greases."

THE INDIANAPOLIS SWITCH & FROG CO., of Springfield, O., has issued through its mine track department a booklet treating of light rail frogs and switches and stands for mines, quarries, industrials and miniature railway tracks. It is illustrated with halftone views showing combined switch and frog for short radius turnouts, single tie-bar split switch, two tie-bar split switch, bolted and filled frogs, riveted plate frog, plain ground throw stand, and spring ground throw stand for use in connection with split switches where a spring is required. The company has also issued a four-page folder illustrating general track work and announcing that folder and catalog will be sent upon request. Other matter issued by the company includes a circular illustrating and describing the "Little Giant" switch stand, for which it is claimed that it excels in durability, utility and economy, it being practically a universal stand which can be used for all purposes.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING CO. has issued an attractive publication of 44 pages, entitled "Works of Westinghouse Electric & Manufacturing Co.; Their Industrial and Sociological Aspect." It is illustrated with 62 camera pictures, and is handsomely bound in heavy paper covers highly illumined in colors and bronze. The pages are ornamented very artistically, also. The text includes a brief history of the plant, which was organized in 1886 with 200 workmen and now has 9,000 employes at the main works at East Pittsburg, with 3,000 additional employes at branch factories. There are also sketches of some of the largest electrical installations which have been made by the company, including those of the Interborough Rapid Transit Co., New York; Louisiana Purchase Exposition; South Side Elevated Railroad Co., Chicago, and installations at Niagara Falls. The views show various interesting features of the great plant, such as interior and exterior views, work in process or completed and installed, views of the Electric Club, of the billiard room and bowling alleys, offices and a group picture of the engineering apprentices. Two very interesting views show the army of employes arriving at and leaving the works morning and night. There is also a map showing the location of the Westinghouse interests and how they are reached by steam and trolley lines.

THE JONES UNDER-FEED STOKER CO. OF AMERICA, Marquette Building, Chicago, in the Publicity Magazine for May published the results of comparative tests between hand stoking and firing by means of a Jones stoker at the plant of the Williams Brothers Co., Detroit, Mich., using a return tubular boiler, 60x16, 80 h. p. The tests covered 8 hours in each instance and for hand firing lump coal was used, while Sandy Creek and washed pea coal were employed with the stoker. The gain in evaporation by use of the Jones stoker was 28.2 per cent and the saving in coal amounted to 22 per cent. The Publicity Magazine for June might be designated a smoke abatement number, as it contains a number of illustrations of the abatement of smoke by the installation of Jones stokers. This company has just received a fifth order from the St. Louis & Suburban Railway Co. for six stokers which will make a total of 45 Jones stokers in that plant.

THE CLIMAX STOCK GUARD CO., of Canton, O., with general sales offices at Chicago, has issued an eight-page booklet treating of the well and favorably known "Climax" stock guard, which is an effective, durable and economical surface stock guard for use on steam and electric lines. Some of the lines upon which the "Climax" guard is used include the Aurora, Elgin & Chicago Railway Co.; Canton-New Philadelphia Electric Railway Co.; Chicago & South Shore Electric Railway Co.; Chicago & Milwaukee Electric Railway Co.; Cincinnati, Dayton & Toledo Traction Co.; Cleveland, Painesville & Ashtabula Railway Co.; Cleveland & Southwestern Traction Co.; Columbus, Delaware & Marion Railway Co.; Dayton & Western Traction Co.; Des Moines Inter-Urban Railway Co.; Illinois Valley Traction Co.; Indianapolis & Plainfield Electric Railway Co.; Marcellus (N. Y.) Electric Railroad Co.; Mobile Light & Railway Co.; Utica & Mohawk Valley Railway Co., and a number of other well-known electric railway systems.

THE INGERSOLL-SERGEANT DRILL CO., 26 Cortlandt St., New York, has just issued Compressor Catalog No. 35. While this catalog is really only the "advance sheets" of a larger and more complete catalog (No. 36), which will appear later in the summer, it is complete in itself. It marks a departure from the usual form and is more like a portfolio of pictures of standard types and prominent installations. In it facts are briefly stated; there are pertinent captions for the illustrations and brief foot notes to the tables describing the standard types of compressors, but lengthy descriptions have been avoided. For the first time in any Ingersoll-Sergeant publication a picture of the new works at Phillipsburg, N. J., is shown. This plant is the largest of its kind anywhere. Another interesting illustration shows the largest corliss air compressor in the world, operated by the Homestake Mining Co., at Lead, S. D. There are also illustrations of electric-driven air compressors, 40 of which have just been installed by the St. Louis Transit Co. for a new system of storage air brakes.

In the city of Mexico, by order of the governor of the federal district, signs have been placed upon all saloons forbidding the entrance therein of minors and street railway employes.

The Boston & Worcester Street Railway Co. recently made a successful trial of operating a two-car train from Worcester to Brookline, Mass., using the multiple unit control system.

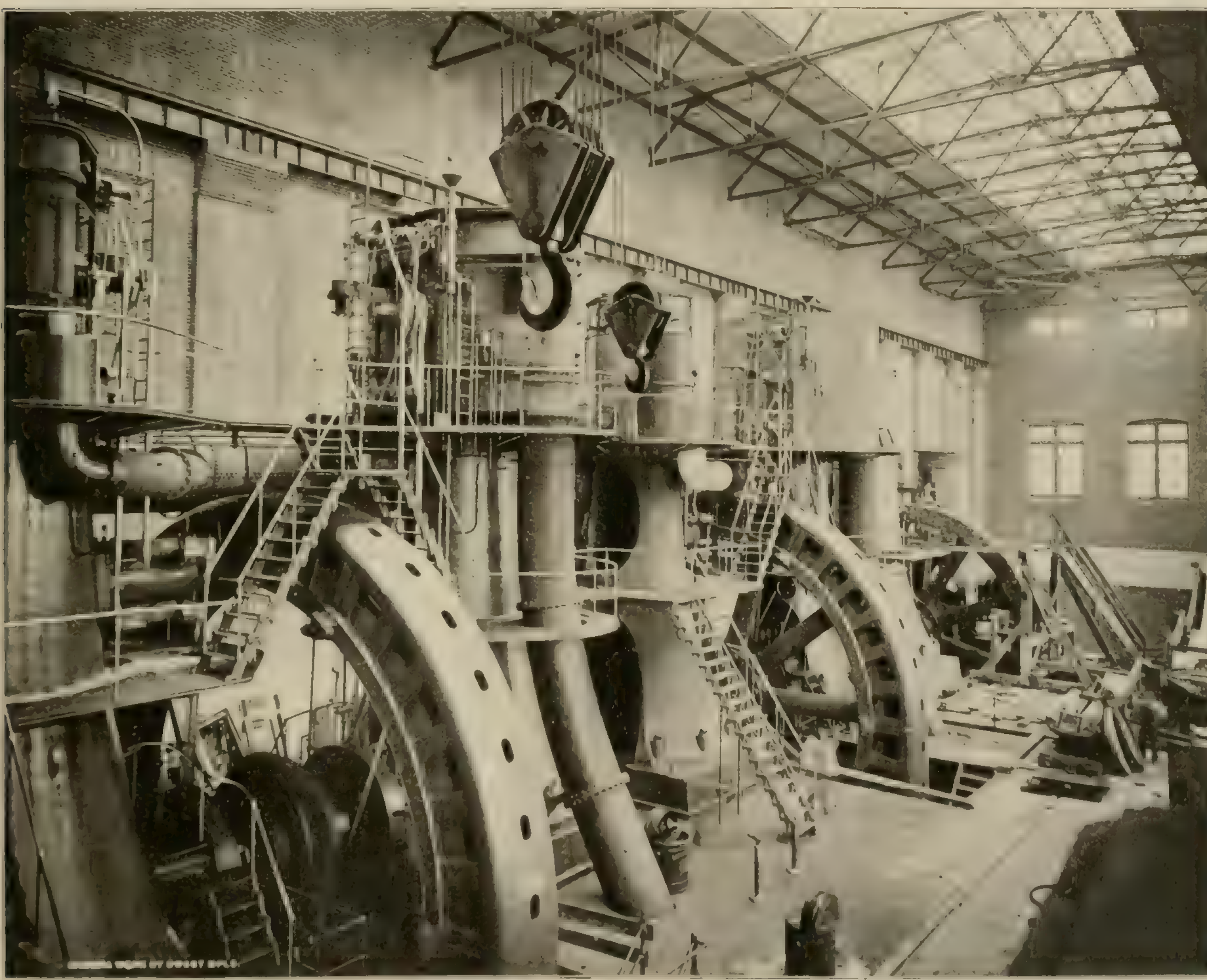
The Parkersburg, Marietta & Interurban Railway Co. is extending its present power station at Parkersburg, W. Va., with Westinghouse-Parsons steam turbines. A 400-kw. unit will be installed for the present, which will operate on 150 lb. steam and 28-in. vacuum. Steam will be furnished by water-tube boilers without superheater. The generator will furnish 2-phase, 60-cycle current at 2,200 volts to a single-phase distribution system supplying current for local lighting. The turbine unit will operate in parallel with the present equipment of the plant, which consists of Westinghouse compound engine generating outfits of the belted type.

STREET RAILWAY REVIEW

Vol. XIV JULY 20, 1904 No. 7

New Power Installation of the Twin City Rapid Transit Co.

The extensive addition which the Twin City Rapid Transit Co., of Minneapolis and St. Paul, has found it necessary to make to its power equipment is an index of the success which has attended the operation of this company. The management of an urban transportation company always has difficulty in deciding where to draw the line between the conservatism that shall properly guard the interests of stockholders, and the optimism sure to be engendered by a study of street railways in America. Those to whom the success of the Twin City company is due have always taken a broad view of conditions, and the courage with which they have acted on their convictions has excited the admiration of all connected with the industry.



ENGINE AND GENERATOR ROOM, NEW POWER STATION, TWIN CITY RAPID TRANSIT CO.

The Twin City Rapid Transit Co. is one of the few of the larger systems in this country in which there has not been a change in management in recent years; Mr. Lowry, the president, and Mr. Goodrich, the vice-president, have been connected with the Twin City system for over 25 years, and Mr. Hield, the general manager, for 17 years.

Prior to 1898 the power for the Twin City Rapid Transit system was supplied from three steam stations, aggregating 10,500 h. p. in capacity, two located in Minneapolis and one in St. Paul. Jan. 1, 1898, the St. Anthony Falls Water Power Co. put in partial operation the water power plant built to supply current to the railway, and a few weeks later seven 700-kw. generators were in service. This water power plant, which was described in the "Review" for February, 1899, was designed for ten 700-kw. generators, and the intention was to abandon regular use of the two steam plants in Minneapolis. One of the steam plants was dismantled and the other held as a reserve.

The rapid growth of the company's business, largely due to the numerous extensions and interurban lines which have been built during the past two years, led the company to plan the erection of a

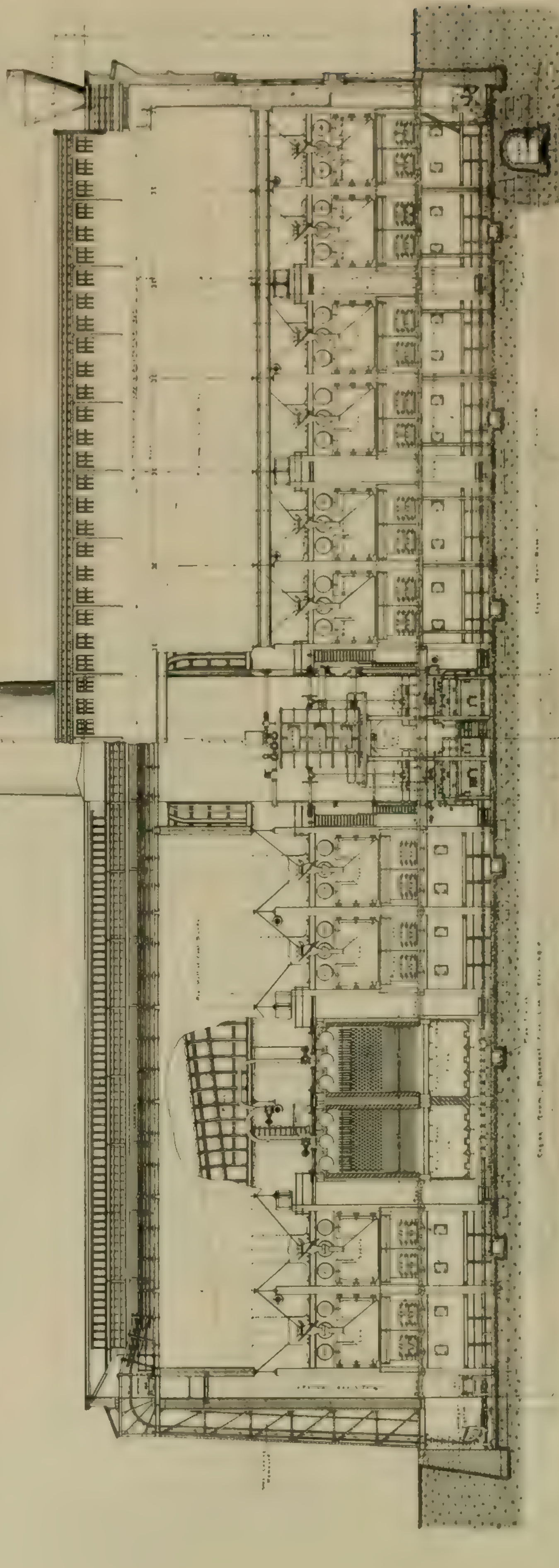
new steam power station, which was begun in 1902 and is now approaching completion.

In this work an attempt has been made to plan for the future, and the design contemplates an ultimate rated capacity of 35,000 kw., or a maximum output of say 50,000 kw. The station as built is just half of the ultimate size, and of the five 3,500-kw. units now provided for, only three are to be installed at present. That is, the present rated capacity is 30 per cent of the ultimate, or 10,500 kw.

The new station lies on the north bank of the Mississippi River, just east of the 10th Ave. bridge in Minneapolis, and is within 300 ft. of the water power plant. The building is of light red brick and is 155 ft. 11 in. wide by 255 ft 2 in. long, the present east wall being 6 ft. beyond what will be the center of the building when extended in accordance with the ultimate plan. At the northeast corner are the coal receiving hopper and ash hopper in a rectangular addition to the main building, measuring 20 x 40 ft. The coal track for serving the station is along the north side of the building; this track is level for 500 ft., and then connects with the Great Northern R. R. by an easy grade.

The engines and generators occupy the south portion of the building, a room 67 ft. wide, extending the full length of the building and 56 ft. high from the floor to the bottom chords of the roof trusses. The floor of the basement is 20 ft. below the engine room floor.

The boiler room is 83 ft. wide and is symmetrical about on east and west line through the center, and with the exception of the cross-conveyor of the coal and ash handling system is also symmetrical about a north and south line through the center of the stacks. The basement floor level under this portion of the building is 10 ft. higher than that under the engine room, and the boiler room floor is 4 ft. higher than that of the engine room.



LONGITUDINAL SECTION THROUGH BOILER ROOM.

The site on which the station was erected is underlaid with sand rock, constituting an excellent foundation, and in fact the foundations of the building are merely concrete blocks or benches laid on the rock to give level surfaces on which to lay the walls or support the iron structure. Near the river shore the underlying rock was covered with loose drift and debris, which required a deep excavation for the foundation of the south wall of the building. To ensure a supply of condensing water at all times it was desirable for the intake from the river to be at a level below that of the water even were the pool above the dam to be drained, and by placing the intake at the south side of the building and making the building wall form one side of the tunnel, this object was attained at a minimum cost for excavation, and suitable foundations secured.

The walls of the building have to support little except their own weight, as the boilers, the coal bunkers, the crane ways and everything involving heavy stresses are all carried on the steel frame of the building.

The arrangement of the apparatus is apparent from the general plan, longitudinal and transverse sections shown in accompanying engravings. Two Custodis stacks 16 ft. inside diameter at the top and 162 ft. high, set on foundations extending 63 ft. above the boiler room floor giving 225 ft. above floor, are on a north and south center line. On each side of each stack is space for six boilers, an arrangement permitting of short and direct smoke flues from boilers to stacks.

Above the boilers are the coal bunkers, which have an aggregate capacity of 2,800 tons.

The two bunkers are continuous from end to end of the building, and are built of concrete reinforced with steel I-beams. The sloping portion of the wall next the boilers is similarly reinforced. All of the beams in the bunker walls are framed into the steel building structure, with girders placed to take the thrusts due to the coal pressure on each wall, and transmit them to the

deep cross girders supporting the bunkers. This construction obviates the need of tie rods through the bunkers, which always give trouble because of their short life, and the obstruction offered to free flow of the coal. Over each boiler is a steel hopper, these hoppers forming, with the sloping wall, the bottom of the bunker.

By placing the coal bunkers back over the boilers as far as the flues permit, and dividing the capacity between two bunkers, space is gained for a wide light shaft. This shaft has a skylight in the roof and ample light is afforded. This arrangement was designed by Mr. Sargent to get ample light into the boiler room and is a radical change from the usual scheme of overhead bunkers, which shut off all light from the firing room.

The cross section also shows the location of the ash hopper, coal crushing machinery, and the conveyor lines.

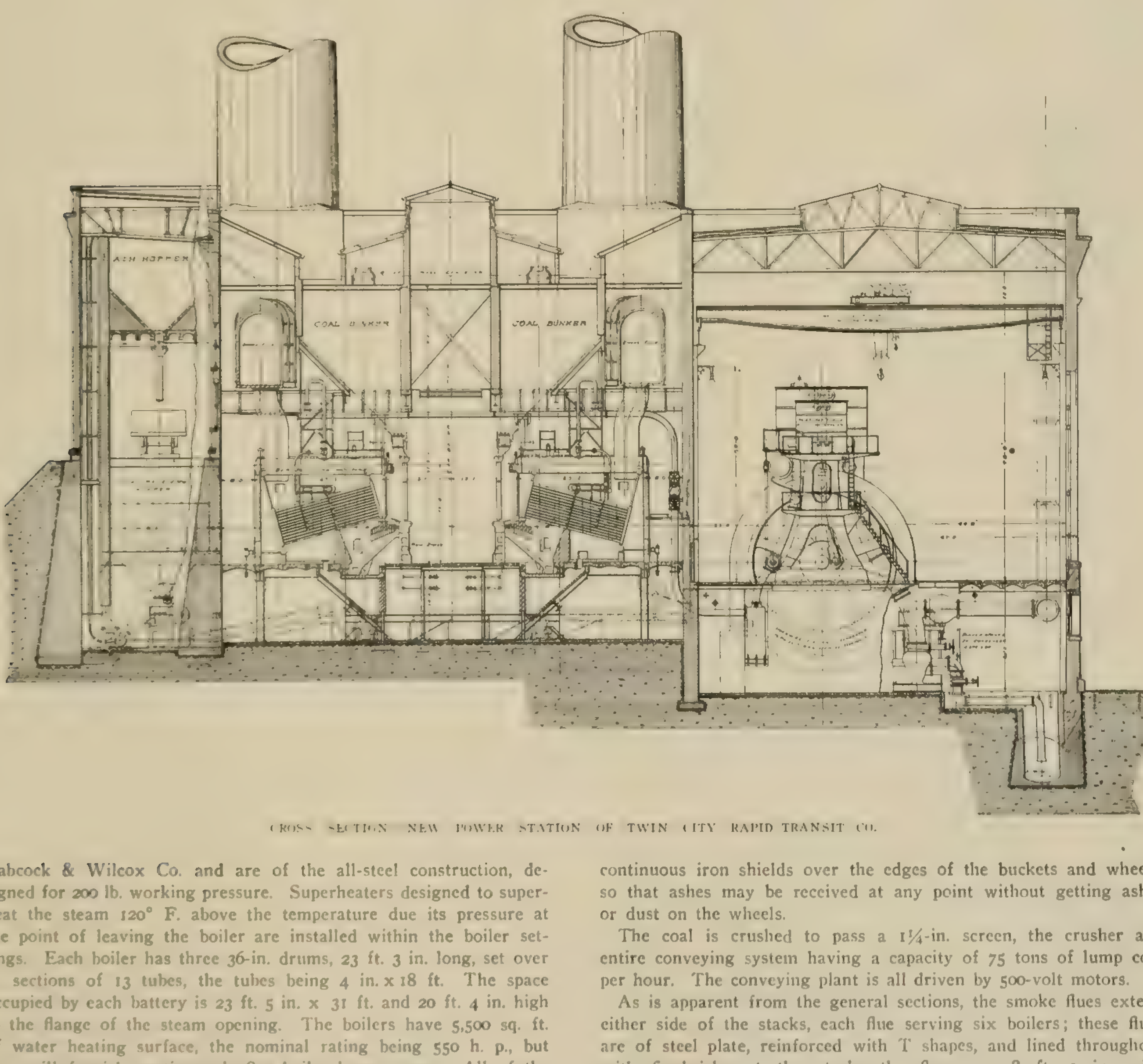
Of the 24 boilers provided for in the portion of the building now built only 18 have been installed, these being sufficient for the present requirements of the company. All the boilers were built by the Babcock & Wilcox Co. and are of the all-steel construction, designed for 200 lb. working pressure. Superheaters designed to superheat the steam 120° F. above the temperature due its pressure at the point of leaving the boiler are installed within the boiler settings. Each boiler has three 36-in. drums, 23 ft. 3 in. long, set over 21 sections of 13 tubes, the tubes being 4 in. x 18 ft. The space occupied by each battery is 23 ft. 5 in. x 31 ft. and 20 ft. 4 in. high to the flange of the steam opening. The boilers have 5,500 sq. ft. of water heating surface, the nominal rating being 550 h. p., but they will furnish continuously 825 boiler horse power. All of the boilers are equipped with Roney automatic stokers, installed by Westinghouse, Church, Kerr & Co., and driven by Westinghouse engines, one engine being installed for each battery in accordance with the specifications of the consulting engineers. The active grate surface in each stoker is 110 ft., making the ratio of grate surface to heating surface 1 to 50 on water heating surface.

The coal crushing and conveying plant was installed by the J. A. Mead Co. There are two longitudinal boiler room conveyors arranged to run over the coal bunkers above the boilers and under the ash pits beneath the boilers, and a cross-conveyor at the east end of the boiler room.

The coal is received in hoppers located to take the coal as dumped from cars on the railroad track, and from the receiving hoppers it is delivered to the crushers. From the crusher the coal is received by the cross conveyor, which passes over the lower lines of the two longitudinal conveyors, and into either of which it can deliver. The longitudinal conveyors elevate the coal and deliver it to the bunkers.

Ashes are taken from the pits under the boilers by the longitudinal conveyors and by them delivered to the upper line of the cross conveyor, which runs under the upper lines of the longitudinal systems, the cross conveyor carrying ashes to the hopper over the coal car track.

The conveyors are of the McCaslin continuous overlapping gravity bucket type, each line of conveyors running in a single plane. The lower horizontal runs under the ash pits are provided with continuous iron shields over the edges of the buckets and wheels, so that ashes may be received at any point without getting ashes or dust on the wheels.

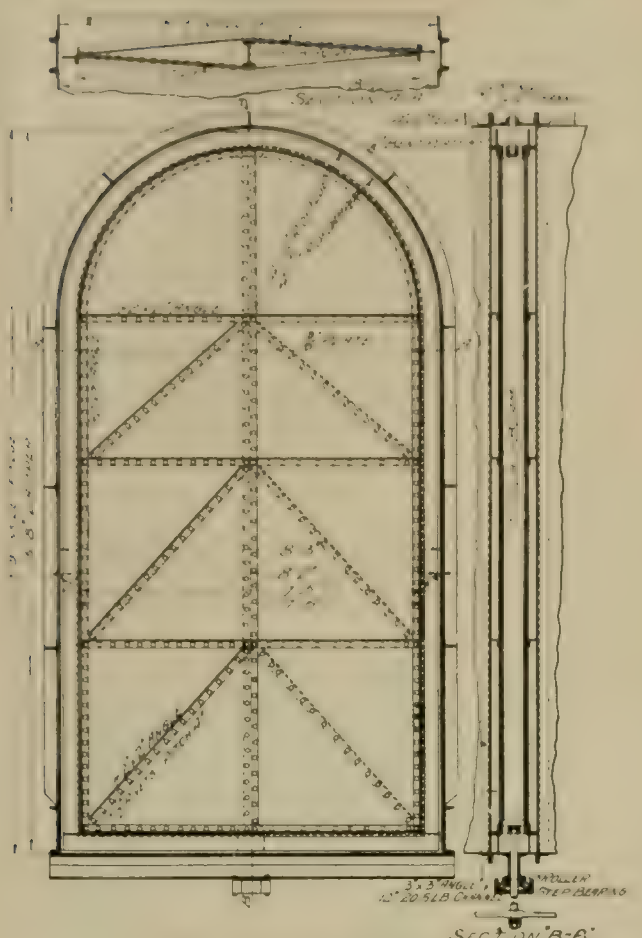


CROSS SECTION NEW POWER STATION OF TWIN CITY RAPID TRANSIT CO.

The coal is crushed to pass a 1¼-in. screen, the crusher and entire conveying system having a capacity of 75 tons of lump coal per hour. The conveying plant is all driven by 500-volt motors.

As is apparent from the general sections, the smoke flues extend either side of the stacks, each flue serving six boilers; these flues are of steel plate, reinforced with T shapes, and lined throughout with fire brick; at the stacks the flues are 8 ft. 3 in. wide by 15 ft. 9 in. high. For control of the draft a damper is placed in the uptake from each boiler. Each flue is also provided with a damper at the entrance to the stack, giving opportunity to isolate the flues and the corresponding boilers for repairs, or when not needed for power.

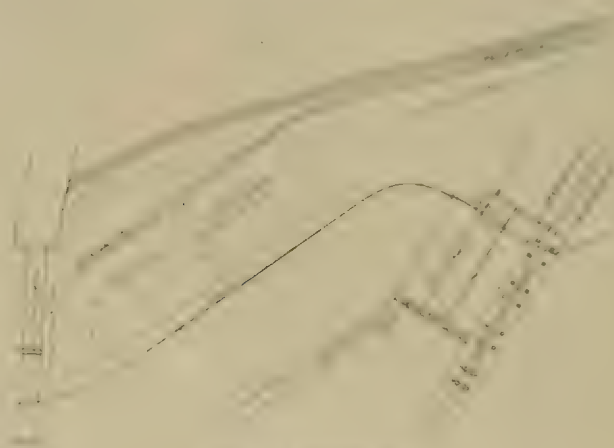
The damper is built of steel and is quite heavy, and to enable it to be handled easily the damper is mounted to turn about a vertical axis through its center of gravity and supported at the bottom in



DETAIL OF DAMPER IN MAIN FLUE.

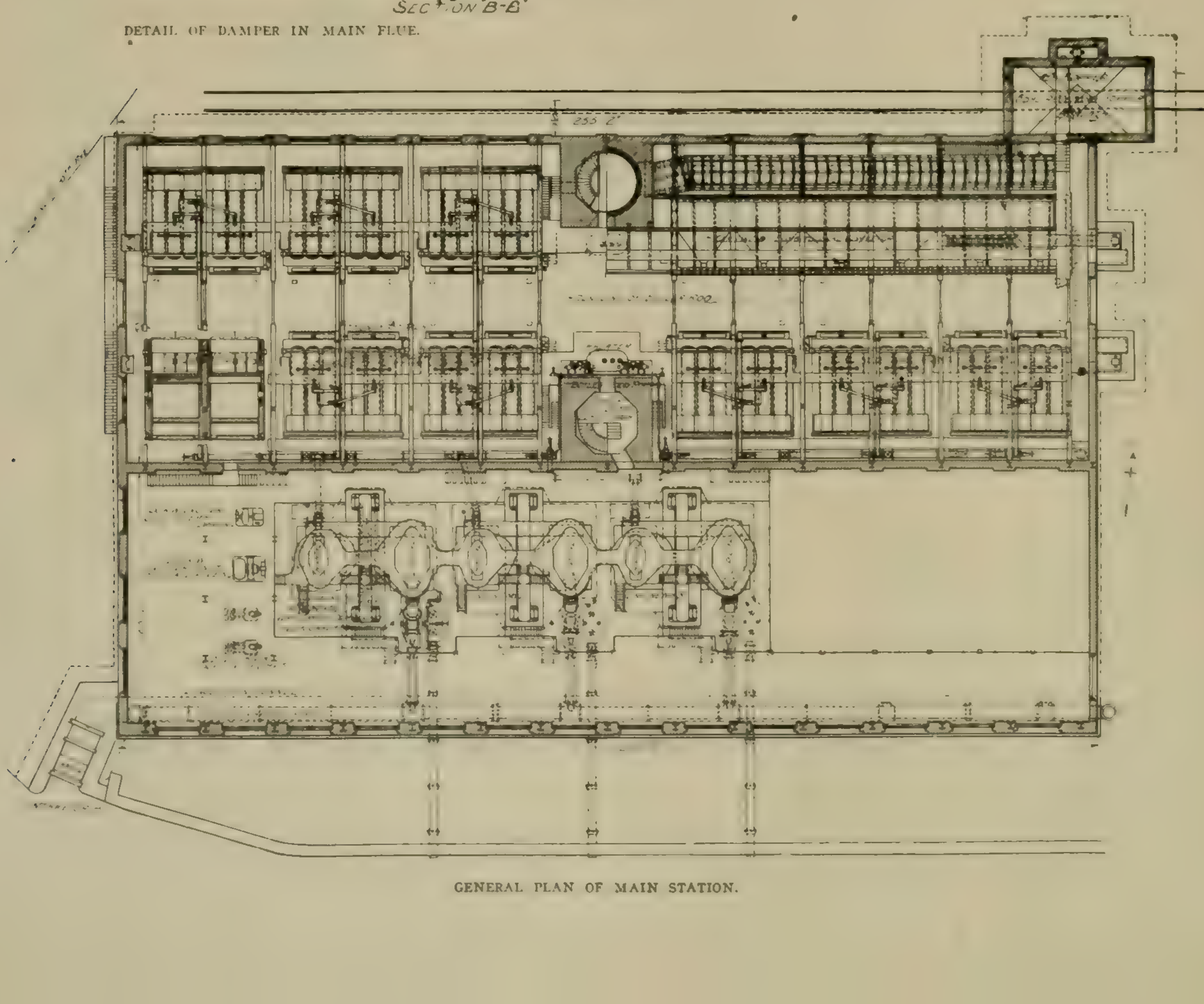
a roller step bearing. The damper, which is shown in detail in the drawing, has for its axis a 15-in. I-beam, to which are riveted sheets of 3-16-in. steel plate. Rigidity is given by 2-in. angles placed as indicated.

The scheme of high-pressure steam piping is shown in one of the accompanying engravings. The main header is of 16-in. wrought iron pipe with welded steel flanges and semi-steel fittings, and is



PLAN OF STATION SITE

carried on the wall behind the south boilers at 12 ft. 6 in. above the boiler room floor (16 ft. 6 in. above engine room floor). At the center of each battery of boilers a 12-in. steel pipe bent to 8 ft. radius is taken off, and on the other end of this is a short section of 12-in. pipe, into which are connected 7-in. leads from the two boilers of the south battery. These connections are curved to a radius of 3 ft. 3 in. Beyond this point a 10-in. pipe is carried across the boiler room and into this connect the two 7-in. leads from the north battery of boilers.



GENERAL PLAN OF MAIN STATION.

The south stack divides the main header into two sections, which are connected by a 14-in. pipe carried through the engine-room basement.

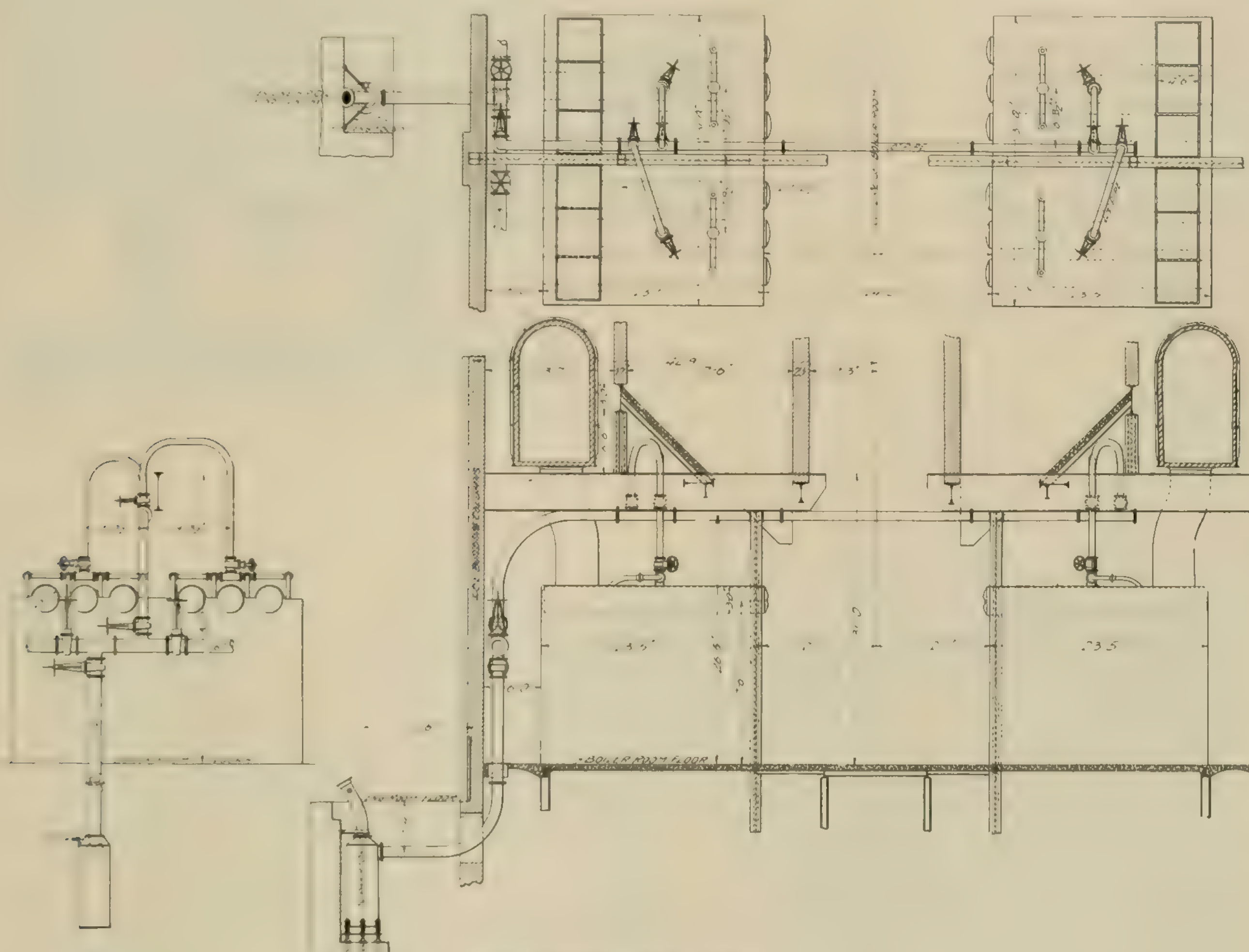
The leads to the engines are 14 in. in diameter and (excepting the one for the engine opposite the stack) are carried down to the boiler-room basement, and thence through the wall (with a bend of 6 ft. radius) to connect with 16-in. "Straight Line" separators, made by the Direct Separator Co., of Syracuse, N. Y., into which the high-pressure piping drains. In each case the separator is set at the edge of the engine foundation, and supported on helical springs to take up expansion of piping and vibration. From the top of the separator a 14-in. pipe leads to the high-pressure cylinder, following the general contour of the engine frame. The steam being superheated, there is no water discharged from the separator except when starting the engine; Bundy traps are provided to drain the separators.

The valves throughout are of the Crane make, all high-pressure valves in pipes above 8 in. in diameter having by-pass.

For the steam-driven exciter unit a 4-in. lead is taken from the main header. In this is a 4-in. "Straight Line" separator.

There are now installed three main generator units, each consisting of an Allis-Corliss vertical cross-compound condensing engine direct connected to a G. E. 3,500-kw. three-phase flywheel type alternator. Current is generated at 34 2-3 cycles, this periodicity being chosen to permit the operation of the plant in multiple with the company's water power plant. It will be remembered that the water power plant was designed in 1897, and at that time 25 cycles had not become so widely accepted as standard for railway work. There was, consequently, at that time no reason for not adopting 34 2-3, for which the hydraulic apparatus was more readily adapted. The engines are designed for a maximum capacity of 9,000 h. p. each.

The diameter of the revolving field which acts as the flywheel is about 26 ft. and this flywheel has the equivalent mass of 308,000 lb., acting at the radius of gyration of 12.2 ft. The angular variation under normal conditions is guaranteed not to exceed .09°. The variation of speed under sudden change of load is within the limits of 73 and 76 r. p. m. The flywheel is of the laminated type, the rim consisting of segments of ⅛-in. steel plate about 3 ft. long. These are assembled in sets of four, so that the cross section of the rim shows at least three solid plates out of every four. Cover plates are placed on the outside of the thin segments, the whole being held together by 1⅛-in. bolts, with the ends riveted. The laminated segments are dovetailed on both concave and convex edges; the dovetails on the inner edge engage over corresponding projections on the spoke castings, while those in the outer edge serve to hold the field pole pieces. This construction insures safety in operation, and the design is economical inasmuch as it is cheaper to punch the plates than to machine a casting.

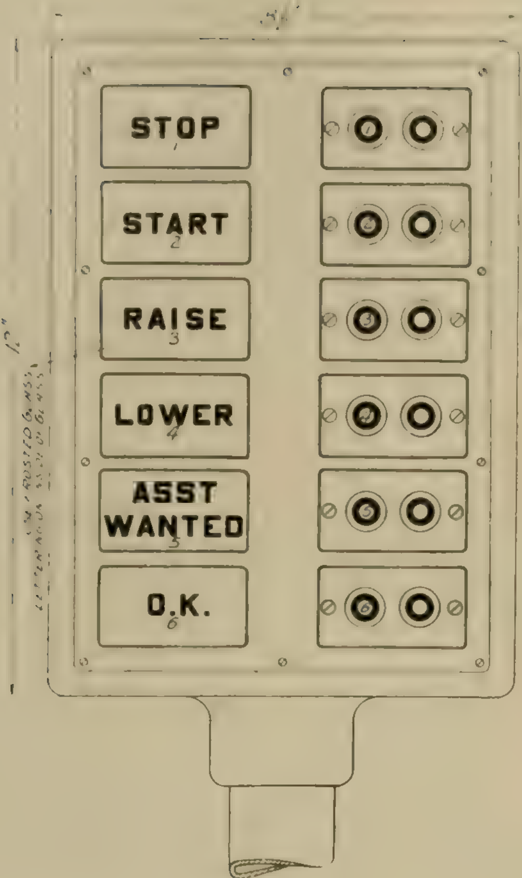


HIGH PRESSURE STEAM PIPING.

The shaft is hollow forged, oil tempered steel, made by the Bethlehem Iron Works, and has main journals 30 x 60 in. The lower shells for the journal boxes are spherical and are fitted accurately to corresponding recesses in the bed plate, giving the ball and socket bearing. All of the engines have automatic stop and butterfly valves, controlled by separate governors.

The cylinders are 46 and 94 in. in diameter, respectively, and the stroke 60 in. The valves are placed in the cylinder heads, the steam and exhaust valves being driven from separate eccentrics. A horizontal receiver without heating coils is placed between the two cylinders. The cylinder, reservoir and piping are all covered with Johns-Manville asbestos fireproof felt, over which is placed planished iron.

The station is equipped with double pressure-oiling systems. All the crank pit pockets, bearings, pump drip pans, etc., drain to two size A Turner oil filters, which are mounted in the basement above

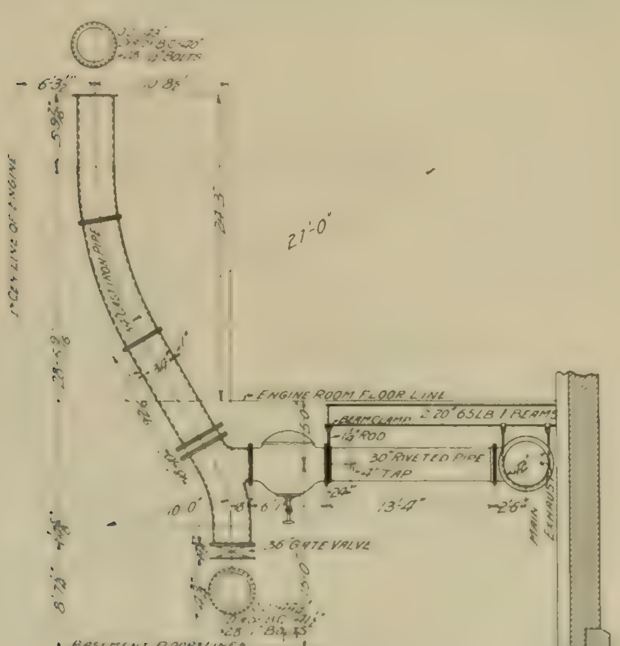


SIGNAL BOARD

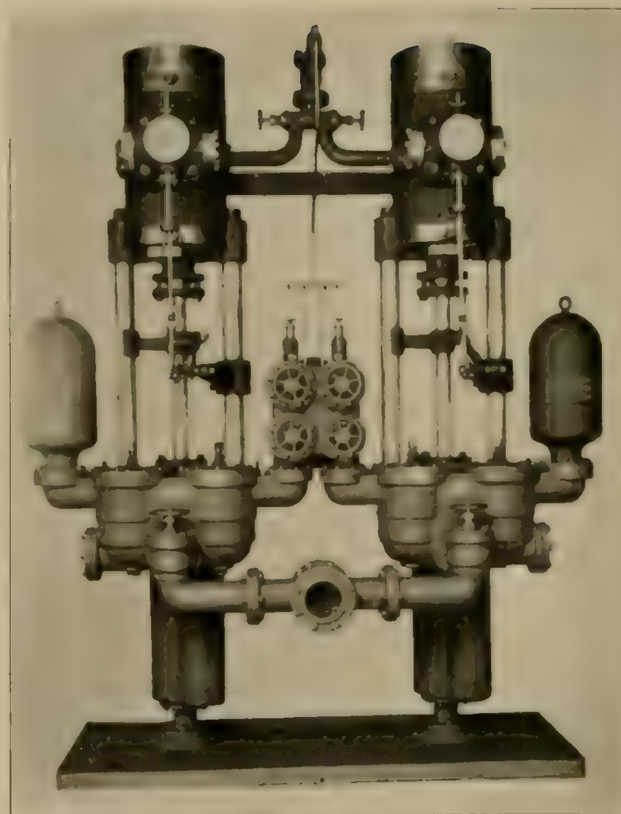
the main oil reservoir. From the tank oil is pumped to reservoirs in the boiler room, from which distribution is made under gravity head.

Cylinder oil is also distributed to the cylinder oil pumps at the engines, from a reservoir mounted at a suitable height in the boiler room.

The exhaust piping between the main engines and condensers is of cast iron, 34 in. in diameter, the connection with the condenser being a 36-in. special narrow gate valve. The atmospheric exhaust



EXHAUST PIPING.

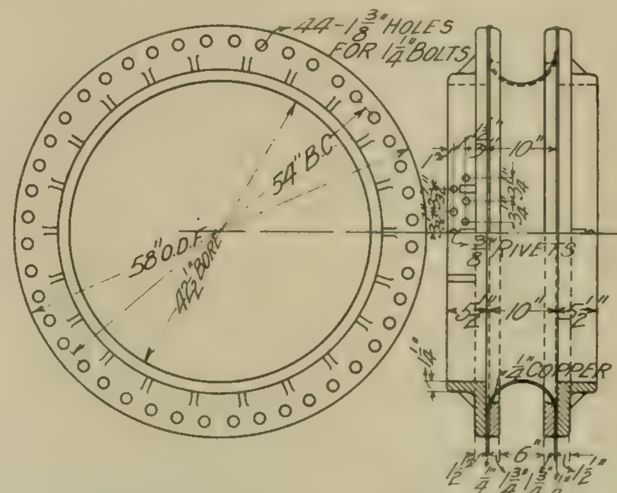


DEAN BROS. "ATLANTIC" TYPE FEED PUMP.

main is 42 in. in diameter, of riveted pipe, with cast iron flanges. Each engine exhaust connects with the atmospheric exhaust through a relief valve and a section of 30-in. riveted pipe.

In the exhaust piping, both cast iron and riveted sections, expansion joints of a somewhat novel type are inserted. The details of the expansion joints for the atmospheric exhaust main are shown in one of the drawings. In this the flexible portion is a ring of ¼-in. copper plate rolled to give a U-shape in cross-section. The internal diameter of the bend is 9½ in. and the straight flanges are 3 in. long. The copper section is held against the pipe flanges by cast iron rings bolted to the flanges. The joints for cast pipe do not differ in dimensions except for the diameter.

Each engine has a separate steam-driven jet condenser. These



DETAIL OF EXPANSION JOINT IN EXHAUST PIPE.

condensers are of the vertical twin air pump type, made by the George F. Blake Manufacturing Co., of East Cambridge, Mass. The water cylinders are each 48 in. in diameter by 24 in. stroke,

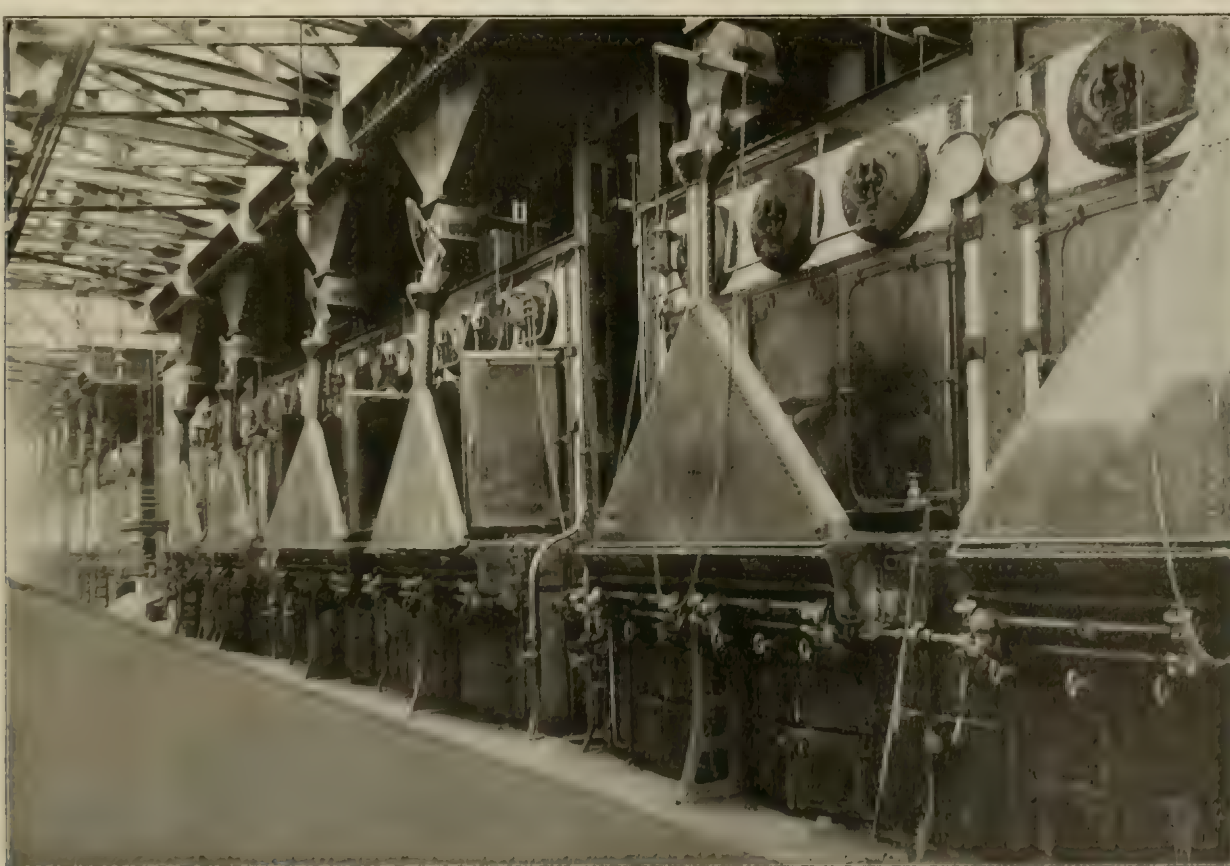
EXTERIOR OF POWER STATION.

and the steam cylinders 18 in. in diameter by 24 in. stroke. The piping is arranged so that the pumps may exhaust into the engine receivers when so desired. The injection pipes connecting the condensers with the intake are made very short and direct, by reason of the location of the condensers with respect to the tunnel, and the opportunity for leaks correspondingly reduced.

The feed-water piping system is such that either hot or cold water can be supplied to the boilers, the arrangement being as follows: The 14-in. suction pipe from the intake tunnel supplies the service pump. From the service pump is an 10-in. discharge to the feed-water heater. From the heater a 10-in. pipe leads to the basement and extends under the two pairs of twin feed pumps. From the 10-in. hot water main a 6-in. riser goes to each pair of pumps. A second 8-in. main is carried from the service pump to the feed pumps, and thence continues to the heater, forming a loop with the regular heater supply and providing two paths to the heater. This second 8-in. main has numerous outlets for service purposes, in the basement and into the boiler room, and branches are run to each condenser to supply forced injection for priming.

Each feed pump has two discharge passages, one for use when supplying the cold water and the other for use when supplying the hot water boiler-feed mains. These feed mains are each 5 in. in diameter and are carried along the basement suspended in the same vertical plane just below the main floor beams, and run in front of the boilers. One pair of pumps has capacity to feed all the boilers; each pair is connected to the feed mains for one side of the boiler room, but in the center the two feed lines are tied together with cross connections, so that any of the pumps may supply water for any of the boilers. From the feed mains 2½-in. branches are taken for the boilers, one branch rising each side of each battery. From the cold water feed main are also taken 1½-in. branches for supplying water to operate boiler-tube cleaners, and to wash the boilers. As one pair of feed pumps can supply the hot feed to the boilers, cold water under pressure may always be available for auxiliary purposes.

The feed pumps are the "Atlantic" type of twin, vertical, double-acting boiler feeders, made by Dean Bros., of Indianapolis, with steam cylinders 14 x 24 in. and water cylinders 10 x 24 in. Each pump, when operating with steam at 140 lb. pressure and at a speed of 40 strokes per minute, has a capacity of 325 gallons per minute against 180 lb. boiler pressure. The pumps are fitted with brass removable liners; the valves are in nests and are conveniently removable with the seats when necessary. The service pumps, two



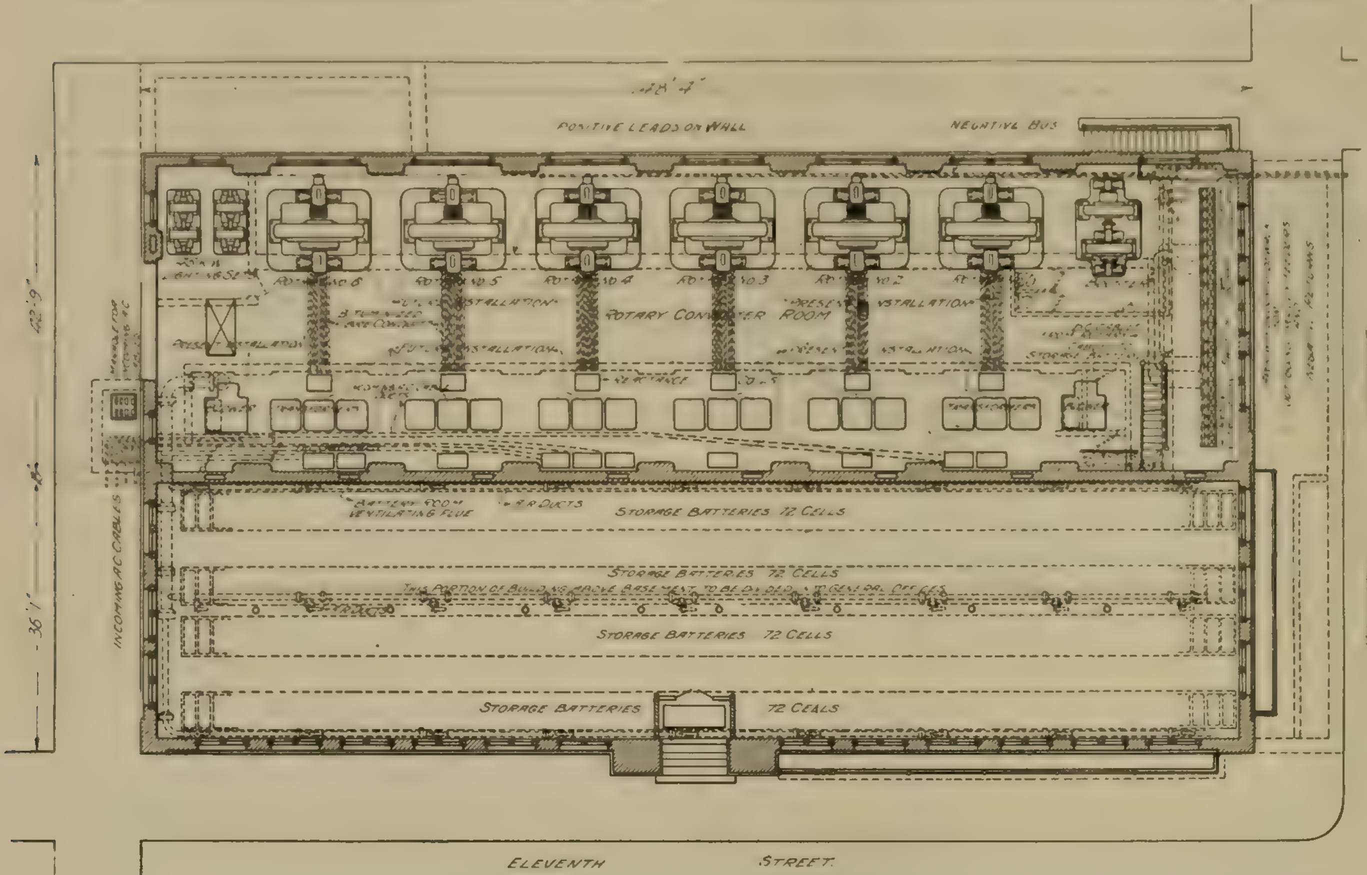
BOILER ROOM OF NEW POWER STATION—TWIN CITY RAPID TRANSIT CO.

in number, are of the Dean Bros. horizontal duplex type, 12 and 16 x 18 in. in size, and when supplied with steam at 110 lb. pressure, operating at 45 strokes per minute, will deliver 1,400 gallons of water per minute against a pressure of 40 lb. per sq. in

The feed-water heater is of the open type, made by the Stilwell-Bierce & Smith-Vaile Co., and is 11 ft. 6 in. x 6 ft. 7 in. x 16 ft. 4 in. high and is set on a platform 10 ft. 3 in. above the boiler room floor. A 14-in. steam inlet and 8-in. outlet are provided. The exhaust from outlets are placed at each generator, one at each exciter unit and three on each switchboard gallery.

The station is served by a 40-ton electric traveling hoist, furnished by the Whiting Foundry & Equipment Co., and the work of installing machinery was further facilitated by laying a railroad track into the building, enabling loaded cars to be run under the crane.

The water power station is to be operated whenever water is

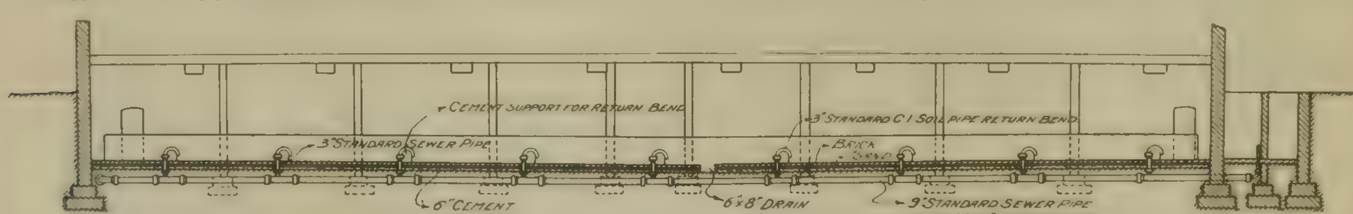


GENERAL PLAN OF SUB-STATION IN MINNEAPOLIS.

all the auxiliary apparatus in the station is led normally to the heater which has a capacity for heating 350,000 lb. of water per hour from 60 to 210 degrees F.

For transmitting orders between the engines and switchboard signal boxes are placed one at the throttle of each engine, and one on the switchboard gallery, thus making a pair of boxes for each generating unit. The signal box, shown in front elevation in the engraving, is 12 in. high, 8½ in. wide and 5 in. deep, made of brass, and supported on a pipe standard which serves as a conduit for the

available, but the distribution will be made from the new station. With this in view, the new electrical power equipment includes three banks of transformers, each consisting of three 550-kw. transformers to raise the voltage of the water-driven generators from 3,450 to 13,200 volts, the potential at which the main units in the new station deliver current. These transformers, along with two 45-in. Buffalo fan blowers driven by 10-h. p. 500-volt direct-current motors, are located in the water power station; 500-volt motors for blowers were adopted in this station because current at this



CROSS-SECTION THROUGH BATTERY ROOM IN SUB-STATION.

connecting cables. The box is divided into two equal compartments, one containing the lamps and the other the push switches controlling them. The six signs are painted on the back of frosted glass, and behind each is a pair of candelabra 125-volt lamps mounted in miniature receptacles; the receptacles are mounted on a fiber base, the two lamps of each pair being in multiple so that one burned-out lamp will not prevent the indication.

The station is provided with a complete system of compressed air piping designed for an operating pressure of 40 lb. per sq. in., but tight for 80 lb. pressure. The tank for this is 24 in. x 6 ft. Two air

voltage is always available, while in order to obtain lower voltage alternating-current, step-down transformers would have to be installed.

The leads from the water power station to the main station are triple-conductor, paper-insulated, lead-covered cables, three in number, one going to each of the three sections into which the main station high-tension bus bars are divided.

The control switchboard for the main station is of blue Vermont marble and is located at the west end of the engine and generator room, where there are two galleries. On the upper gallery

provision is made for 10 alternating-current generator panels (3 now installed), 2 panels to control the a. c. side of motor-driven exciter sets (1 now installed), 3 panels to control incoming lines

EXTERIOR VIEW MINNEAPOLIS SUB-STATION.

from the water power plant, 1 bus sectional panel, 9 outgoing line panels (6 now installed), and 3 panels to control direct-current side of exciter sets.

On the lower gallery are the offices, and when the station is completed there will be installed here the bus bars, oil switches and switchboard panels for 12 additional feeder lines, making a total of 21 outgoing feeders, for which provision has been made.

The bus bars are of copper, ¼ x 2 in., and are mounted in compartments 23½ x 12⅝ in.

The bus bars are divided into three sections. Between adjacent sections are oil switches, with disconnecting knife switches on each side, so that the oil switches can be isolated when desired. Disconnecting switches are also placed between the bus bars and oil switches on the generator leads, and between the bus bars and oil switches on the feeder lines. Also in each branch of each feeder circuit, between the oil switch and the triple conductor cable, is a disconnecting switch; each of the static dischargers for the feeders is similarly provided with a disconnecting switch so that it can be isolated for repairs when necessary.

The oil switches for the generator circuits extend in a line across the building; behind and parallel to these is the bus-bar structure; behind this and parallel to it is the second row of oil switches for the feeder lines. All the oil switches are furnished with specially designed Kinnear rolling doors. This apparatus is located on the gallery behind the switchboard.

Connections between generators and the oil switches are made by 250,000-c. m., three-conductor, paper-insulated, lead-covered cables, which are run in 4-in. pipe suspended from the basement ceiling. The cables were furnished by the General Electric Co. At the generator leads are carried through 6-in. wrought iron pipes embedded in the engine foundation, these pipes being bent to bring the leads cable from the floor level to the lower side of the armature in an easy curve. The field leads at the generators are similarly protected by 2-in. wrought iron pipe.

The exciter units are under the switchboard gallery. There are now installed one steam-driven set consisting of a 50-kw., 125-volt generator and a 11 x 11-in. simple engine operating at 280 r. p. m., and one motor-driven set, consisting of a 200-kw., 125-volt generator and a 440-volt three-phase induction motor operating at 520 r. p. m.

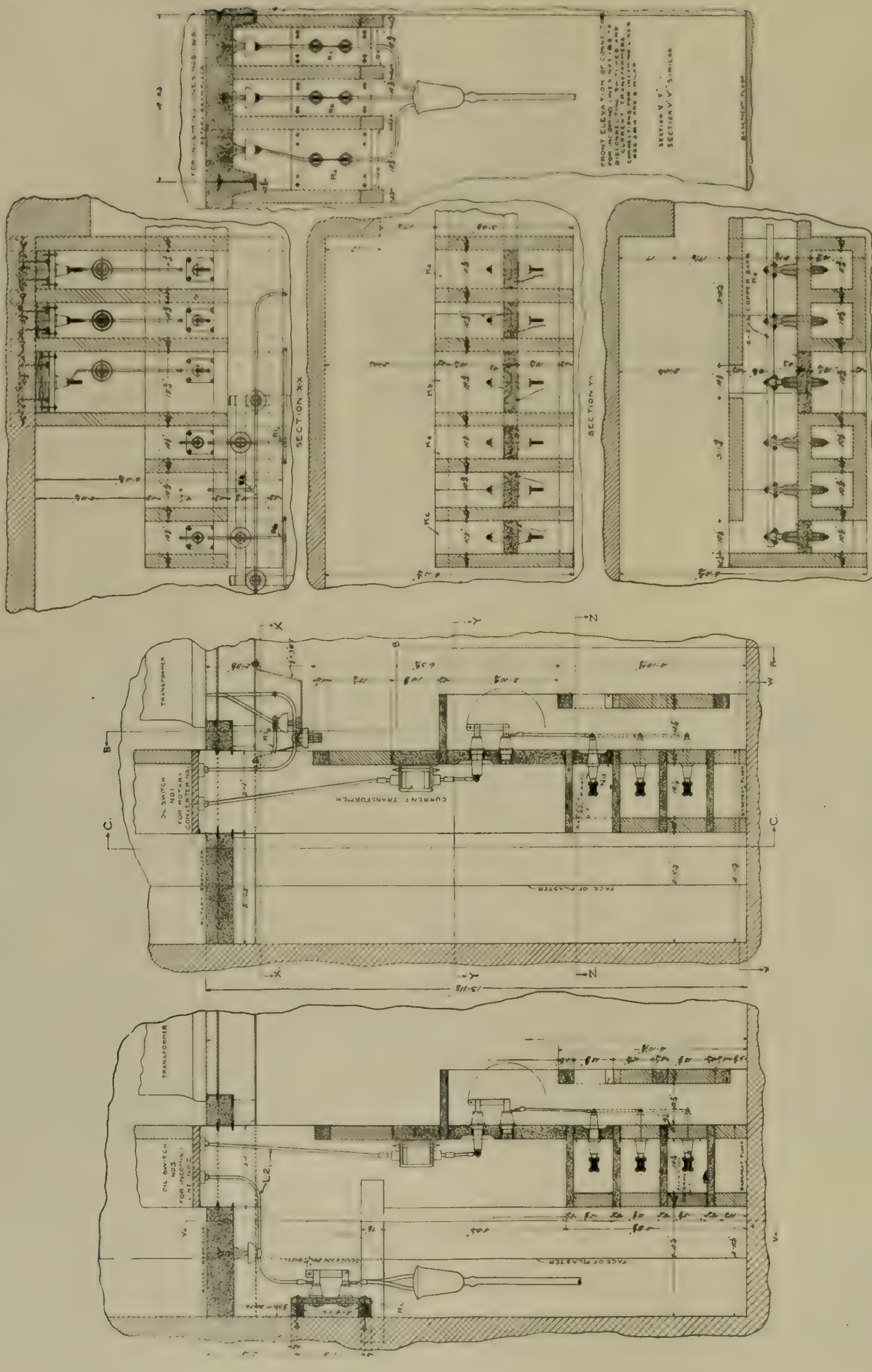
The positive bus bar for the field circuits is placed under the engine-room floor.

There are no transformers in the main steam station, excepting for the exciter motors, the generators delivering current at 13,200 volts, which is also the potential for the distribution system. Of the six feeder lines now installed, two go to the sub-station in Minneapolis, two to the sub-station in St. Paul, and two supply the Stillwater line, going to what is known as the Wildwood station.

Outgoing current is carried by triple conductor cables laid in tunnels or in conduits wherever the lines are within the city limits; outside of the city limits to Wildwood they are carried on poles. These cables were furnished by the National Conduit & Cable Co.

The two new sub-stations, which have been built, one at Hennepin Ave. and 11th St. in Minneapolis, and the other at Wabasha and College Aves. in St. Paul, are almost exactly similar in design and are for an ultimate rated capacity of 9,000 kw. each in rotary converters. The buildings are according to architectural plans of Mr. Charles F. Ferrin, of the Twin City company, the electrical work,

INTERIOR OF MINNEAPOLIS SUB-STATION.



SECTIONAL ELEVATIONS AND PLANS THROUGH OIL SWITCHES AND BUS BAR COMPARTMENTS—ST. PAUL SUB-STATION.

floor framing, bus-bar and battery room being designed by Sargent & Lundy. The lower part of the structure is stone, and above this the walls are of light buff speckled pressed brick; the roof is of concrete. Inside the walls are of pressed brick, with a wainscoting of white enamel brick. The rotary converter room is floored with white tile.

The ground dimensions of the sub-station are 148 ft. long by 80 ft. wide. At one side is the rotary converter room, 41 ft. wide inside; below this is a basement, with part partitioned off for an air-pressure and high-tension chamber. The other section of the building, 33 ft. wide, excepting the basement, which is the battery room, is occupied by offices, which are arranged on three floors. The third office floor also extends over the rotary converter room. The offices at both sub-stations include rooms for the use of Mr. Lowry, Mr. Goodrich and Mr. Hield, as well as for the local operating staff and heads of departments.

The general arrangement of the apparatus in the sub-stations is apparent from the drawing, but there are several features to which especial attention should be directed.

The storage battery room is thoroughly ventilated by means of a system of underground ducts which is of admirable as well as novel design. The battery room is 34 ft. wide by 145 ft. long and contains 288 cells with type H plates, made by the Electric Storage Battery Co., of Philadelphia. The capacity of the battery is 1,000 kw. for one hour, and the tanks are of a size to permit addition of plates to give 1,500 kw. total capacity. The tanks are arranged in four rows. The floor is laid with vitrified bricks, and underneath are three lines of 9-in. standard sewer pipe, one in the center of the room and one at each side wall. These extend the entire length of the building and at intervals of 17 ft., 3-in. branches are brought up through the floor, terminating in 3-in. standard cast iron soil pipe return bends. The bends are supported on concrete blocks so that the opening into the room is directed downwards and is 4 in. above the floor.

The 9-in. longitudinal mains are connected by a 15-in. cross-main carried to the fan room. Ventilation is secured by admitting air from the pressure chamber through the pipes into the battery room. Flues for exit of air are placed at the ceiling.

The sub-stations are each designed for six 1,500-kw. rotary converters; but one-half of this number is now installed. These are General Electric machines, with 16 poles, and operate at 260 r. p. m.; they are designed to operate in multiple on both a. c. and d. c. sides, taking 34 2-3 cycle, three-phase current at 430 volts and delivering direct current at 600 volts.

As the machines will carry a 50 per cent overload for two hours, the maximum output with the present equipment is 6,750 kw. for two hours, or with the battery 7,750 kw. for one hour.

The rotaries are arranged along the outer wall of the station. At one end of the building is the booster for regulating the battery. This is a differential wound machine, built by the Western Electric Co., Chicago. At the opposite end of the room are two G. E. motor-generator units—75-h. p. 600-volt motor and 45-kw. 110-volt generator—which are for lighting the sub-station and offices; one machine will carry this load, and normally only one is operated.

Each sub-station has nine 550-kw. single-phase air-blast step-down transformers for reducing the incoming current from 12,500 volts to 430 volts for the rotaries. The transformers are ranged opposite the rotaries, with reactance coils in front of each group and the corresponding oil switches between the transformers and the wall.

The bus-bar structure is located in the air-pressure chamber under the transformers. The bus bars are divided into two sections by air-brake switches, each section (when the complete equipment is installed) having two feeder lines and three rotaries.

The two sub-stations, as already stated, are of similar capacity, and the principal differences between them lie in the relative arrangement of the transformers, oil switches and high-tension bus bars. The sub-station plan we show is that for the Minneapolis station; the drawings showing the bus-bar construction are for the St. Paul sub-station, as this is considered the better design of the two. The relative arrangement of the high-tension apparatus in the two stations will be apparent from these drawings.

All lines enter and leave the station underground. The path of the incoming current is first through oil switches to the bus-bars in the basement, thence from the busbar through oil switches to the transformers. From the low-tension side of the transformers the cables to the rotary converters are carried through electrolysis-proof conduits in the floor.

The positive and negative direct-current buses are separated as far as possible, one being on each wall. The positive terminal blocks for the rotaries are not placed on the machines, but have been mounted on the wall with the positive leads, an arrangement which is an additional protection against a breakdown between the positive lead and the frame of the machine.

All of the converters will have alternating-current starting switches mounted on top of the reactance coils, and, while the rotaries may be started from either side, they will in normal operation be started by alternating current only.

The sub-station switchboard for incoming lines, rotary converters and booster is on the main floor. The board for the direct-current feeders is in a gallery, the feeders being hidden from view in the wall, which is of channel iron construction.

The cooling for sub-station transformers is effected by two 70-in. Buffalo fans driven at 525 r. p. m. by 75-h. p. 350-volt induction motors.

The rotary converter room is served by a 20-ton motor hoist hand travel Whiting crane.

Messrs. Sargent & Lundy, of Chicago, were the engineers for the new power station, and the entire electrical equipment of the sub-stations and the high-tension distribution system. All of the contracts for the work were let on their specifications and drawings. The design and arrangement of the main station were prepared by the engineers, and the architectural and structural steel drawings by Messrs. E. C. and R. M. Shankland, of Chicago. The architectural work on the sub-stations and the general design, aside from the electrical equipment, were by Mr. C. F. Ferrin, of the Twin City company.

The construction and installation were carried out under the superintendence of the mechanical and electrical departments of the Twin City company, which are in charge of Mr. E. H. Scofield, electrical engineer, and Mr. D. W. Dozier, chief engineer of power stations.

For data and illustrations we wish to make special acknowledgment to Mr. Scofield, to Mr. W. S. Monroe and Mr. F. Woodmansee, of Sargent & Lundy, and to Westinghouse, Church, Kerr & Co.

A Novel Condensing Plant.

In a paper presented before the Association of Municipal and County Engineers at the Northern District meeting, held at Newcastle, Eng., Mr. A. E. Le Rossignol, general manager and engineer of the Newcastle Corporation Tramways, briefly described that system. One point in connection with its stations which he mentions is interesting, showing a novel method of overcoming unfavorable conditions as to water supply.

All of the circulating water for the surface condensers of the engines has to be pumped up a quarter of a mile and 90 ft. high from the river. As this would involve a big loss in the ordinary way, the water after passing through the surface condensers is carried back in another pipe to the pumping station, where the centrifugal pumps are situated, driven by electric motors, and passes through turbines on the same shaft as the motors, thus helping to drive the pumps and returning about 50 per cent of the power to the motor. By this means the cost of power for pumping purposes is reduced by about half from what it would otherwise be. A special high lift centrifugal pump is used, the largest set being capable of delivering 3,000 gallons per minute to a height of 100 ft.

It has been rumored more or less persistently that negotiations are pending for a consolidation of all the urban railway lines of New York City.

The Allis-Chalmers Co. has issued a cordial invitation to the trade for visitors to the World's Fair to use as their headquarters the facilities which the company has provided at its power exhibit in the Machinery Building. Besides being a comfortable place to rest there are writing tables and stationery, attendants who will receive and forward mail and telegrams, and who will check parcels and wraps and provide ice water, all free of charge.

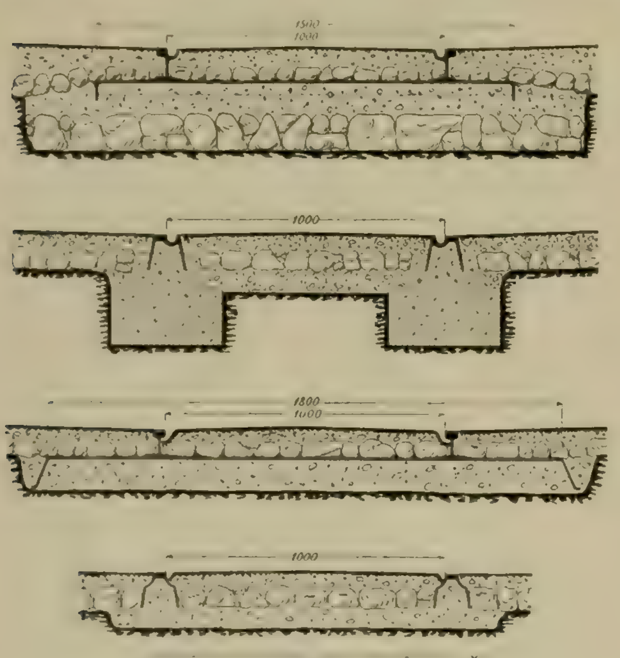
The Electric Tramways of Neuchatel.

BY L. RAMAKERS.

The electric railways of Neuchatel and its suburbs, the construction of which has been finished but a few months, have a total length of 26.309 km. The current for the entire system is supplied from the continuous current central station of the city of Neuchatel. The line is partly double and partly single track and the radius of the shortest curve is 27.5 m. All the switches have a radius of 50 m. The grades are rather severe and in some places reach 8.6 per cent for lengths of from 80 to 100 m.

Part of the track is laid with Demerbe rails which are generally laid directly on the ground with wooden supports under each joint. There are, however, some places where the substructure is made of concrete. Groove rails are used on another part of the line and these are laid on metal ties. The rest of the track which comprises the greater part of the line is of T-rails laid on iron ties. The gage is 1 m. except in the curves having a radius of less than 100 m. On these curves the gage is widened by 6 mm. In order to secure drainage holes are bored through the rails at certain points and under these holes are receptacles for water connected to each other by pipes.

The tension of the line is 580 volts and the maximum fall of potential is 5 per cent. The conductors are copper wires of 9 mm. in diameter and a trolley wire is supported on steel span wires with double insulation; these are 6 mm. in diameter. These span wires are carried between the poles and also between rosettes placed on the walls of buildings. There are in use wooden poles, iron pipe poles and lattice iron poles. These are set in the ground in a mass of concrete 2 m. deep. The wooden poles are used only outside of the city and there are 450 of them in use. The brackets of the wooden poles are made of gas pipe of 48 mm. in diameter. In the city there are 150 poles provided with brackets. The length of the iron pipe poles varies from 9 to 10 m. and there are 40 lattice poles 10 m. in length erected in the city. The line is divided into sections each of which is separated by a section insulator and each section is provided with a lightning arrester. On the interurban part of the line



CROSS SECTIONS OF SUBSTRUCTURE.

the return circuit is carried by the rails which are provided with special joints and by a special conductor. These joints have two copper wires riveted to the rails and the return conductor is formed of a bare copper wire 8 mm. in diameter, which is laid under ground. This runs the entire length of the line and is connected to the rails at every joint by means of the two wires mentioned. On part of the line the joints are provided with bonds which are soldered to the ends of the rails, these bonds consisting of two wires 5 mm. in diameter. For a distance of 500 m. these two bond wires are connected to a conductor of 8 mm. in diameter and this conductor is riveted to the rail.

The distribution on this part of the line is on the three-wire system; two of the three conductors are overhead wires and the track

VIEW OF TRAMWAY LINE IN NEUCHATEL.

circuit constitutes the third conductor. There is a difference of potential of 580 volts between each overhead wire and the track and 1,160 volts between the two overhead wires. This system was adopted with the object of reducing the section of the feeders between the track and the central station and for avoiding the use of a special return conductor. By this method only the difference in current carried by the two overhead wires is returned to the central station.

Part of the motor cars have a length between the axles of 1,800 mm. and a total length of 8,500 mm. They provide for 18 seated and 16 standing passengers. They are equipped with eight brake shoes. The cars which operate on the part of the line having heavy grades have a special system of brakes. On each of the two platforms of these cars is found a lever which operates steel shoes provided with points. On each side of the line alongside of the rails are laid wooden girders. The points on the shoes are forced into these girders by means of which an almost instantaneous stopping of the car may be obtained. It is only in case of great emergencies that these brakes are used. The cars have a double suspension and are carried on helical as well as elliptical springs. The motor trucks are of rolled steel sections. The equipment further comprises a number of motor cars with two axle bogie trucks and enclosed platforms. The distance between the axles of the bogies is 1,400 mm. and the distance between the trucks is 6,500 mm., measured axle to axle. The wheels are provided with Vander Zypen tires and have a diameter of 800 mm. The equipment of the latter cars comprises electric brakes with eight shoes acting against all of the wheels and also air brakes which operate on the trail cars. There is seating space for 28 passengers in the interior of the car, 12 standing places in front and 16 in the rear. Very large double doors are used on these cars and there are four sanders on each car. The total length of these cars is 12.54 meters and they weigh 15 tons each. All of the ordinary cars are provided with two motors with a normal capacity of 18 h. p., capable of developing a maximum of 25 h. p. The ratio of

reduction of the gearing is 1 to 4.5. The armatures have 29 slots each containing 12 turns of wire and the field coils are wound with 120 turns arranged in eight layers. The controllers are of the series parellel type and provided with additional resistances for bråking. For starting and at low speeds the motors are connected in series and for a high speed they are coupled in parallel. The electrical equipment comprises further two automatic circuit breakers, two switches, a lightning arrester, a trolley, electric heaters placed under the seats, each of which consumes 600 watts, and the necessary lamps for lighting. The lamps are six in number and are wired in series. Two of these serve for signal lamps, two light the platforms and the other two the interior of the car.

INTERIOR OF DOUBLE TRUCK CAR.

The double truck cars also use two motors each. At 635 r. p. m. they develop 40 h. p. The gearing has a ratio of reduction of 1 to 4. These motors are of the Oerlikon tramway type and have a jointed frame of cast steel. The lower part opens downwards, so as to provide for taking out the armature without dismounting the motor from the truck. A covered opening is provided in the upper part of the motor casing to permit inspection and manipulation of the commutator. A second opening in the lower part is left to facilitate the cleaning. The bearings are provided with rings and the bearing shells are of the best quality of white metal. They are of a large size, so that the journal pressure and the friction are reduced to a minimum. The design of the motor casing and the tightness of the joints are such that the moisture and oil from the journals cannot appreciably penetrate to the winding.

VIEW ALONG THE LINE.

The coil of the armature has a diameter of 390 mm. and is 150 mm. long. Each of the 37 slots contains 18 wires, each wound with three layers of silk and protected with shellac. There are four field spools in series, each composed of 112 coils. The commutator is of large dimensions to provide ample cooling surface. The current is collected by carbon brushes which are held on the commutator by strong springs. These can carry an overload of 100 per cent without dangerous sparking and at normal load there is no sparking. The insulation of all parts of the motor was tested by an alternating current of 3,000 volts. The two controllers of each car are of the series parallel type and have seven running points and five braking points. They are provided with magnetic blow-out coils. The rest of the electrical equipment comprises two resistances, two automatic circuit breakers which can be operated by hand, two switches with magnetic blow-out, a lightning arrester and two trolleys. The electric lighting of these cars is obtained by means of two independent circuits, one having six and the other seven lamps in series. The heating is by means of two electric heaters consuming 2,000 watts. The entire installation was furnished by the Oerlikon Works.

The International Electrical Congress.

The American Institute of Electrical Engineers, which in connection with the Institution of Electrical Engineers of Great Britain will hold a joint meeting in St. Louis at the time of the International Electrical Congress meeting, has issued a circular describing the general arrangements made for that meeting, also the accommodations to be had at St. Louis as well as the plan of a circular tour for the reception and entertainment of visiting electrical engineers at the Congress. The Congress will convene at St. Louis on Monday, September 12th, and will continue its sessions up till Friday of that week. The annual convention of the American Institute of Electrical Engineers will be formally opened at Festival Hall in the exposition grounds on Wednesday, of that week.

A general invitation has been extended to European electrical engineering societies to join in a circular tour visiting the important cities and industrial centers of the United States. A preliminary tour has been arranged for the visiting members of the Institution of Electrical Engineers when they arrive at the wharf at Boston. The local reception committee in Boston has arranged to take the visiting engineers to the power house in Boston, to the Massachusetts Institute of Technology and to Harvard University, where a reception will be held on Saturday, September 3rd. They will then go to Providence by train, where they will take the steamer for New York, arriving Sunday, September 4th. The itinerary of the circular tour proper includes visits to Schenectady, September 6th; Montreal, September 7th and 8th; Niagara Falls, September 9th; Chicago, September 10th; St. Louis, September 11th to 17th; Pittsburg, September 18th and 19th; Washington, September 20th; Philadelphia, September 21st. Full details in regard to this tour can be obtained by addressing Mr. Ralph W. Pope, secretary, American Institute of Electrical Engineers, 95 Liberty St., New York City.

Through Traffic from Jackson to Detroit.

An agreement was signed July 1st whereby the Detroit, Ypsilanti, Ann Arbor & Jackson, the Jackson city line and the lines to Wolf Lake and Grass Lake will be operated as one system. Negotiations to this end have been under consideration a long time by Messrs. Coler & Co., owners of the Jackson Consolidated Traction Co., and Messrs. Hawks and Angus, owners of the other properties. Under the agreement neither company loses its corporate identity but the joint operation of the lines will enable the companies to effect a number of economies and it also harmonizes their interests so that the agitation for an opposition road between Jackson and Detroit will be effectually ended.

The Chattanooga Electric Railway Co. now operates with power from its steam turbine plant and has abandoned its old power house.

Underwriters' Rules for Car Wiring and Equipment of Cars.

These rules for car wiring were formulated by a conference committee consisting of a committee appointed by the American Street Railway Association and a sub-committee from the Underwriters' National Electric Association.

The rules are laid down as embodying the principal precautions necessary in safeguarding street railway cars from the fire hazard of their own electrical appliances. It is not expected that old equipments will be rapidly brought up to this standard, but it should be required that all new equipments and repairs to old equipments closely follow the rules.

a. Protection of Car Body, etc.

1. Under side of car bodies to be protected by approved fire-resisting insulating material, not less than 1-8 in. in thickness, or by sheet iron or steel, not less than .04 in. in thickness, as specified in Sections 2, 3 and 4. This protection to be provided over all electrical apparatus, such as motors with a capacity of over 75 h. p. each, resistances, contactors, lightning arresters, air brake motors, etc., and also where wires are run, except that protection may be omitted over wires designed to carry 25 amperes or less if they are encased in metal conduit.

2. At motors of over 75 h. p. each, fire-resisting material or sheet iron or steel to extend not less than 8 in. beyond all edges of openings in motors, and not less than 6 in. beyond motor leads on all sides.

3. Over resistances, contactors and lightning arresters, and other electrical apparatus, excepting when amply protected by their casing, fire-resisting material or sheet iron or steel to extend not less than 8 in. beyond all edges of the devices.

4. Over conductors, not encased in conduit, and conductors in conduit when designed to carry over 25 amperes, unless the conduit is so supported as to give not less than 1-2 in. clear air space between the conduit and the car, fire-resisting material or sheet iron or steel to extend at least 6 in. beyond conductors on either side.

Note.—The fire-resisting insulating material or sheet iron or steel may be omitted over cables made up of flameproof braided outer covering when surrounded by 1/8 in. flameproof covering, as called for by Section *i*, 4.

5. In all cases fireproof material or sheet iron or steel to have joints well fitted, to be securely fastened to the sills, floor timbers and cross braces, and to have the whole surface treated with a waterproof paint.

6. Cut-out and switch cabinets to be substantially made of hard wood. The entire inside of cabinet to be lined with not less than 1-8 in. fire-resisting insulating material which shall be securely fastened to the woodwork, and after the fire-resisting material is in place the inside of the cabinet shall be treated with a waterproof paint.

b. Wires, Cables, etc.

1. All conductors to be stranded, the allowable carrying capacity being determined by Table A of Rule No. 16, except that motor, trolley and resistance leads shall not be less than No. 7 B. & S. gage, heater circuits not less than No. 12 B. & S. gage, and lighting and other auxiliary circuits not less than No. 14 B. & S. gage.

The current used in determining the size of motor, trolley and resistance leads shall be a per cent of the full load current, based on one hour's run of the motor, as given by the following table:

Size each motor.	Motor leads.	Trolley leads.	Resistance leads.
75 h. p. or less	50 per cent	40 per cent	15 per cent
Over 75 h. p.	45 per cent	35 per cent	15 per cent

Note.—Fixture wire complying with Rule No. 46 will be permitted for wiring approved clusters.

2. To have an insulation and braid as called for by Rule No. 41 for wires carrying currents of the same potential.

3. When run in metal conduit, to be protected by an additional braid as called for by Rule No. 47.

Note.—Where conductors are laid in conduit, not being drawn through, the additional braid will not be required.

4. When not in conduit, in approved molding, or when not in cables surrounded by 1-8 in. flameproof covering, to be protected by an additional flameproof braid, at least 1-32 in. in thickness, the outside being saturated with a preservative flameproof compound.

Note.—This rule will be interpreted to include the leads from the motors.

5. Must be so spliced or joined as to be both mechanically and electrically secure without solder. The joints must then be soldered and covered with an insulation equal to that on the conductors

Note.—This rule will not be construed to apply to connection of leads to motors, plows, or third rail shoes

6. All connections of cables to cut-outs, switches and fittings, except those to controller connection boards, when designed to carry over 25 amperes, must be provided with lugs or terminals soldered to the cable, and securely fastened to the device by bolts, screws, or by clamping; or, the end of the cable, after the insulation is removed, shall be dipped in solder and be fastened into the device by at least two set screws having check nuts.

All connections for conductors to fittings, etc., designed to carry less than 25 amperes, must be provided with turned-up lugs that will grip the conductor between the screw and the lug, the screws being provided with flat washers; or by block terminals having two set screws, and the end of the conductors must be dipped in solder. Soldering, in addition to the connection of the binding screws, is strongly recommended, and will be insisted on when above requirements are not complied with.

Note.—This rule will not be construed to apply to circuits where the maximum potential is not over 25 volts and current does not exceed 5 amperes.

c. Cut-outs, Circuit Breakers and Switches.

1. All cut-outs and switches having exposed live metal parts to be located in cabinets. Cut-outs and switches, not in iron boxes or in cabinets, shall be mounted on not less than 1-4 in. fire-resisting insulating material, which shall project at least 1-2 in. beyond all sides of the cut-out or switch.

2. Cut-outs to be of the approved cartridge or approved blow-out type.

3. All switches controlling circuits of over 5 ampere capacity shall be of approved single pole, quick break, or approved magnetic blow-out type.

Switches controlling circuits of 5 ampere or less capacity may be of the approved single pole, double break, snap type.

4. Circuit breakers to be of approved type.

5. Circuits must not be fused above their safe carrying capacity.

6. A cut-out must be placed as near as possible to the current collector, so that the opening of the fuse in this cut-out will cut off all current from the car.

Note.—When cars are operated by metallic return circuits, with circuit breakers connected to both sides of the circuit, no fuses in addition to the circuit breakers will be required.

d. Conduit.

Note.—When from the nature of the case, or on account of the size of the conductors, the ordinary pipe and junction box construction is not permissible, a special form of conduit system may be used, provided the general requirements as given below are complied with.

1. Metal conduits, outlet and junction boxes to be constructed in accordance with Rule No. 49, except that conduit for lighting circuits need not be over 5-16 in. internal diameter and 1-2 in. external diameter, and for heating and air motor circuits need not be over 3-8 in. internal diameter and 9-16 in. external diameter, and all conduits where exposed to dampness must be water tight.

2. Must be continuous between and be firmly secured into all outlet or junction boxes and fittings, making a thorough mechanical and electrical connection between same.

3. Metal conduits, where they enter all outlet or junction boxes and fittings, must be provided with approved bushings fitted so as to protect cables from abrasion.

4. Except as noted in Section *i*, 2, must have the metal of the conduit permanently and effectively grounded.

5. Junction and outlet boxes must be installed in such a manner as to be accessible.

6. All conduits, outlets, or junction boxes and fittings to be firmly and substantially fastened to the framework of the car.

e. Molding.

1. To consist of a backing and a capping and to be constructed of fire-resisting insulating material, except where circuits which they are designed to support are nominally not exposed to moisture, they may be constructed of hard wood.

2. When constructed of fire-resisting insulating material, the backing shall be not less than 1-4 in. in thickness and be of a width sufficient to extend not less than 1 in. beyond conductors at sides.

The capping, to be not less than 1-8 in. in thickness, shall cover and extend at least 3-4 in. beyond conductors on either side.

The joints in the molding shall be mitred to fit close, the whole material being firmly secured in place by screws or nails, and treated on the inside and outside with a waterproof paint.

Note.—When fire-resisting molding is used over surfaces already protected by 1/8 in. fire-resisting insulating material, no backing will be required.

3. Wooden moldings must be so constructed as to thoroughly encase the wire and provide a thickness of not less than 3-8 in. at the sides and back of the conductors, the capping being not less than 3-16 in. in thickness. Must have both outside and inside two coats of waterproof paint.

The backing and the capping shall be secured in place by screws.

f. Lighting and Lighting Circuits.

1. Outlets to be provided with either single lamps of not over 32 candle power, the lamps being supported in approved porcelain receptacles, or with approved clusters.

2. Circuits to be run in approved metal conduit, or approved molding.

3. When metal conduit is used, except for sign lights, all outlets to be provided with approved outlet boxes.

4. At outlet boxes, except where approved clusters are used, porcelain receptacles to be fastened to the inside of the box, and the metal cover to have an insulating bushing around opening for the lamp.

When approved clusters are used, the cluster shall be thoroughly insulated from the metal conduit, being mounted on blocks of hard wood or fire-resisting insulating material.

5. Where conductors are run in molding the porcelain receptacles or cluster to be mounted on blocks of hard wood or of fireproof insulating material.

g. Heaters and Heating Circuits.

1. Heaters to be of approved type.

2. Panel heaters to be so constructed and located that when heaters are in place all current carrying parts will be at least 4 inches from all woodwork.

Heaters for cross seats to be so located that current carrying parts will be at least 6 inches below under side of seat, unless under side of seat is protected by not less than 1-4 in. fire-resisting insulating material, or .04 in. sheet metal with 1 in. air space over same, when the distance may be reduced to 3 in.

3. Circuits to be run in approved metal conduit, in approved molding, or if the location of conductors is such as will permit an air space of not less than 2 in. on all sides except from the surface wired over, they may be supported on porcelain knobs or cleats, provided the knobs or cleats are mounted on not less than 1-4 in. fire-resisting insulating material extending at least 3 in. beyond conductors at either side, the supports raising the conductors not less than 1-2 in. from the surface wired over, and being not over 12 in. apart.

h. Air Pump Motor and Circuits.

1. Circuits to be run in approved metal conduit or in approved molding, except that when run below the floor of the car they may be supported on porcelain knobs or cleats, provided the supports raise the conductor at least 1-2 in. from the surface wired over and are not over 12 in. apart.

2. Automatic control to be enclosed in an approved metal box. Air pump and motor, when enclosed, to be in approved metal box or a wooden box lined with metal of not less than 1-32 in. in thickness.

When conductors are run in metal conduit the boxes surrounding automatic control and air pump and motor may serve as outlet boxes.

i. Main Motor Circuits and Devices.

1. Conductors connecting between trolley stand and main cut-out or circuit breakers in hood, to enter car through approved bushings, or to be protected where wires enter car to prevent ingress of moisture.

2. Conductors connecting between third rail shoes on same truck, to be supported in an approved fire-resisting insulating molding, or in approved iron conduit supported by soft rubber or other approved insulated cleats.

3. Conductors on the under side of the car, except as noted in No. 4, to be supported in accordance with one of the following:

a. To be run in approved metal conduit, junction boxes being provided where branches in conduit are made, and outlet boxes where conductors leave conduit.

b. To be run in approved fire resisting insulating molding.

c. To be supported by insulating cleats, the supports being not over 12 in. apart.

4. Conductors, with flameproof braided outer covering, connecting between controllers at either end of car, or, controllers and contactors may be run as a cable, provided the cable where exposed to the weather is encased in a canvas hose or canvas tape, thoroughly taped or sewed at ends and where taps from the cable are made, and the hose or tape enters the controllers.

Conductors with or without flameproof braided outer covering connecting between controllers at either end of the car, or, controllers and contactors may be run as a cable, provided the cable throughout its entire length is surrounded by 1-8 in. flameproof covering, thoroughly taped or sewed at ends, or where taps from cable are made, and the flameproof covering enters the controllers.

Cables, where run below floor of car, may be supported by approved insulating straps or cleats. Where run above floor of car, to be in a metal conduit or wooden box painted on the inside with not less than two coats of flameproof paint, and where this box is so placed that it is exposed to water, as by washing of the car floor, attention should be given to making the box reasonably waterproof.

Canvas hose or tape, or flameproof material surrounding cables after conductors are in same, to have not less than two coats of waterproof insulating material.

5. Motors to be so drilled that, on double truck cars, connecting cables can leave motor on side nearest to king bolt.

6. Resistances to be so located that there will be at least 6 in. air space between resistances proper and fire-resisting material of the car. To be mounted on iron supports, being insulated by non-combustible bushings or washers, or, the iron supports shall have at least 2 in. of insulating surface between them and metal work of car; or, the resistances may be mounted on hard wood bars, supported by iron stirrups, which shall have not less than 2 in. of insulating surface between foot of resistance and metal stirrup, the entire surface of the bar being covered with at least 1-8 in. fire-resisting insulating material.

The insulation of the conductor, for about 6 inches from terminal of the resistance, should be replaced, if any insulation is necessary, by a porcelain bushing or asbestos sleeve.

7. Controllers to be raised above platform of car by a not less than 1 in. hard wood block, the block being fitted and painted to prevent moisture working in between it and the platform.

j. Lightning-Arresters.

1. To be preferably located to protect all auxiliary circuits in addition to main motor circuits.

2. The ground conductor shall be not less than No. 6 B. & S. gage, run with as few kinks and bends as possible, and be securely grounded.

k. General Rules.

1. When passing through floors, conductors or cables must be protected by approved insulating bushings, which shall fit the conductor or cable as closely as possible.

2. Molding should never be concealed except where readily accessible. Conductors should never be tacked into molding.

3. Short bends in conductors should be avoided where possible.

4. Sharp edges in conduit or in molding must be smoothed to prevent injury to conductors.

Geneva Traction Co.

The Geneva (Ind.) Traction Co., which was recently incorporated to build an interurban line between Geneva, Ind., and Celina, O., has completed its survey. The route passes through the center of the Indiana oil fields and a thickly populated and prosperous country, with no east and west steam or electric line within 15 miles. Mr. W. Osgood Orton, of South Bend, Ind., is the general manager of the company.

Whitman Electric Railway and Power Co.

The Whitman Electric Railway & Power Co., capital $500,000, with headquarters at Colfax, Wash., has been incorporated to build and operate an electric and steam railroad from Colfax through Albion to Palouse City, 24 miles, connecting with the Northern Pacific Ry. and the Oregon Railroad & Navigation Co.; also from Palouse City into Idaho and up the Palouse River towards Princeton, Idaho, tapping a heavily timbered and hay raising country, and furnishing supplies to the mining region above, a further distance of 15 miles or more as the traffic demands. It is also planned to build a spur from the main line at the junction of Four Mile creek to a point near Viola, Idaho. The length of this spur will be about 12 miles, and it will serve a fine wheat, hay and garden-truck growing country, and tap an inexhaustible supply of cordwood. The population to be served by this road is about 15,000. The line does not parallel any other steam or electric road. The surveys have been completed and part of the franchises secured. The officers are: President, I. B. Harris; vice-president, S. D. Lommasson; treasurer, John Hart; secretary, Charles F. Stuart, Colfax.

The Cost of Band Concerts.

The park department of the Pittsburg Railways Co. uses band concerts as leading attractions at its three pleasure parks, giving afternoon and evening concerts during the entire park season. It has always engaged members of the local musicians' union, and up to the present season the relations between the union and the company have been very satisfactory. It is the practice of the company to engage about 20 men for each band during the first months of the park season, and 25 or more during the height of the summer business, with never less than 28 men for the Sunday concerts. However, at the opening of the present season, the musicians' union adopted a resolution, stipulating that the railway company must employ not less than 28 men for each band at every concert. This the company could not see its way to do, and therefore began engaging non-union bands for its parks. As a result, from 60 to 75 members of the local union have lost the chance to make $5.00 per day for eight weeks.

Recently the union has come to recognize the unfairness of its demand, and has withdrawn the stipulation as to the number of men that shall constitute a band, and its members are again playing at the parks.

We are indebted to Mr. A. S. McSwigan, superintendent of parks for the Pittsburg Railways Co., for the following schedule, covering the employment of musicians at park concerts as agreed upon by the musicians' union and the railway company.

The price paid per man for park concerts is as follows:

Single concerts, week-day afternoons or Sunday afternoons, $3.00.

Single concerts, week-day evenings or Sunday evenings, $4.00.

Any afternoon and evening, same day, same place, $5.00.

If a man is shifted from one park to another in the same day, the concerts are to be considered as separate engagements.

Where the men are engaged by the week, the rates are to be as follows:

Six evenings, without Sunday, $18.00.

Six evenings and Sunday afternoon and evening, $22.00.

Six afternoons and evenings without Sunday, $25.00.

Seven afternoons and evenings, $28.00.

Seven evenings, $20.00.

If engaged for the season, the rates per man shall be as follows, it being stipulated that a season shall be not less than ten consecutive weeks and not less than six days to the week:

Six evenings, without Sunday, $16.00.

Six evenings and Sunday evening, $20.00.

Six afternoons and evenings, $25.00.

Seven evenings, $18.00.

No concert shall exceed two hours without intermission or two and one-half hours without one-half hour intermission. Unless otherwise provided for, time of sessions for miscellaneous park engagements shall not exceed three hours with one-half hour intermission.

All single park engagements contracted for shall be paid for in full whether the engagement is played or not on the date contracted for.

Where bands play on car immediately before or after the concert, they shall receive $1.00 per hour per man extra. A band playing on car used only to advertise a concert or other affair shall receive $3.00 per man for not over three hours.

Pianists, if engaged to play without band in parks, shall receive for Sunday only or any other single day, $7.00; more than one and less than six consecutive days, per day, $5.00; six consecutive days (a week), $25.00; seven consecutive days (a week), $30.00.

The agreement provides that not over two sessions shall be held per day, and all expenses and transportation of musicians are to be paid by the company.

The rates for holidays are somewhat higher. On July 4th, for concerts in parks not to exceed eight hours' actual time, $8.00 per man per day is to be paid. On Decoration Day for concerts in parks, single afternoon, three hours, $4.00 per man; evenings, three hours, $5.00; afternoon and evening, each concert not over three hours, $8.00. Other holidays, $1.00 extra per man.

Mr. McSwigan states that band concerts are fairly popular with the public at Pittsburg, although people like new and startling attractions, and some novel vaudeville piece will draw a much larger crowd than a good band concert. But he believes that afternoon and evening band concerts are desirable as regular and permanent attractions at any pleasure park. The public responds in large crowds to some particularly famous band, such as Sousa's, but the better known bands cost so much that it is not practicable to engage them frequently.

The Privileges of a Patron.

Blatant horn-blowing, we concede, is a futile way to prove one's worth. It is bad form and worse judgment. It requires neither argument nor horn-blowing to show the influence upon the economic and industrial life of a community of such a great enterprise as the Detroit United Railway. We simply point it out. That service which is used by every member of a community and consequently is the center of universal attention is exposed always to the onslaught of him who seeks to make a noise among his fellow-men. We say such is inevitable. So is mosquito-time. But the thoughtful citizen looks deeper and his hysterics are not easily evoked.

Last week we attempted to show in what manner your nickel-fare buys bread and clothes and shelter for upwards of 4,000 families in this community. Now it is our aim to show the influence of the Detroit United Railway upon the business activities and manufactures of Detroit. Of many local firms the Detroit United Railway is the largest customer. This company's orders, in many instances, insure these firms a stable and unvarying market that brings them their working expenses. That means much. Wherever possible the Detroit United Railway insists upon taking the products of home industry. That means hundreds of thousands a year. Coal, for instance, bought in Detroit is alone an enormous item. In the power houses 380 tons of slack are burned daily. For heating and power about 147,000 tons of expensive fuel are bought annually by the Detroit United Railway. There are a thousand other items, such as printing, stationery, etc. One might ask what your theaters and hotels and department stores would do without the best means of transportation. Also, one might ask what the merchants and business men of Detroit would do without this one great unfailing demand for their wares. The people's benefits are to be considered before the theories of your "public champion."—From Detroit United Weekly.

Canton-Akron Ry. Time-Table.

The summer time-table of the system which comprises the Canton-Akron Railway Co., the Canton-New Philadelphia Railway Co., and the Tuscarawas Traction Co., which are called the "Scenic Lines," is a very attractive folder in which Meyer's Lake and Springfield Lake and wood, the principal resorts of the system, are described and illustrated with half-tone views. The steam line connections are printed in connection with the time-table, information is given as to special cars, rates, etc., and there is a map showing the electric lines, as well as the steam lines, which connect therewith, both in operation and under construction. The folder was issued under the direction of the general manager, Mr. George W. Rounds.

The Auburn & Syracuse Railroad Co. has opened a new park on the shore of Owasco Lake, 2½ miles from Auburn.

Massachusetts Railway Legislation.

While the street railway committee of the Massachusetts legislature of 1904 had the usual amount of petitions to consider these did not materialize in any great number of acts. There were as usual a number of cases where promoters who had secured charters in years past asked for extensions, but there were only three instances which received the favorable consideration of the House of Representatives. These were the Hartford & Worcester, the Lowell & Fitchburg, and the Danvers & Georgetown roads.

As the Commonwealth of Massachusetts has for several years been engaged in constructing what in course of time will be through lines of highways radiating from Boston, the legislature this year amended the law relative to claims for damages against street railway companies. Previously, if these injuries were caused by a defective highway the parties sued the city or town within whose limits the accident happened, and the city or town could recover from the street railway company if the company was liable. If the accident had happened on a section of the so-called state highway the state could not have recovered. The new law places the state in the same position as the city and town.

In financial affairs connected with street railways the largest privilege allowed was that to the Massachusetts Electric Companies, which is made up of the Old Colony Street Railway Co. and the Boston & Northern Street Railway Co. Each in turn is composed of a number of companies mostly acquired by lease. The legislature passed two bills allowing the Boston & Northern and the Old Colony companies to issue coupon and registered bonds for 50 years at a rate of interest not exceeding 4 per cent, and having as security a first mortgage upon the company's property and franchises. The restriction of the legislation is that all outstanding bonds of the minor companies shall be refunded by these new issues. The supervision of the issuance of these bonds and the fixing of the amounts allowed at different times is placed in the hands of the railroad commissioners. Already the commissioners have allowed the Boston & Northern to issue bonds amounting to $9,660,000, and the Old Colony to the amount of $6,600,000. As the mortgages and bonds of the minor companies outstanding were nearly all bearing interest at 5 per cent, the refunding process will save the companies 1 per cent on their bonded indebtedness.

In the matter of transfer tickets the legislature has declared its position. A new act provides that street railway companies shall cause to be printed on each transfer ticket issued the conditions upon which such tickets may be used. A penalty of a fine of $50, or 30 days' imprisonment, is provided for whoever attempts to wrongfully use such a ticket.

The spending of public money to promote a street railway has been sanctioned in but one instance this season. The Plymouth, Carver & Wareham road, which has had a paper existence for some time, last year secured the passage of a bill authorizing the town of Plymouth to purchase stock to the amount of $15,000. This year the amount was raised to $30,000.

A two or three years' effort to compel street railway companies to establish waiting rooms on the order of local authorities has culminated this year in an act which puts the street railways under the same law as applies to steam roads in this matter. The local authorities, or in fact a number of citizens, can petition the railroad commissioners, stating that suitable accommodations are not provided, and ask for improvements. The board can, after a hearing and investigation, order the street railway company to do what it thinks is proper. This is a compromise measure, as the promoters of this legislation have been very persistent that the matter should be left entirely in the hands of the local board of aldermen or selectmen.

The legislature has passed an act attempting to protect firms which sell street railway construction supplies and builders. Such a firm, having a charge against a contractor acting for a street railway company, now has right of action against such company to recover such debt. The claim for the debt must be filed within 30 days after the completion of the work with the city or town clerk. In a case for material furnished it is necessary for the supplying firm to file with the city or town clerk a written notice of its intention to claim such right, and an action must be begun within 60 days of the date the material was furnished.

In one case special authority has been granted to the town of Boxford to allow it to lay out a special town way for an electric line. The selectmen are given authority to locate a street railway on its own highway and to require the road to pay for the same "such amounts and in such manner as the railroad commissioners shall determine," or the selectmen can lease the location to the railroad company. The understanding during the pendance of this legislation was that the railway in question is to recompense the town for the actual expense incurred in the new railway.

The placing of explosives on the tracks of street railway companies is one of the minor matters that has received legislative attention this year. There are a number of cases where cars have been derailed by such explosives, and while in the main no direct injury has been caused, it has resulted in panics and passengers have been hurt in the rush to get out of the car. The new act provides a sentence in the state prison for not more than 10 years, in jail for not more than 5 years, or a fine of not more than $500, for whoever "wilfully, intentionally and without right, throws into, against or upon, or puts, places or explodes or causes to be exploded in, upon or near a dwelling house, shop, building, street railway, street railway car or vessel, gun powder or other explosive, or bombshell, torpedo or other instrument filled or loaded with an explosive with unlawful intention to injure or destroy such property."

The common carrier law in regard to freight has been amended this year so as to provide that interested parties need only secure a favorable action of local authorities to compel roads to do this kind of business. Under the law of last year they had to petition the railroad commissioners also. It is but a small difference, however, as an appeal to the railroad commissioners by a company is left open under the new act.

The legislature has authorized a railway company (Haverhill & Boxford) to build a bridge across the Merrimac River for the purpose of getting into the city of Haverhill. As a public footwalk is to be provided the company has the right of eminent domain to take such land as may be necessary for the approaches to the bridge.

The company which made the greatest unsuccessful fight was the Western Massachusetts Street Railway Co., which wanted to build a section of road which would complete a line from Pittsfield to Springfield, and which in connection with existing roads would make possible a trolley trip the entire width of the state. It was a settled question that to build this road the charter would have to contain special privileges on account of the hilly country through which it would run, in order to interest sufficient capital. The bill passed the committee successfully, but it was feared that the consolidation features, in the hands of capable financiers, might make possible the consolidation of all the street railways in the state into one company.

The Boston & Northern and the Old Colony companies asked the legislature to allow them to increase their facilities for supplying power to their different lines. These companies are establishing power stations of large capacity and wish to radiate feed lines from them to different parts of their roads. They sought authority to issue bonds to cover the expense of this work, but had coupled with it a provision to allow them to take by right of eminent domain land on which to erect their poles and string their wires. The matter went through to the governor in this form, but he refused to sign it until it was amended, striking out this eminent domain feature. The companies can now enter upon land for the purpose of surveying without being guilty of trespass, but must come to a satisfactory agreement with the owners of real estate before locating wires.

Chicago Elevated Traffic.

The daily average of passengers carried by the Metropolitan West Side Elevated Railroad Co. in June was 110,923, a decrease of 690, or 0.62 per cent; the daily average of the South Side Elevated Railroad Co. was 81,405, a decrease of 3,860, or 4.53 per cent; the daily average of the Northwestern Elevated Railroad Co. was 68,222, an increase of 1,651, or 2.48 per cent; the daily average of the Chicago & Oak Park Elevated Railroad Co. was (main line) 41,220, a decrease of 942, or 2.23 per cent, and with transfers the daily average was 43,850, a decrease of 1,010, or 2.27 per cent. Comparisons are with June, 1903.

CHICAGO THE LONDON

STREET RAILWAY REVIEW

AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

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We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

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VOL. XIV JULY 20, 1904 NO. 7

SUMMARY OF CONTENTS.

THE CONVENTION SOUVENIR "REVIEW."

The regular September 20th number of the "Review" will be made the St. Louis Convention Souvenir; the paper will be mailed well in advance of the convention so as to reach delegates before they leave for St. Louis. All those who are familiar with the former Souvenir issues of the "Review" know what to expect from us on such occasions, as our special numbers are conceded to be in every way the finest publications of their kind. We are not given to boasting about what we intend to do, but in this instance feel justified in promising a more interesting convention number than ever before.

THE "DAILY REVIEW."

The "Daily Street Railway Review" will be published at St. Louis, October 11th, 12th, 13th and 14th, covering the work of the three railway associations and the other matters of interest in connection with the conventions. This year the "Daily" has a wider field than at former conventions, as the crowded condition of hotels and the widely scattered exhibits at the Fair make it practically impossible to have common meeting places such as the headquarters hotel and the exhibit hall have been in former years, and the "Daily Review" will constitute the common bond. It is not necessary to say a great deal about the scope and importance of the "Daily Review," as a paper that has appeared regularly for five years, and each issue of which contains nearly one hundred pages may be presumed to speak for itself.

There is one matter, however, in connection with the "Daily" to which special attention is directed. While the "Daily Review" is a distinct publication with a subscription list entirely separate from our monthly paper, it is in its nature supplementary to the latter, and in order to have the contents of the "Daily" conveniently accessible these papers should be bound with the 12 numbers of the monthly "Street Railway Review." For this reason the page numbers of the "Daily" are made consecutive with those of the next preceding monthly.

The four numbers of the "Daily Review" contain in the aggregate about twice the number of reading pages that appear in the "Review" each month. To have your files for the year complete, save the "Dailies" for binding.

THE NAME OF THE A. S. R. A.

At the Saratoga convention a resolution that the name "American Street Railway Association" be changed to "American Electric Railway Association" was unanimously carried, but it was thought that, while all the delegates present at that meeting favored such a change, the change of name was not a matter which should be so hastily acted upon, and accordingly the resolution was reconsidered and this question referred to the executive committee for this year with instructions to report at the next convention. The new name proposed is one that is in every way appropriate and far more descriptive of the scope of the association than is the present one. The "Review" has advocated this change in name for several years and earnestly hopes that favorable action will be recommended and the action ratified by the association.

RECENT MASSACHUSETTS LEGISLATION.

Nothing furnishes a more striking demonstration of the extent to which "street railways" have in recent years outgrown their old limits, than the amount of new legislation that is found necessary in order to make the old laws fit new conditions as affecting electric railways. The new laws for the most part confer new rights or confirm claims that under existing precedents might be of doubtful validity; there are, however, some new duties imposed, and in some instances there are now imposed as duties the very things that were once refused as favors.

At the last session of the Massachusetts Legislature laws were passed to protect electric railways against the wrongful use of transfer tickets, to punish persons placing explosives on street railway tracks, and in a number of instances granting, by special act, a limited right of eminent domain. As new burdens on the railways may be classed an amendment of the common carrier law so that local authorities may require the street railways to handle freight, a law giving the railroad commission power to require, on petition of local authorities, street railways to establish and maintain waiting stations, and a lien law for the protection of contractors supplying electric railways.

ADVERTISE.

We have at various times commented upon what appeared to be the lack of enterprise and good judgment on the part of electric railway companies in failing to properly advertise their lines. This applies particularly to interurban companies who have lines that can conveniently be used for more or less extended pleasure trips. Some companies carry time cards in the daily papers, but the number doing this is much smaller than it should be. Other companies advertise by means of posters, but it would seem that these effective modes of telling the public what the railway company has to offer are practiced in the smaller towns where the benefit to be derived is less than it would be were the population to be reached greater. Companies operating parks appear to be the ones most keenly alive to the benefits of advertising, having learned by association with amusement enterprises.

Interurban lines having friendly relations with connecting steam railroads are running excursions and of course advertising them, but little has been done towards making the public familiar with the opportunities for trips of considerable length over connecting electric roads.

The best example of systematic advertising to secure excursion traffic is that done in New England. The electric lines connecting with the city of Boston aggregate 3,500 miles in length and naturally in the territory covered special advantages are offered for picnics of clubs and societies and for excursions. The excursion business in New England has been greatly increased through the work of Mr. R. H. Derrah, who has been interested in it for several years. This season in particular an active advertising campaign has been carried on. Placards suitable for display at news stands and shop windows have been distributed by the thousands, and folders and circular letters by the hundreds of thousands, with most satisfactory results.

"QUESTION BOXES" AND "WRINKLES."

Every man engaged in business is from time to time confronted with troublesome questions on which he would be glad to consult with others similarly situated were there at hand a convenient medium for reaching those who had already met and perhaps satisfactorily solved the same difficulties. If the point of doubt is one affecting some general scheme to which it is desirable that all in the same business should conform, the need for consultation is of course greater. In many instances there exist reasons why the matter should be treated as confidential, at least as regards the identity of the inquirer and the particular application of the question.

With the idea of making their respective bodies more useful to members by affording opportunity for interchanging information in the form of answers to definite questions, both the Street Railway Accountants' Association and the American Railway Mechanical and Electrical Association have decided to institute a "Question Box" to be handled by the secretary. At present, we understand, it is only contemplated to have the Question Box a feature of the convention program. The questions after being received by the secretary will be printed, omitting name and address of the inquirers, and then submitted to the entire membership for answers. Both questions and answers will be printed and constitute a convention report, in which doubtless many points will be found for further discussion. If the Question Box proves to be a success arrangements will doubtless be made to have the exchange of questions and answers continued throughout the year.

The reason why Question Boxes conducted by the Associations should be of more value to the members than were a similar interchange of information attempted through some other medium are first, the feeling of loyalty to the association which will prompt members to render assistance, and second, the fact that the questions although anonymously presented to members, have the indorsement of the association as a guarantee of good faith.

There is always danger that considerable rubbish will find its way into the Question Box; but even this feature has its good side, because if a man in good faith asks what his colleagues may properly consider foolish questions, his need for information is all the greater.

The Question Box takes care of one branch of the interchange of information between individuals. The question is, so to speak, a shot in the air, with the hope that the missile will find for a target someone who has the information at hand for an answer, and also sufficient interest in the subject to take the trouble to reply. Another way of exchanging information is to make the answer a shot in the air; that is, for those who have followed some practice or developed some device, that has proved especially convenient, and which it is believed is not generally used, to submit a statement to a general clearing house, with the idea that in this way a considerable number can profit by it. This is covered in the National Electric Light Association by the "Wrinkle" department. At the last Convention of this Association, Mr. Charles H. Williams, who is the editor of "Wrinkles," submitted a pamphlet of over one hundred pages of short contributions of interest to members. In this issue we have reprinted several of the "Wrinkles," which are equally applicable to the railway field, and from these it is apparent that the department is a valuable one to the practical men.

A judicious combination of "Question Boxes" and "Wrinkles" might yield better results than either alone; the questions would help in suggesting subjects for wrinkles, and the author of a wrinkle need not let modesty prevent him from submitting it because no one had thought to ask the proper question.

INSTRUMENTS AND CAR TESTS.

The choice of instruments in an engineering test is one of the most important features of the experimental problem. Without the use of apparatus suited to the particular work in hand, there is always a chance that the most ingenious arrangement of instruments and wiring, plus painstaking observations, will be unable to secure the results required by operating men.

It is one thing to make tests in a laboratory and quite another to put questions to nature on the platform of a swiftly moving car, surrounded by the complex traffic of a city street. Room is at a premium in the motorman's vestibule and rugged simplicity of apparatus the prime requisite of service tests. Elaborate arrangements of instruments and wiring are often installed for experimental work on cars, and not seldom does the complication of the equipment defeat its own ends and cause the manager to abandon the whole affair in disgust.

An instance of misuse of facilities for obtaining a very simple physical quantity—kilowatt-hour per car mile—occurred a few days ago on a road which prides itself upon its progressiveness. The problem in hand was the determination of the relative power consumption of two cars fitted with different gear ratios in actual service. An ammeter and a voltmeter were installed upon a temporary switchboard panel in the vestibule of one of the cars, and a round trip of about 10 miles made over a certain route directly in front of the other car. Two men stationed in the vestibule took readings from both instruments every half minute, and a second round trip with the other car completed the test. The results are not yet in hand, but it is difficult to see how accurate deductions of the relative power consumption of the two differently geared cars can be made from 30-second readings taken in this way. Voltage and current readings were not the quantities desired in this case; but watt-hour consumption—a figure obviously available by the use of a single recording wattmeter which could have been far more accurately and easily obtained if the company had possessed such an instrument or even borrowed it from the electric light company supplying the city with current. One man's time would have been saved for other work and readings easily taken at any desired point on the system, while the comparison could scarcely have been more simply obtained than by putting the wattmeter upon first one car and then the other, using the same motorman in each case. It has often been pointed out that a difference of 20 per cent in power consumption will frequently occur between different motormen on the same car and in the test under consideration this precaution was not taken.

The voltmeter and ammeter are, of course, most useful in many kinds of car tests, and serve their purpose well on roads which cannot afford the expense of the elaborate apparatus now on the market for determining the speed, time, current, voltage, power and distance quantities which make up any given cycle of car and train movement. It is scarcely necessary to point out that 10-second readings are the limit of even commercial accuracy in modern rapid transit measurements and that 5 or even 2-second readings are far more satisfactory, even at the cost of the observers' bodily comfort. When the expense of paying a dozen or so of observers in a large series of tests is taken into account, the cost of a complete testing set with recording apparatus, does not appear so high, after all.

The test made in actual service is always more satisfactory than one conducted in the car house, for the conditions of practical daily operation are those which the equipment must face. Thus it is better to make resistance tests while the motors and rheostats are still warm, or at any rate with a current which is capable of heating them as nearly up to service conditions as possible, rather than with an ohmmeter or other instrument using an insignificant current in its operation. It is hard to simplify Ohm's law beyond the need of a commercial ammeter and voltmeter.

It is always a good sign when a road begins to spend time and money upon tests, for it means that an ultimatum has been declared against many small losses and wastes which are decidedly worth saving. But it is a mistake to attack these physical problems in any half-hearted way, and unless the instruments and methods are adapted to each particular problem, far-reaching decisions will often be based upon untrustworthy figures.

INTERNATIONAL ELECTRICAL CONGRESS.

In accordance with plans announced nearly two years ago, the International Electrical Congress will convene at St. Louis on Monday, September 12th, and be in session until September 17th. The work of the congress will be divided into eight sections, each of which has its separate chairman and secretary. Section "F", which is to cover the subject of "Electric Transportation", will be presided over by Dr. Louis Duncan, of the Massachusetts Institute of Technology, and have for its secretary Mr. A. H. Armstrong, of Schenectady, N. Y. Seven of the associations, including the American Institute of Electrical Engineers, the American Electrochemical Society and the National Electric Light Association, are coöperating in the holding of the congress, and it is a matter of regret that the American Street Railway Association should not have been represented in this work.

Montreal Benefit Association.

The Montreal Street Railway Mutual Benefit Association held its annual meeting June 20, 1904, at which the first annual report was submitted by the president of the association, Mr. W. G. Ross, managing director of the Montreal Street Railway Co. The association was formed Oct. 1, 1903, and at the end of the fiscal period, Apr. 30, 1904, had a balance of $5,800.48, after paying all benefit claims and expenses. During the seven months of its operation the association has paid out $3,049.95 in sickness and injury benefit claims. The Montreal Street Railway Co. made a Christmas gift of $3,000 to the association, this contribution being in addition to that provided for in the by-laws of the association. This makes the total received from the company $9,513.40. The membership of the association has increased steadily and now numbers 1,152.

Mr. W. G. Ross succeeded to the presidency of the association when Mr. F. L. Wanklyn resigned as vice-president and general manager of the Montreal Street Ry.

The association dues are $1 to join and 50 cents per month thereafter. This secures: Sick benefit of 60 cents per day after the first six days for 90 days, and 30 cents per day for the next 90 days; free medical attendance; free medicine; 20 per cent discount on medicines required by the family of a member; life insurance policy of $500; $50 towards cost of funeral expenses, and a superannuation pension.

MR. THOMAS FARMER has resigned as superintendent of the C. G. Kuhlman Car Co., Collingwood, Ohio.

Race Trains at Seattle.

The accompanying illustration shows one of the race track trains operated between Seattle and the Race Track, which is located at the "Meadows," 6 miles from the city, on the line of the Puget Sound Electric Railway Co. The Puget Sound Electric Ry. is practically double track for all of the distance between Seattle and the Meadows, but for two seasons past it has been found rather expensive, as well as unsatisfactory, to handle the traffic to and from the races, which are held during June and July, with the ordinary double truck passenger cars. The principal objection was that the number of accidents was increased because of the large number of separate cars operated, and the management has found it almost impossible to obtain men who will keep the cars the proper and safe distance apart.

This season the problem has been solved in a most satisfactory manner by using the ordinary flat car, fitted with temporary top and seats, as shown in the engraving.

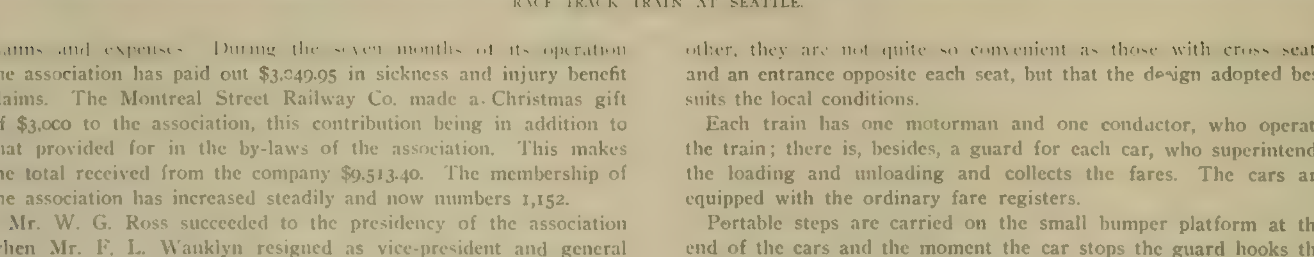
The company is now able with two trains of this type, making a half hour service between Seattle and the Race Track, and two to four ordinary double truck passenger cars running in between to pick up the stragglers, to handle the crowds in a manner satisfactory to all concerned.

As soon as the season is over the tops will be removed from the cars and stored one upon top of another in a car house used for summer cars, where they will be ready for use next season. The railing around the cars will also be taken off and the motors and flat cars will again be ready for the freight service. The motor is one of the center cab type freight motors used in the freight service between Seattle and Tacoma, and has four 125-h.p. G. E. No. 66 motors, geared for about 30 miles per hour.

The trailer cars are arranged with two seats lengthwise of the car down the center and a seat lengthwise of the car on each side. There are two openings for entrance and exit, placed at diagonally opposite corners of the car.

On busy days the trains consist of one motor and five trailer cars. During the middle of the week when the crowds are smaller the traffic can be handled with one train, consisting of a motor and eight trailer cars.

Mr. W. S. Dimmock, manager of the Puget Sound Electric Ry., to whom we are indebted for the photograph and data on the race track trains, states that while these cars are quite as safe as any other, they are not quite so convenient as those with cross seats and an entrance opposite each seat, but that the design adopted best suits the local conditions.



RACE TRACK TRAIN AT SEATTLE.

Each train has one motorman and one conductor, who operate the train; there is, besides, a guard for each car, who superintends the loading and unloading and collects the fares. The cars are equipped with the ordinary fare registers.

Portable steps are carried on the small bumper platform at the end of the cars and the moment the car stops the guard hooks the step into a heavy iron fastening opposite the entrance, making an easy mode of ingress and egress.

The Eastern Wisconsin Railway & Light Co. uses an attractive hanger, 18 x 18 in., to advertise its service between Oshkosh and Fond du Lac, Wis. In large letters at the top of the card is the injunction: "Take the Yellow Car," and in the center is a cut showing a pedestrian taking literal advantage of the injunction by carrying a yellow interurban car under his arm. A time-table and general information are given, the lettering being in colors. The top and bottom edges of the hanger are protected by brass strips.

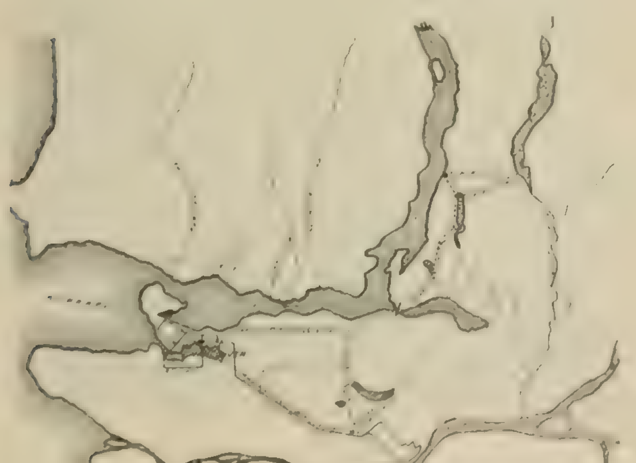
British Columbia Electric Railway.

The electric railways of the three cities of Vancouver, New Westminster and Victoria, British Columbia, are operated by the British Columbia Electric Railway Co., Limited, which was organized in April, 1897, and is the successor of the Consolidated Railway & Light Co. In 1889 there were three companies in this territory, the Vancouver Electric Railway & Light Co. and the Victoria Electric Railway & Light Co., operating in the two cities named, and the Westminster & Vancouver Tramway Co., which is claimed to have been the first interurban electric railway. In 1894 the Vancouver company and the interurban were merged into the Consolidated Railway & Light Co. May 1, 1896, this company acquired the Victoria property and arrangements were made for extensive improvements, but all of these plans were frustrated by the appalling accident of May 26, 1896, when a car on the Victoria line fell through a high bridge and 56 persons on board were killed or drowned. A receivership for the company followed, as its financial backers were not willing to furnish funds with the probability of their being diverted to the payment of damage claims instead of paying for betterments. The litigation following resulted, however, in holding the municipality, which owned the defective bridge, and not the railway company liable for negligence; the case was carried to the Privy Council of Great Britain.

The British Columbia Electric Railway Co., Ltd., is organized under the Imperial Companies Acts, and has authorized share capital as follows: £200,000 in 5 per cent cumulative perpetual preference shares; £200,000 in 5 per cent non-cumulative preferred ordinary stock, ranking in any one year for additional dividend ratably with the deferred ordinary stock after the latter has received a dividend of 7 per cent; £210,000 in deferred ordinary stock; £40,000 in ordinary shares. Of the authorized share capital there has been issued and fully paid up £75,000 in cumulative perpetual preference shares and all of the preferred and deferred ordinary stock, making a total of £485,000. There were outstanding at the close of the last fiscal year, ending June 30, 1903, 4½ per cent debenture bonds amounting to £420,200.

Beginning in 1898 the company paid 4 per cent per annum on the ordinary stock until 1902-3, when the dividend rate was increased to 5 per cent.

The reserve accounts carried by this company are three in number—reserve fund, capital amortization fund, and renewals main-



MAP OF RAILWAY AND POWER LINE.

tenance fund. The credit to capital amortization for the last fiscal year was in round numbers £1,600. Bonds amounting to £2,400 were called and redeemed. These two items amount to 45/100 per cent of the total capital stock and bonds.

Depreciation charges, written off annually, are as follows:

Electrical machinery	5	per cent.
Steam and water machinery	5	" "
Rolling stock	3½	" "
Track	2	" "
Poles	10	" "
Lines	3	" "
Buildings	1	" "
Office furniture and fixtures	5	" "

In 1902 the company instituted a plan whereby the employes would share in the profits, all employes sharing equally in one-

POWER STATION ON BURRARD INLET.

third of the profits available for dividends after stockholders had received 4 per cent. The details of this plan are thus described by the general manager, Mr. J. Buntzen, in a letter to the department of labor of Canada:

"The profit-sharing idea is, of course, not a new one. It has been tried many times before, sometimes successfully, sometimes otherwise. But I am not aware that it has so far been attempted by a street railway company, although this particular class of business appears to offer a specially attractive field for its adoption. The men in charge of a street car are to a great extent left to their own devices. To supervise their work continually is an impossibility, and even to inspect and check it occasionally requires a distasteful system of espionage. Still, on the spirit in which the men carry out their work hinges the success of the company very largely. I am not sanguine enough to imagine that participation in profits will immediately change a careless man to a watchful one, and a lazy fellow to a hustler, but I do believe that, given a fair chance to prove what it amounts to, the system will gradually create a partnership feeling in the employes that will eventually make them take the same interest in the company's welfare as they would in their own business, for the simple reason that, having the proof in their pockets, they cannot help realizing that the company's welfare is their business.

"Attempts are being made by parties who do not believe in good relations between employes and employers to belittle the profit-sharing idea by calling it wages sharing, and claiming that it is only granted by employers to get better work out of the men. Certainly, the system is based on the assumption that better and more careful work will be done, and that it will result in benefit to the employer. But if it does, it also benefits the employe, and that is exactly where its strength lies. It is a system of mutual benefit, the only fair method of co-operation. Under the arrangement with our employes we pay them union wages for skilled labor, and best local wages for unskilled labor. If, in addition to getting best local wages for their work, our men receive a substantial cash bonus,

it can hardly be denied that they are better off than those who receive no such bonus. And if they have really done better work than some others—with no longer working hours—is that something to reproach them for? Does it not add to the self-respect of any decent man to feel that he is doing his duty well, and that he is paid not only for the quantity of his work, but also for its quality?

"Shortly, our arrangement is as follows: After the ordinary shareholders have received a 4 per cent dividend the balance of profits available for dividends yearly will be divided as follows: Two-thirds to the shareholders, one-third to the employes. Every employe who has worked regularly for the company during the twelve months ending June 30 each year will participate in the division, and their proportion of the profits will be divided equally among them.

"Our arrangement being yet in its infancy, it is, of course, impossible to prophesy whether or not it will turn out a success. It is an experiment, heartily approved by our directors, and, I think, also by most of the men. If it is allowed to pursue its even course for three years I will venture to predict it a long and prosperous life.

"The principal cause of friction between employer and employe today is undoubtedly lack of mutual understanding and consideration. With proper understanding must come proper consideration. The employe must understand that capital is entitled to fair interest, and the employer must recognize that when he has had that fair interest he owes to the producers to give them a fair share in the success largely due to their efforts."

This letter was written shortly after the plan was put in effect; after a year's trial Mr. Buntzen was well satisfied with the results, and a similar satisfaction seems to exist among the employes.

For the year ending June 30, 1903, the bonus was $25 per capita, the total translated into English units being £1,494 16s. 11d.

For three years or more the British Columbia Electric Railway Co. has had in view operating by water power within the present year, the development of a plant at Trout Lake having been under consideration since 1900. This work is being done by the Vancouver Power Co., a corporation which is controlled by the same interests as the British Columbia Electric Ry. The work was commenced early in the summer of 1903 and has been pushed as rapidly as practicable, the first 3,000-h. p. unit being put in service Dec. 17, 1903.

The sources of water supply are two deep glacial lakes known as Coquitlam Lake and Trout Lake. Trout Lake lies about 15 miles east and a little north of the city of Vancouver and has an area of 460 acres, being principally of value as a reservoir. Coquitlam Lake is a long and narrow body of water some 2,300 acres in area and lies at an elevation of 32 ft. above that of Trout Lake. The south end of Coquitlam Lake is 2½ miles east of the north end of Trout Lake, from which it is separated by rugged mountains.

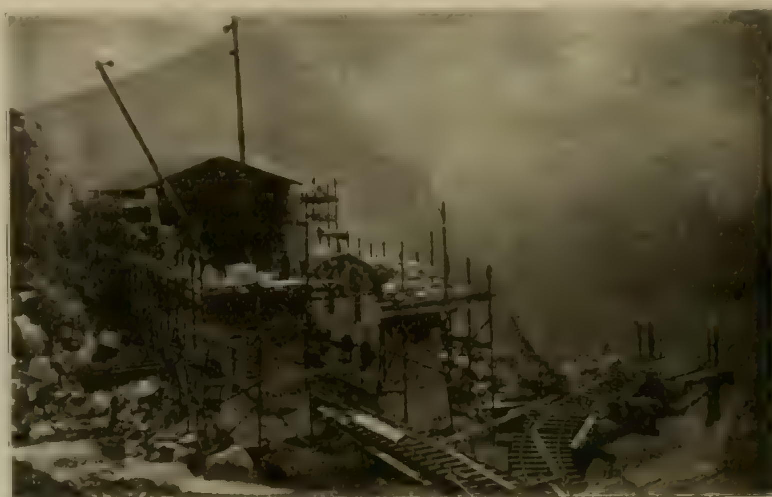
Coquitlam Lake has a water shed sufficiently large to make it a reliable source for supplying a 30,000-h. p. plant, for which capacity the hydraulic portion of the installation has been designed. The first machinery installed, however, will be of 12,000 h. p. capacity only.

Trout Lake lies quite near the north arm of the large inlet, so that a penstock can be carried from the dam on the outlet of the lake to the power house, which is just above high tide level. A tunnel 13,000 ft. long is being cut to join the two lakes. For controlling the water level at Coquitlam a timber dam was erected at the outlet, which fixed the level at 12 ft. above the former low water level. This dam is a rock filled timber crib, a type which has proved to be very successful in controlling mountain streams.

The tunnel joining the two lakes is 9 ft. high by 9 ft. wide, with rounded corners, and is driven from both ends by drills operated by compressed air.

A concrete dam 364 ft. long and 54 ft. high, built across the outlet, controls the level in Trout Lake. In this dam arrangements are made for ten 54-in. openings for pipe lines which supply water to 3,000-h. p. units. The pipes from the power house to the dam, of which only three are now installed, are 1,800 ft. long and are 48 in. in diameter at the upper end, 44 in. in the middle section and 42 in. at the power station. The effective head at the power house is 395 ft.

The main generating units each comprise a 1,500-kw. Westinghouse engine type, rotating field generator and a pair of Pelton impulse wheels designed to give a maximum of 1,500 h. p. each at 200 r. p. m., with the effective head mentioned of 395 ft. The generators give 2,200-volt, three-phase current, at 60 cycles. Each water wheel has a single combination deflecting and needle regulating nozzle, fitted with a high-pressure ball joint, which is leather



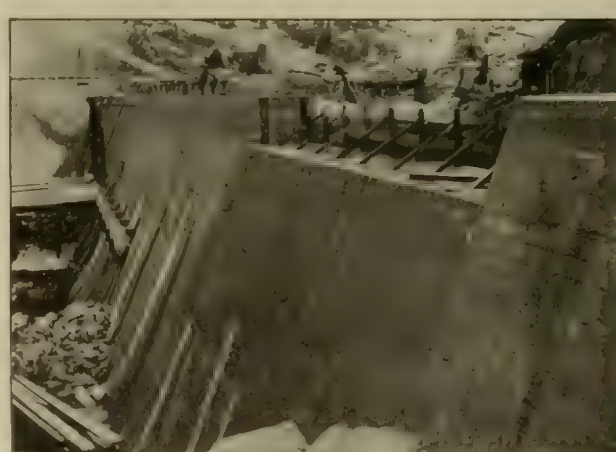
POWER HOUSE UNDER CONSTRUCTION

packed and rocks on forged steel trunnion bolts. The deflecting portion of the nozzle is counter-balanced by hydraulic pressure.

There are two 80-kw. exciters mounted with their respective wheels on a common bed plate, and with a 120-h. p. induction motor between the two exciters. Clutch connections are provided, so that the exciters may be driven by the water wheels or by the motor at will. The exciters operate at 580 r. p. m.

The switchboard has nine panels, one for the induction motor, one for the exciters, three panels for control of the main units and three for the control of three sets of 550-kw. air-cooled transformers with their motor blower sets, which are 20-h. p. motors driving 110-in. Sturtevant fans. The transformers are located in a separate building just back of the main power house.

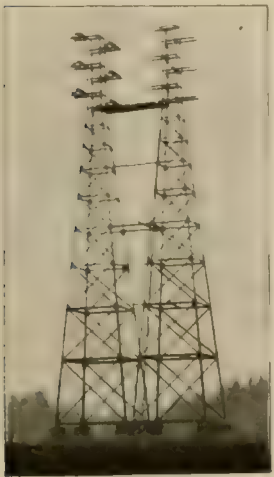
There are two sub-stations, one at Burnaby, a station on the



CONCRETE DAM COMPLETED.

Vancouver-Westminster interurban line near Westminster, and the other in Vancouver. From the power house on the inlet two parallel transmission lines are carried along the route indicated in the accompanying map to a point on the south shore of the inlet directly north of Burnaby. Thence one line continues west direct to Vancouver, and the other south to Burnaby, and thence to Vancouver along the right of way of the interurban.

As stated, the first unit was put into service December 17, 1903, supplying current for the incandescent lighting service of the British Columbia Electric Co. at Vancouver. In March of this year the sub-station at Burnaby began operating, supplying current for the interurban railway line. A second 3,000-h. p. unit was ready for operating in May. Foundations have been completed for two more units, which will be installed at intervals of about five months. The tunnel joining the two lakes is completed for 8,000 ft. out of its total length of 13,000. The permanent sub-station at Vancouver is expected to be ready for service by July 1st.



TOWERS AT BARNET CROSSING.

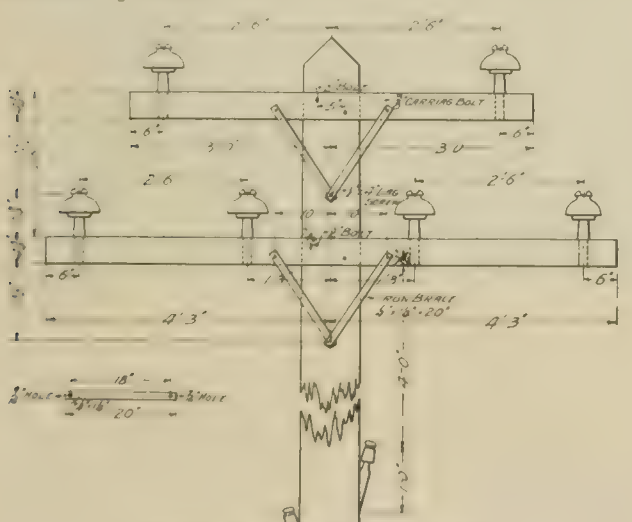
The route of the transmission lines is 16 miles in length and crosses a navigable arm of the inlet overhead. The span here is 2,750 ft. and on the south side there are required two steel towers 135 ft. high. On the north side the ground is sufficiently high to permit the use of poles for supporting these spans. The conductors are 12 in number for four three-phase circuits and are 9-16 in. galvanized plow steel cables with wire centers. At their lowest points the cables are 150 ft. above the navigable water in the narrows. The rest of the transmission line is of No. 2 copper. The generating potential at the power house is 2,300 volts, 60 cycle, and the potential for transmission is 23,000 volts.

The details of pole construction and of the malleable iron insulator pin used in this work are shown in the accompanying line drawing.

The Vancouver Power Co's. installation has been under the direction of Mr. Wynn Meredith, consulting engineer of the Engineering Offices (now Cory, Meredith and Allen, of San Francisco), assisted by Messrs. Hermon and Burwell, civil engineers, of Vancouver. Mr. R. H. Sperling, chief engineer of the British Columbia Electric Railway Co., supervised the work on behalf of his company.

The track mileage of the British Columbia company comprises 13 miles in Victoria and 35 miles in Vancouver and New Westminster. The interurban line is 12 miles long and an hourly service is maintained.

In Victoria 13 cars are operated regularly and 5 extra ones put in service at 5 o'clock.



DETAIL OF POLE LINE CONSTRUCTION.

The Vancouver car equipment consists of about 60 passenger motor cars, 2 freight motor cars, 4 flat cars, 2 construction cars and 2 train cars. The passenger cars for interurban service are 48 ft. long over all, with 38-ft. bodies, and those for city service are single truck cars with 22-ft. bodies and double truck cars with 32-ft. bodies. The standard trucks are Brill 27 for the interurban, Brill 27-G for double truck city cars and Brill 21-E for single truck city cars.

The cars used in city service have bodies of two types; those operated on single track routes are semi-convertible, while those on double track routes have one entire side removable. In summer open cars are desirable, but some adequate protection for passengers in case of sudden showers, which are frequent, is necessary; also the tracks are so close that screens are needed on the inner side. These conditions are met by making one side of the car permanently closed and the other so that it can be closed for winter service.

A freight and express service is maintained between Vancouver and New Westminster, three round trips being made per day with express cars and freight being handled on flat cars, according to the demand. The motor cars for this service are of the railroad box type without platforms, and have small compartments at each end for the motorman and conductor.

In dispatching cars on the interurban line the form reproduced herewith is used; it is made out in triplicate, one copy each for motorman and conductor, and one for the dispatcher's file.

The main offices of the company are in Vancouver, being located in the "Terminal Building," which is the terminus of the interurban line to New Westminster. The freight depot is also located at this point. The steam power plant of the company in Vancouver is two squares from the offices; this plant is to be abandoned within one year, after the water power installation at Trout Lake is completed.

FIRST PIPE LINE.

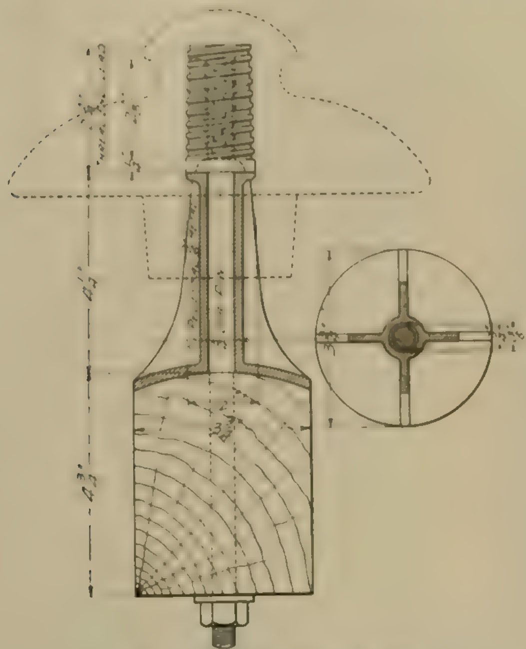
The present capacity of the steam station is about 3,000 h. p. The lighting department has 350 arc lamps for the municipality, and 80,000 incandescent lamps of 6, 8, 10 and 16 candle power; the 10-c. p. lamp is most popular. For commercial lighting current is transmitted to the customers' transformers at a potential of 1,100 volts. Motor service current is furnished from the railway generators; this arrangement is to be changed later to a two-phase 1,000-volt motor service.

The equipment in this station is of the most varied kind. In the boiler room are Scotch marine type, horizontal return tubular, and "Climax" boilers. In the generator room are: Two 50-light T. H. arc machines, two 100-light Western Electric arc machines, two 125-light Brush arc machines, all belted; four single-phase 150-kw. alternators belted, one 500-kw. two-phase alternator direct connected, one 500-kw. three-phase alternator belted, one 500-kw. railway generator direct connected and one 300-kw. railway generator belted.

The interurban power house is near Westminster and is equipped with the "Ideal" simple engines belted to 200-kw. Edison generators and four return tubular boilers. Cordwood is used for fuel at this plant. This will also be abandoned when the water power installation is completed.

The company has car houses and general shops in Vancouver and in January, 1903, built new car shops at Westminster. In this plant it has constructed a number of cars, using native fir throughout excepting for door panels and the interior moldings, which are of native cedar. For the interior natural finish was used.

In paved streets concrete [illegible] construction is used for the tracks, the beam being 2½ in. [illegible] and 14 in. deep. The ties for new work are [illegible] 7 in. [illegible] imbedded in the beams 2 in. The



DETAILS OF INSULATOR AND PIN.

company pays for paving the extra cost involved by their special track construction.

The gross earnings for the last fiscal year were as follows:

Railway	Vancouver	$158,083
	Westminster	110,318
	Victoria	113,842
Lighting	Vancouver	180,237
	Victoria	92,402
Total earnings		$672,882
Expenses		448,535
Net earnings		$224,347

About two-thirds of the passenger receipts are tickets, of which there are several kinds; 6 for 25 cents or 25 for one dollar, ordinary tickets; 8 for 25 cents, tickets good between 6 and 9 a. m. and between 4:30 and 7 p. m.; 8 for 20 cents, school tickets. The single fare is 5 cents on city lines, and 35 cents from Vancouver to Westminster on the interurban, with limited round trip tickets at 60 cents; Sundays 50 cents.

B. C. Electric Railway Co., Ltd.
Running Orders.

Conductor........................ CAR
Motorman........................ No.....
Leave Vancouver at.........................M.
Cross........................Cars at Park Drive
Cross......................Cars at Central Park
and report for orders. **Be Cautious. Run no Chances.**
Cross............Cars at Burnaby.
Received.
.... Dispatcher.

DISPATCHER'S ORDER BLANK.

As the interurban power house is remote from schools and markets, the company, in order to encourage employes to live near their work and where real estate is low enough to enable them to own houses, provides free school tickets for children of employes, and also issues passes for their families good for two round trips per week.

Medical attendance is provided for employes under an arrangement by which married men pay one dollar and single men fifty cents per month, which fees are deducted from their pay.

The chairman of the board of directors of the company is R. M. Horne-Payne, of London; the secretary is Francis Hope, with offices at 28 Bishopgate Street Within, London.

The officers and operating staff in Canada are: J. Buntzen, general manager, Vancouver; R. H. Sperling, chief engineer and general superintendent, Vancouver; W. F. Gitchell, comptroller, Vancouver; W. V. Hunt, assistant superintendent, Vancouver; A. T. Goward, local manager, Victoria; F. R. Glover, local manager, Westminster; W. Hazlitt, purchasing agent, Vancouver; J. Rannie, traffic superintendent, Vancouver; H. Gibson, traffic superintendent, Victoria; G. M. Tripp, superintendent, Victoria; J. H. Hughes, master mechanic, Vancouver; George J. O'Loane, chief engineer, Vancouver; W. Woodroofe, chief engineer, Vancouver.

Consolidated Railway Co. of New Haven.

The Consolidated Railway Co. was recently incorporated by the New York, New Haven & Hartford Railroad Co., to control under the charter of the old Worcester & Connecticut Eastern Railway Co. all the trolley lines which the New Haven company now owns or may hereafter acquire. Since the organization of the new company the New York, New Haven & Hartford has taken over the Meriden (Conn.) Electric Railroad Co., and the Worcester (Mass.) & Southbridge Street Railway Co., including the latter's subsidiary lines, the Worcester, Rochdale & Charlton Depot Street Railway Co. and the Southbridge & Sturbridge Street Railway Co. These have been duly transferred to the Consolidated company. Officers of the Consolidated Railway Co. have been elected as follows: President, Charles S. Mellen; first vice-president, E. H. McHenry; second vice-president, H. M. Kochersperger; secretary, J. G. Parker; treasurer, A. S. May; assistant treasurer, T. F. Paradise. Mr. McHenry is in immediate charge of all the electric lines of the company.

Cars on the New Williamsburg Bridge.

To provide for the operation of cars over the new Williamsburg Bridge, New York, a contract has been entered into between Bridge Commissioner Best and the Brooklyn Heights Railroad Co., the Coney Island & Brooklyn Railroad Co., the New York City Railway Co., and the recently incorporated Bridge Operating Co. The last named company is to provide cars for the local bridge service, as distinct from the through service to be provided by the other companies. In general the contract is similar to the existing contract for operation on the Brooklyn Bridge. Local bridge passengers will pay a fare of three cents. The contract provides, however, that the New York and Brooklyn companies must carry through passengers across the bridge without charging an extra fare.

The north pair of tracks will be equipped for use by the underground trolley system, so as to permit the operation of through cars across the bridge to the Brooklyn terminal by the Metropolitan system. The south pair of tracks will be equipped with the overhead system, so as to permit the Brooklyn cars to cross to the Manhattan terminal. It is expected to have the latter tracks ready for service on or before July 15th.

The trolley tracks, terminals and equipments are to be constructed by and remain the property of the city and the companies are to pay a rental of $10,000 per annum, in addition to a toll of 5 cents for each car per round trip. The term of the contract is 10 years from Sept. 1, 1904, but it may be extended under certain conditions.

The Aurora-Southwest Traction Co. is to be incorporated to build an electric line from Marionville to Peirce City, Mo., 25 miles, passing through Aurora, Verona, Spring Park and Monette. The company will also furnish light, heat and power. John A. Williams, of Aurora, Mo., is the promoter.

The Marienfelde-Zossen High Speed Trials.

BY DR. ALFRED GRADENWITZ.

Although there are numberless tramways and suburban railways in all parts of the world operating by electricity the steam locomotive is still practically unrivalled in the field of long distance railroading. In spite of the still further possibilities of the steam locomotive, which up to the present time has been able to meet all requirements of modern traffic, engineers have gradually become aware of the practical limits which oppose its development. It seems evident that on account of the heavy weight of this type of engine that speeds of say 95 miles per hour are all that can possibly be hoped for from the steam locomotive.

Apart from the special advantages inherent in electric service the

VIEW OF ALLGEMEINE ELEKTRICITAETS GESELLSCHAFT CAR TAKEN IMMEDIATELY AFTER THE RECORD RUN

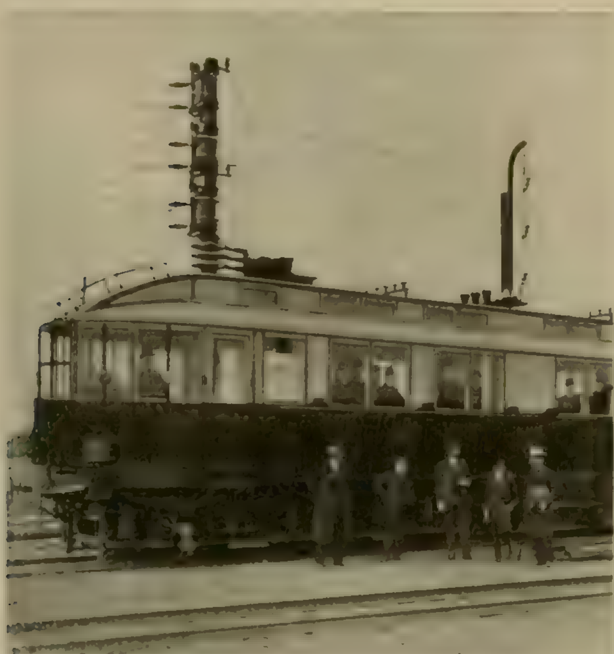
problem of high speed electric traction appeals to the mind of every one interested in the progress of modern life. Four years ago two of the most prominent exponents of electrical engineering, Mr. Rathenau and Mr. Schwieger, happened to meet on a journey to Moscow in a sleeping car and their exchange of views on this subject resulted in a combination of the two big electrical concerns of Germany, the Siemens & Halske Co. and the Allgemeine Elektricitaets Gesellschaft with a view of studying the question of high speed electric railways. The Marienfelde-Zossen military railway near Berlin was lent for the purpose and some of the leading German banking firms as well as the authorities concerned gave their support to the new undertaking. The Siemens & Halske Co. undertook the construction of the line supplying the electric power and the Allgemeine Elektricitaets Gesellschaft supplied the power from its Oberschöneweide electricity works and constructed a feeder line thence to Marienfelde-Zossen. The line was constructed after the model of the Gross-Lichterfelde experimental track and the same arrangement of the conductors and collectors as well as the same kind of current was used.

The Marienfelde-Zossen military line is 23 km. long and seemed specially available, as it contains no curves of less than 2,000 m. radius and the short gradients being not more than 1 in 2,000. The permanent way, however, was similar to that of the older types of Prussian railways, consisting of light rails, 67 lb. per yard, placed partly on wooden sleepers and partly on short iron sleepers. The roadbed was built mainly of inferior material. Although it was reasonably anticipated at the outset that the existing permanent way would not be sufficiently strong for speeds as high as 200 km. per hour, it was decided to begin the trials without any rebuilding of the track apart from some immaterial improvement. After the number of ties had been somewhat increased and the roadbed reinforced with considerable amounts of broken stone, the track withstood the strain involved by speeds up to 130 km. (80.8 miles) per hour perfectly well. Serious trouble, however, was experienced in connection with the experiments made in the fall of 1901, where maximum speeds of 140 to 160 km. per hour were obtained, and a thorough rebuilding of the track was effected during the summer of 1902. The new rails weigh about 84½ lb. per yard and are 12 meters long, laid with 18 ties per rail. There were 15,000 cubic meters of broken basalt used for the roadbed, and about 18 kilometers of the track were fitted with guard rails, such as are used in

connection with ordinary railway bridges, etc. These guard rails are placed 15 mm. from the main rail and are fixed on cast iron beds screwed to each tie. This arrangement, in addition to preventing derailments, imparts unusual strength to the whole of the roadbed

Overhead Line.

The arrangement of the overhead line is shown in the accompanying illustration, the center of the pole being about 2¼ m. distant from the middle of the track. The three horizontal wires which conduct the three-phase current are about 1 m. apart. The whole of the line is divided into sections of about 1 km., each of which is provided in the middle with a device for compensating losses in pressure. The neutral point of the system is connected to the earth and to the rail. The suspension point of the wires moves aside somewhat as the collector presses against the horizontal wire, thus making a satisfactory and simultaneous contact between the three horizontal wires and the contact arcs. This is procured by having the single parts on the outrigger intended for carrying the insulator connected by joints. The horizontal wires have a double insulation between them and the earth, each insulation separately being capable of withstanding the whole of the maximum pressure of 20,000 volts, which was the voltage used during the experiments. The wires



SIEMENS & HALSKE CAR, SHOWING COLLECTORS.

have cross sections of 100 sq. mm. each and the tension between each two wires varied between 10,000 and 12,000 volts. Hard drawn copper wire with a breaking strength of 38 kg. per sq. mm. and a conductivity of over 97 per cent of pure copper was used. Lightning arresters were also provided as well as safety devices in case of a break, by means of which the wire is automatically grounded.

Collectors.

The collectors were built after the model developed by the Siemens & Halske Co. on its Grosse Lichterfelde experimental track. They are nearly identical on both sides and differ only in detail. On the Siemens & Halske car the collectors are mounted on two masts supported at either end of the car which revolve around a vertical axis. These masts consist of two Mannesmann tubes about 200 mm. in diameter inserted one into the other. By means of a crank acting on double toothed gearing any desired rotation of the masts may be effected from the motorman's cab. Sliding rings are attached to an insulated tube, and contact springs with hard rubber insulators are screwed on a special flat iron frame, these being fixed to the three sliding rings. Into the insulating tubes and partly into the lower part of the collector the upper tube is slipped so as to be readily dismounted after loosening a few screws. This tube carries at distances of 1 m. each, three rotating axles for the contact bows. The wind pressure against the bow on one side of the rotating axle is balanced by means of a vane attached to the other side of the axle.

The Allgemeine Elektricitaets Gesellschaft car is likewise fitted with two groups of two collectors each, one for each phase which, however, instead of being placed on one common mast are arranged one behind the other as shown in the illustration. Both arrangements have given entire satisfaction and it was found impossible to decide which was the more available. Sparking between the overhead wires and the collector bows as occasionally noted in connection with the earlier experiments was later prevented by some slight improvements in the construction of the collectors. One of the most difficult problems, namely the transmission of large amounts of energy from a stationary conductor to a train running at enormous speeds, has thus been satisfactorily solved.

Motor Cars.

The two motor cars used in these trials were constructed by Messrs. van der Zypen & Charlier, Cologne—Deutz, designed to accommodate the electrical apparatus supplied by the two companies. These cars are intended for about 50 passengers and are 21 and 22 meters in length respectively, their dimensions and equipments corresponding with the technical regulations of the Association of German Railway Administrations. The body of the car rests by means of two center bolts on two trucks without any special springs. In addition there are on the frames of these trucks four steps limiting the latteral oscillation of the body by taking part of the weight of the car. The lateral oscillations of the body were only observed at lower speeds up to 100 km. per hour, whereas, at higher speeds the motion of the car was perfectly steady, much more so than in ordinary high speed trains. Each of the trucks was fitted with three axles, the outer one carrying the motor and the other two serving as running axles. The wheel base was at first 3.8 meters, but this was increased to five meters at the time of the recent successful trials. The distance between the centers of the two trucks is 13.3 and 14.3 m. respectively on the different cars, and the diameter of the wheels is 1.25 m. Two springs are used in connection with the journal boxes, one plate spring 1.5 meters long above each box, these plate springs being in turn supported at their ends by spiral springs, the tension of which is regulated by means of screws. As the trucks used in the earlier experiments registered every irregularity of the track, the distance between the wheels, as above stated, was increased to five meters and the bearing spring placed so as to be visible and connected to one another by compensating levers. The center bolts which were formerly rigidly fixed to the lower frame were, during the recent reconstruction provided with lateral pegs fitted with springs so as to prevent any transmission of the oscillation of the body to the frame.

Electrical Connections.

The Allgemeine Elektricitaets Gesellschaft car has armored cables which lead the current from the two groups of collectors to the main switch in the machine compartment and thence the current is led by separate conductors to the transformers. The main cut-out switch is operated only after the completion of the run or as an emergency switch in case of trouble during the run. From the transformers the low tension conductors lead through the main controllers to the motors. The main controller is also placed in the machine compartment of the car and is easily actuated from each motorman's cab by means of a steering wheel connected by gearing to a shaft traversing the whole length of the car. This controller directs the working current to the motors and through the resistances, permits reverse running and also provides for the breaking of the car by means of reverse current. In addition to this there is a small controller in the motorman's cab which supplies low tension current from the transformer to the motor operating the air compressor for the compressed air brakes.

The connections in the Siemens & Halske car are somewhat different. The high tension current is first conveyed to one of the two main switches for forward and backward running, which are controlled from the motorman's cab, and thence to the two large transformers, from which the working current is again conveyed through individual switches towards the motors and the resistances. From the main conductors on the roof of the car branches are led to a small transformer placed above the motormen's cab from which the motor for the air pumps is operated. Two cranks are provided in the cab for actuating the reversing switch and the motive switch respectively, the working resistances being controlled by the motor-

men through a special controlling wheel either with or without the agency of compressed air. The equipments of both of these cars have proved very satisfactory and effective and have afforded full protection against accidents.

Transformers.

In the transformers of the Siemens & Halske car the iron sheets are placed vertically on their edges and distributed in groups between which is a space for the passage of air. The secondary coil is well insulated from the iron cores and the primary winding is placed above it. In the ventilating channel of the iron cores there are protective boxes carried out to the front face of the casings and expanded into the latter so as to facilitate the drawing in of the air.

The transformers in the Allgemeine Elektricitaets Gesellschaft car are designed after the patents of this company with three parallel iron cores the axes of which run longitudinally.

Each core has a longitudinal slot through which, as well as between the rectangular cores in the round coil, an air current is allowed to pass. The transformers in both cars have given entire satisfaction, the strong air current proving particularly effective and preventing any considerable heating effects.

Motors.

The motors of the Allgemeine Elektricitaets Gesellschaft car have a capacity of 250 h. p. each and the exciting current has a tension of 435 volts. The motor cases are fixed on an iron frame supported on both sides of the truck by plate springs, each of which is fixed on the main bearing spring of the car. The motor casings have a hollow axle slipped over the car axle on which the armature of the motor is built. The motor is coupled to the wheels of the corresponding axle by means of double arms attached on both ends of the hollow axle and touching the sliding pieces placed on the wheels. The weight of the motor instead of resting immediately on the axles of the car is thus supported by bearing springs on the axle boxes of the truck.

The motors built by the Siemens & Halske Co. are six-pole machines of 250 h. p. each, the current being conveyed to the rotor at a tension of 1,150 volts by means of three sliding rings. The pressure of the secondary circuit at rest and at starting is 650 volts. The rotor is provided with closed direct-current bar windings and the stator has rotary current bar windings. The rotor with its box is pressed solidly on the axle of the car. The stationary part of the motor is enclosed by a double cast iron casing and rests without any intermediate springs on the car axle bearing. The diameter of the rotor is 780 mm. and the external diameter of the motor 1,050 mm.

Both the direct mounting of the motors on the axles and the suspension by springs on the truck have proved very satisfactory in connection with the experiments so far made. In general the spring suspension seems to be preferable to the rigid suspension.

Exciters and Resistances.

The exciters and resistances necessary in starting and controlling the speed show some essential differences in the two cars. In order to avoid any abrupt variations in the speed and excessive sparking the resistances must be switched out of the circuit quite gradually. In the Allgemeine Elektricitaets Gesellschaft car liquid resistances are used constructed as follows:

The terminal plates of the open circuits are placed in two reservoirs in the central machine compartment of the car. Alongside of the reservoir is an electrically driven centrifugal pump which conveys into the upper reservoir a soda solution carried in a box below the car. The higher the liquid in the reservoir the smaller will be the resistance between the electrodes. The height of the liquid is regulated from the motorman's cab by means of a valve. The pumps worked continuously during the run, the liquid circulating in a conduit in which it is cooled. This resistance has the advantage of dispensing with the contacts and cable joints necessary with metallic resistances.

In the Siemens & Halske car there are metallic resistances formed of "Kruppine" bands 45 x 2 mm. in section. These bands are placed in groups in flat boxes fitted outside of the body of the car below the windows. There are in all 29 steps, four of which are used in starting and 25 for increasing and regulating the speed of the motors. Below the resistance boxes there are rollers placed longitudinally which bear bronze contact pieces. The corresponding contacts are attached to two steel tubes placed one beside the other and insulated from them. In order to avoid disturbances that would attend abrupt increase in connecting the current the single contacts are inserted successively and not simultaneously. The rollers are actuated through a longitudinal spindle traversing the whole length of the car and is rotated from the motorman's cab by means of conical toothed gearing. To facilitate the handling of this device compressed air is used, which assists the motorman in starting, and which automatically turns the controller to its zero position if the current has to be switched off. By means of a special gearing the controller may also be operated without the aid of compressed air.

The Trials.

In the trials made in the fall of 1901 speeds as high as 150 km. and in one case as high as 160 km. per hour were obtained. As, however, considerable oscillation and shocks were experienced even at 140 km. per hour no further increase of speed was deemed advisable at that time, and the remainder of the year was used in taking measurements and making records of the consumption of electrical energy. The acceleration at starting varied considerably. In order to obtain speeds of 100 km. starting distances of 2,000 to 3,200 m. with starting times ranging between 138 and 220 seconds were necessary, these figures corresponding to accelerations as high as .13 to .2 m. per second. This by no means represents an upper limit as the power required for this acceleration was only from 700 to 1,000 h. p., whereas the motors are capable of supplying about 3,000 h. p. for short intervals. In regard to the braking of the cars, both cars may be stopped either by means of Westinghouse brakes or by using reversed current. In addition to this the Allgemeine Elektricitaets Gesellschaft car is fitted with an electric brake. The Westinghouse and electric brakes may be operated from each motorman's cab simultaneously, though the brake equipments are independent for each of the trucks. With an air pressure of six atmospheres in the braking cylinders, two of which are placed on each truck, the pressure on each of the 24 brake shoes, which are arranged on both sides of the wheels is about 6,000 kg., the brake shoes thus receiving a total pressure of 144,000 kg., or 156 per cent of the weight of the car. In connection with the numerous braking experiments carried out accurate observations were made of the air pressure in the conduits and brake cylinders, and the time and distance in which the braking took place was also ascertained. On the basis of the braking curves obtained from these experiments the braking coefficient may be calculated from the equation

MOTORMAN'S CAB—A. E. G. CAR.

$$fD + W + gMa = p\ (M + R)$$

Where f = the coefficient of friction,
D = total pressure on the brake shoes,
M = the mass of the car,
R = equivalent mass of the rotating parts,
W = the air and proper resistance of the car,
a = the gradient of the track,
p = retardation in meters per second.

The following figures are given in the report of the experiment [illegible] kilometers per hour:

for v = 20, p = 1.7 and f = 0.17
for v = 60, p = 0.75 and f = [illegible]
for v = 100, p = 0.6 and f = [illegible]

The brake experiments made by means of reverse current on the Allgemeine Elektricitaets Gesellschaft car did not give in the beginning very satisfactory results. As, however, reverse current is likely to act better in the case of higher speeds, the report of the recent experiments will undoubtedly give more satisfactory figures. This method of braking, however, is only intended for emergency use.

In regard to the resistances of the cars the mean value of 3.6 kg. per ton as obtained for a speed of about 110 km. per hour is materially below the figures calculated from the usual resistance formulæ.

Extensive experiments were made to determine the consumption of energy both at the generators, where records were taken at intervals of 10 seconds, and on the cars where the readings were taken at intervals of from 15 to 30 seconds. In starting the cars with accelerations ranging between 0.1 and 0.2 m. per second the consumption of energy in the car at the collectors ranged between 400 kw. (544 h. p.) and 740 kw. (1,000 h. p.). In the case of prolonged runs, however, the consumption of energy varied between

SHOWING TRUCK OF SIEMENS & HALSKE CAR

148 kw. corresponding to a speed of 90 km. and 520 kw. corresponding to a speed of 140 km. It may be stated in this connection that 2,300 kw. (2,000 h. p.) were required to obtain the maximum speeds of upwards of 200 km. recently attained.

The resistance of the air was carefully studied in these experiments and recent trials gave values as high as 210 kg. per square meter for the air pressure.

After the trials were made in 1901 a thorough rebuilding of the track was found necessary. This work occupied part of the year 1902, the remainder of which was taken up in the continuation of experiments on the consumption of energy, etc., for speeds up to 130 km. The results of the improvement in the track were found to be most satisfactory and even surprising; the track not only easily withstood the strain to which it was put by trials at constantly increasing speeds, but the cars ran so smoothly as to make the shocks of the rail joints nearly unnoticeable.

The Siemens & Halske car was first given a chance to show its possibilities. After reaching speeds as high as 189 km. per hour in the previous experiments it was anticipated that a maximum speed of 200 km. would be finally reached, and this was actually the case on October 6th last, the event being watched by a large number of people. The distance between Marienfelde and Zossen was repeatedly traversed inside of 18 minutes each way, including starting and stopping. A maximum speed of 201 km. (126 miles) per hour was attained on one section of the road about 5 km. in length. A mean speed of 175 km. per hour would enable the journey between Berlin and Cologne (577 km.) to be complete in about 3¼ hours, whereas the fastest present trains require fully 9 hours. This speed, which aroused a great deal of comment in the engineering world, was exceeded on October 23, at which time a speed of 207 km. per hour was attained without any disturbing factors being noticed.

The Allgemeine Elektricitaets Gesellschaft car was also included in the experiments during October. Moderate speeds were at first made, which, however, were rapidly increased so that eventually this car on October 28th slightly exceeded the former record, reaching the enormous speed of 210 km. per hour. At these high speeds both cars ran so steadily that all those present were highly gratified.

From a car running at such an exceedingly high speed neighboring objects disappear from view almost instantly. Although the motorman can distinguish obstacles on the track, his doing so would be of little use, as the distance passed in bringing the car to a stop from the time of applying the brakes is 2 km. Those watching the car could just distinguish the presence of men in it; before they were able to recognize them, however, the car had disappeared from view. Although the track is very straight, there elapsed at most 1½ minutes between the first appearance of the car and its disappearance on the horizon.

It is thought probable that under existing conditions speeds as high as 230 to 240 km. per hour may be reached without difficulty, but proof of this is still forthcoming. The German railway authorities commenced a short time ago a series of trials with steam locomotives, the results of which are likely to be interesting in comparison with the performances of the electric cars. Speeds as high as 138 km. per hour were readily attained during the latter experiment. It is not unlikely that after the successful results of the above trials some railway will be equipped according to the plans adopted on the military railway, so as to allow of these experiments being continued on a larger scale.

In concluding I wish to express my thanks to the manager of the Studiengesellschaft, Regierungsbaumeister Denninghoff, as well as to Dr. Hamburger and Dr. Reichel, chief engineers of the two electric companies, for kindly supplying the data given in this article and the illustrations here reproduced.

International Tramway Union.

In order to accommodate the large number of members of the Union Internationale de Tramways et de Chemins de fer d'interet local who desire to attend the St. Louis exposition the date of the 13th general assembly, which will be held at Vienna, and which had been fixed for Sept. 12 to 15, 1904, has been changed to Sept. 5th to 8th. The program for the meeting of the association includes papers and reports on sixteen subjects, which are as follows:

Correct Principles for Establishing Renewal Funds, M. Hazelmann, Aix-la-Chapelle.

Control of Transfers.

Advantages and Disadvantages of Different Systems of Brakes for Electric Railways, Herr Scholtes.

Means of Protection Against the Fall of Telephone and Other Wires Across the Trolley Wire, M. Pettit, Brussels.

Advantages and Disadvantages of Trailer Cars in City Service, M. Pavie, Paris.

Possible Economies in the Use of Current for Electric Cars, Herr Klitzing, Magdebourg.

Advantages and Disadvantages of Electric and Steam Traction for Interurban Lines, Herr Luithlen, Vienna.

Kind and Potential of Current for Interurban Electric Traction, Herr Pforr, Berlin.

Roadbed for Interurban Lines Operated by Steam, M. de Burlet, Brussels.

Tramway Legislation of the Different Countries of Europe, M. R. H. Scotter, London.

Accounting System and Monthly Report for Electric Tramways.

Control of Electric Installations and the Maintenance of Overhead Work, M. Pedriali, Brussels.

The Use of Auto Cars on Interurban Lines, Herr Ziffer, Vienna.

Rules for Tests for the Acceptance of Tramway Motors.

German Legislation in Favor of Workingmen and Its Effect on Tramways, Together with a Comparison of Assurance Requirements in Different European Countries. The paper includes accident insurance, sick benefit insurance superannuation and age pensions.

Means for Preventing the Influence of Tramway Circuits Upon Measuring Instruments of Physical and Electrotechnical Institutions, Herr Bjorkegren, Berlin.

J. Clifton Robinson's Testimony Before the Royal Commission on London Traffic.

The evidence given by Mr. J. Clifton Robinson before the Royal Commission which is now investigating the subject of traffic in London, with especial reference to the betterment of existing conditions, will be of general interest, as Mr. Robinson has had an experience which particularly qualifies him to judge of this subject. Mr. Robinson is managing director and engineer of the London United Electric Tramways, director and engineer of the Bristol Electric Tramways, and of the Imperial Tramways Co., Limited (Middlesborough, Thornaby and Stockton Electric Tramways), and also a director of the Metropolitan District and the Corris Railways. He has been closely identified with the development of tramways in this country since their introduction at Birkenhead in 1860, and has also had much experience in the United States and on the Continent.

Mr. Robinson was heard by the Commission June 3, 1904. An abstract of his testimony is as follows:

The London United Electric Tramways Co. was formed in 1894 to acquire and reorganize the old West Metropolitan horse tramways, which had fallen into a condition of decrepitude. The first section of the electrified system was brought into operation at Easter, 1901. With the considerable extensions since carried out the company were now working 36 route miles of tramway, while 38 additional miles had been authorized, and 5 further miles passed by Committee of the Commons in the present session. In 1900 the passengers carried on the 9 miles of horse tramway then existing numbered 8 millions. In 1903 the total number carried on the increased mileage was 45 millions. In the same period the number of workmen's cars run daily had increased from 3 to 30. Passengers by these particular cars could travel, on an average, 5 miles for one penny, and in some instances they could go 7 miles for one penny. The total number of persons conveyed at workmen's fares in 1900, under horse traction, was 142,000. In 1903, under electric traction, it was 2,562,000. The receipts of the company were £59,000 in 1900, and £278,000 in 1903, an advance of over 450 per cent. In the last 5 years the population in the districts concerned had increased from 424,000 to 534,000, and small and convenient house property is rapidly taking the place of bare and unprofitable tracts of land. As evidence of this improved order of things, he pointed out that his company carried 20,000 people (18 per cent of the day's traffic) from the suburbs to the various railway termini for London, every morning before 10 o'clock.

Speaking generally, however, the witness considered that, owing to the methods of procedure and the restrictions imposed, tramway development had been seriously checked and hampered in Great Britain, as compared with the United States, where a fair chance was offered to private enterprise and the electric tramway system had undergone a remarkable expansion. One could, for instance, make the journey of 262 miles from New York to Boston by various continuous lines of tramway (except for a few miles, where the railway would have to be taken); and from Boston one could proceed by "trolley" another 76 miles to Newport, returning thence to New York by steamer.

The "purchase clause" of the Tramways Act of 1870 had been a serious obstacle in the way of the proper development of tramways in Great Britain. He recommended that, in any future re-arrangement of the position, the term of years allowed should bear some relation to the capital outlay.

Looked at dispassionately, he considered that the Act of 1870 never had in its purview the working of tramways by any local authority at all. It was inconceivable that it was ever contemplated that a local authority should be able to acquire, in perpetuity, under such confiscatory conditions as those known as "scrap iron" terms of purchase, and then proceed to work the lines. He supported the view by reading an extract from the speech delivered by Mr. Shaw Lefevre in introducing the Bill of 1870. Mr. Shaw Lefevre said, among other things: "Now, although the Bill would give the power to local authorities to construct tramways—but not, of course, to work them—yet he believed that, as a general rule, they might look forward to the tramways being constructed rather by companies than by municipal authorities. . . . He did not think that profit should be made by local authorities out of tramways at the expense of the general public, for whose use they were intended, and more good was to be arrived at by lowering fares than by reducing local rates." The witness further related in detail the history of the tramways of Huddersfield (the first town in this country to operate its own lines) in order to show that it was the result of accident rather than of design that the precedent was established in this country for the entrance of a local authority upon a field of commercial enterprise which had previously been left in the hands of private companies.

Then, again, one of the greatest stumbling blocks in the way of tramway promotion lay in Standing Order 22, which required the assent of two-thirds of the local authorities before a scheme could be submitted to Parliament at all. A tramway promoter ought to be able to bring his proposals either before Parliament or before some such new tribunal as might be set up, so that they could be judged on their merits. He had no doubt it was with the best of intentions that the power of veto was originally conceded; but in a quarter of a century many changes had taken place in the position both of local authorities and of tramway locomotion, and he saw no reason why rules, regulations, or even Standing Orders that had become out of date, should not be scrap-heaped in a similar manner as mechanical appliances that had become obsolete. Since 1870 local authorities had developed into rival promoters and competitors of tramways, and it was now obviously to their advantage to throw impediments in the way of private enterprise. That they should, as interested parties, be able to decide a case for themselves, and block the way to an appeal to Imperial Parliament, was opposed to all considerations of equity. The Board of Trade had introduced a Bill which would repeal the rights of veto possessed by local authorities in regard to electric lighting. With this precedent before them he urged that the Commission should recommend to Parliament the abolition of the like power to veto in respect to tramway promotion.

Dealing with the demands sometimes made by local authorities as conditional to their assent to tramway schemes, he said that from first to last he had had to negotiate with some 30 public bodies within the sphere of operations of the London United Tramways, and the exactions made upon the company in respect of their Bills in the year 1898, 1900, 1901, 1902 and 1903, for street widenings and improvements—being "the price of local authorities' assents"—represented an outlay of £745,500, apart from the capitalization of numerous way-leaves, which amounted to a further £241,000. This was equivalent to over £20,000 per mile of tramway, irrespective of construction and equipment. On the bill they brought forward at the beginning of the present session—but which they dropped owing to the extortionate prices placed by the local authorities on their assents—the company were asked to carry out public improvements costing £642,630, in addition to certain widening works, involving an expenditure of £217,932, to which, perforce, they had to agree; the total being £860,562. In Brentford, the requirements of the Urban District Council represented an outlay at the rate of £608,000 per mile in respect to the 6 furlongs of new tramway which alone fell within that district under the new bill. Altogther, the proposed new tramways which the London United had had to abandon, owing to the action of various local authorities, represented a total of about 60 route miles. These important tramway extensions had not, however, been checked solely by the desire of local bodies to get as much out of the company as they could. The attitude consistently adopted towards them by the London County Council and the Middlesex County Council seemed to have been inspired by a wish to jealously prevent

the company from laying their lines at all, so that these bodies might strengthen their own position as tramway authorities.

The London County Council, as stated in evidence by Mr. W. H Dickinson, had laid down a rule, in regard to street widenings carried out for tramway construction, that one-third of the cost should be paid by the Council, one-third by the Tramways Department, and one-third by the local authority. Thus, the witness continued, the policy of the London County Council, as a tramway promoter, had been to ensure the throwing on the local rates of two-thirds of the cost of such widenings, whereas the policy of local authorities not themselves promoters of tramways had been to throw the entire burden on the tramway company. It was conceivable that the course thus taken by the London County Council had been dictated not alone by a sense of justice as regarded the local character of the improvements, but also by a desire to keep the cost of construction of their tramways as low as possible, so that better results could be subsequently shown from the operation. But if it were right that two-thirds of the cost of such improvements should be thrown on the rates when the tramways were made by a local authority, it was surely unfair that the entire cost should fall on the shareholders when the scheme was that of a private company. It was true that his own company had flourished, notwithstanding the demands of which he had spoken. Enterprises of that class were under the concentrated control of men of great practical experience, who, in spite of all difficulties, succeeded in showing good results—better results, indeed, than were attained by certain local authorities, even with all the advantages which they enjoyed. But if the cost of construction had not been swollen so greatly by the exactions of local authorities, his company would have been able to carry passengers either at lower fares or longer distances for the same amount. In the long run, therefore, it was the public who suffered.

The witness favored the appointment of an impartial tribunal which would deal with all questions affecting London traffic, sitting all the year round, according to requirements, and not simply during the session of Parliament. Such a body could, at least, do much of the routine or technical work now left to be dealt with in the double inquiry before Committees of the two Houses, questions concerning public necessity being left to a Joint Committee. He would urge, with the greatest possible emphasis, either that inquiry before such a tribunal should take the place of the veto at present possessed under Standing Order 22, or, alternatively, that Parliament should, if Standing Order 22 were not absolutely repealed, delegate the enforcement of a modified Standing Order to the Committee dealing with any particular Bill. He demurred emphatically to the claim of the London County Council that it should be made a law unto itself, and excluded in any way from the authority of the new tribunal. As regarded the control of London traffic, the witness said he would not approve of the proposed tribunal being expressly instructed not to sanction tramways in the heart of London. The objections arising in this respect were mainly due to the fact that, under existing conditions, "dead ends" constituted tramway termini, and thus naturally caused blocks. As regarded the proposal of Mr. Dickinson that the new authority should have power to regulate through fares, etc., on tube and other railways in London, the witness detailed some of the increased facilities which would be offered to the public on the completion of the combination of "trams, tubes and trains" to be formed by the London United Electric Tramways, the Metropolitan District Railway, now being electrified, and the various new tube railways in course of construction which would form part of the combined scheme. He agreed with Mr. Edgar Harper that to get people out of congested districts there was "no measure so effective as cheap fares," coupled with quick and frequent transit.

He further suggested that it would be a very great advantage to the public if the representatives of different tramway interests had powers given to them, where physical junctions existed, to run over one another's lines (as was already done in the case of many of our railways), so as to avoid a change of cars.

The Toronto (Can.) Railway Co. recently increased the wages of its motormen and conductors 1½ cents per hour and the men will now receive from 20 to 22½ cents per hour. This action averts a long-threatened strike that would have involved 1,150 employes. The new agreement covers a period of three years.

The Growth of an Electric Railway. II.

BY I. E. GOULD

Power Requirements.

With our approximate schedule decided upon, we may now proceed with the determination of the amount of power which will be required from the generating and distributing stations. The procedure at this point can best be illustrated by the following argument, which will show in a simple way the method of determining what capacity the power stations must have. The argument as here shown was used in the preliminary determinations of a single track trolley road in the practically level country of western Illinois, the road having a branch at nearly the central point of the main line.

Argument.

Weight of cars, 32 tons.

Equipment, four so-called 75-h.p. motors with multiple unit control.

Schedule speed, 30 miles per hour with stops averaging every three miles.

Average voltage at the car, 550 volts.

Average kilowatts per car, allowing 80 watts per ton mile, equals $80 \times 30 \times 32 = 76.8$ kw. per car.

Number of cars running, 8.

Number of sub-stations, 4.

Cars per sub-station, $7 \div 4 = 1.75$ for sub-stations Nos. 1, 2 and 4.

Sub-station No. 3, $1 + 1.75 = 2.75$

Sub-station is located at the junction of the main and branch lines, the schedule calling for a shuttle car on the branch line.

Loss in trolley, trolley feeders and track return will average 10 per cent of power delivered to motors.

Then $76.8 \times 0.10 = 7.68 + 76.8 = 84.48$ kw. required at the sub-stations per car.

Then $84.48 \times 1.75 = 147.84$ kw. required at each of sub-stations Nos. 1, 2 and 4.

And $84.48 \times 2.75 = 232.32$ kw. required at sub-station No. 3.

On this road storage batteries are to be placed at each sub-station and so designed that they will care for the load between the average and maximum points, hence the rotaries will be designed for the average load, this load consisting of the power used by the cars and an allowance for heating, lighting, etc.

Then rotaries in sub-stations Nos. 1, 2 and 4, equal 200 kw.

And rotary in sub-station No. 3 equals 275 kw.

As above, the average load at the cars for the eight car schedule is 614 kilowatts, and the losses between the generating station and the cars must be added to the average load to obtain the total amount of power necessary. Then taking

Loss in control and feeder, 10 per cent

Rotaries, 5 per cent

Step down transformers, 3 per cent

High tension line, 2.5 per cent

Step up transformers, 3 per cent

Total loss from generator to cars, 21.6 per cent.

Say, in round numbers, 25 per cent.

Then the average load at the power house for 8 cars is $614.4 \times .25 = 153.6 + 614.4 = 768.0$ kw. required for the average load at the power house. To care for this and any extra loads

TABLE I.

Distance Between Stops.		Watt Hours per Ton Mile for Schedule Speeds of					
Miles.	Feet.	40 M.P.H.	35 M.P.H.	30 M.P.H.	25 M.P.H.	20 M.P.H.	15 M.P.H.
3	15,840	110	80	78	65	53	40
2½	13,200	121	90	83	74	54	40
2	10,560	142	99	86	80	60	41
1½	7,920		123	95	85	68	43
1	5,280	....	....	128	90	74	50
½	2,640	....		.	145	119	56
¼	1,320	....	....		.	.	120
Train Friction in lb. per ton		35	30	27.5	25	20	15

The braking effort or retardation is taken at 150 lb. per ton.

The stops are taken at 15 seconds each, except in case of the 15 mile per hour schedule, where ten seconds is taken.

such as lighting, heating, and machine shop tools, use two 500-kw. units. With these units should be installed a third unit of like capacity as an assurance for continued operation in case of breakdowns in the generating machinery or storage batteries, or for use in case of overloads.

With the average interurban, to the generator capacity which the average operation load calls for must be added 50 per cent extra capacity for overloads caused by extra traffic.

In concluding the subject of preliminary determinations of the amount of power required the accompanying Table 1 is given to show the relation between watt hours per ton-mile for different schedule speeds. This table may be found on page 50 of "Electric Railway Economics," by W. C. Gotshall.

Along with the other calculations for the railway distribution system, come those for power and lighting.

Today there are indeed very few interurban railways which have been in operation for three years or more, which if they had been planned so that an electric lighting and power business could have been economically added as demanded, and the demand for the sale of this commodity is always gaged as in other commercial lines—by the amount of hustling done for business—but that would have by now been enjoying safe profits from its sale. The doing of a lighting business from a railway power station is made commercially possible by use of a storage battery, and a motor generator set, the motor generator set consisting of a synchronous motor direct connected to a generator capable of supplying alternating current at 2,000 volts, and 60 cycles. If the motor is designed with both commutator and slip rings, it may be conveniently operated upon the three-phase alternating current, and during that time in the night when the power house is not operating the generator can be driven by the motor, then using direct current from the storage battery. Thus current can be supplied for lighting purposes throughout the entire 24 hours of the day. Power for motors can be separately supplied either with alternating current or when distance will allow from the direct current feeders.

Very few electric railways have as yet taken hold of the business to be derived from an electric lighting and power system. This is undoubtedly due in the largest measure to the unsuitability of the original design of their plants, as well as the unfamiliarity of railway managers with the lighting business, and the comparatively small returns when compared with railway earnings.

These returns, however, are nearly all profits, and such a series of additional revenues should not be neglected.

Right of Way.

If our electric railway in question extends through a farming district or in fact any district except one in which the land has an excessive value, a private right of way will be one of its most valuable features. Such a right of way adds very little to the fixed charges against the net earning of our railroad, and these small charges are in fact the only arguments possible against the use of a private right of way. Its advantages are many. The increased cost and small fixed charges are offset by the fact that no franchise need be sought for from the local authorities, and in the beginning much time in this way be saved. The right of way once having been purchased is railway property, and the renewal of franchises and permits is thus done away with. A private right of way allows for the hauling of any class of business desirable. It insures against removal at a comparatively small additional fixed charge. On a strip of land 40 ft. or 60 ft. wide, a single track embankment may be given a much more advantageous grade, and many unnecessary curves eliminated which could not possibly be escaped if the track were located in the center or at one side of the country highway. It is needless to elaborate upon the advantages of low percentage of grade, and small amount of curvature. Where any competition is present, speed is one of the requisites for meeting such competition. A private right of way from the latter argument alone is indispensable. From an operating standpoint, the expense of handling traffic will be less for a railway on a private right of way. The maintenance cost for track, bridges, drainage and renewals will be lessened. Steam road standards for all special work and grading can be adopted. T rails will then be used, and when placed upon an embankment with the track given drainage and good ballast, the trouble from dirt on the rail is very much less, and therefore the power required to handle a given amount of business is greatly lessened. Schedule speeds may be very greatly increased where cars run in an enclosure well fenced, with very few crossings or possible opportunities for pedestrians or teams to come in contact with cars. Increasing the schedule speed will decrease the largest factor in operating expense, namely, trainmen's wages per car mile or per car hour. Accident expense and the legal expense connected with them will be greatly obviated.

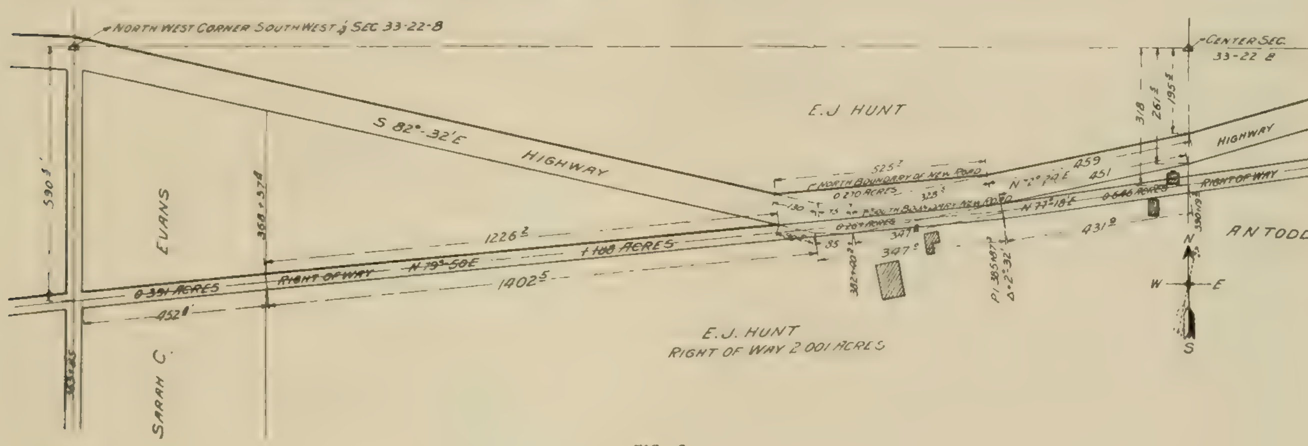


FIG. 3.

In locating the private right of way there are many factors to be taken into consideration. As mentioned earlier in the article, the railroad must seek the traffic, and not wait for the traffic to seek the railroad. With this in view, there are many cases where it will be policy to keep our right of way in the neighborhood of a well traversed highway, and thus be able to serve a country population directly at their doors. As to just how far from the highway such an interurban track can be located and still hold the local traffic, immediate conditions must decide. In a fairly level country, a very good grade and alignment, for any but high speed propositions, can usually be obtained on a right of way, located parallel with and adjacent to a public highway, by purchasing extra land for curves and heavy grades. Some engineers have put forth claims for a right of way paralleling a highway but at a distance from two to four hundred feet. The writer does not agree with them in this idea for several reasons. In the location of the right of way practically the same grades and alignment can be obtained by keeping the track adjacent to the existing highway as in attempting to keep it at a distance of say 300 feet away.

The farmers over whose land the railway is to pass object much more strongly to having a line of tracks cut them off from their barns, fields and pastures, to and from which they must be continually passing during the day, than in being cut off from the public highway. The average farmer uses his barn yard lane gate five times as much as his public highway gate. The taking of a right of way 300 feet distant from the highway would cut into the most valuable part of the farm, and thus the first cost be

greatly increased over that for a strip parallel with the highway, the other comprising a portion of the farm the loss of which in no way damages the remainder. When closely traced the element of danger is in no way different except that the fewer number of crossings on the railway adjacent to a highway would favor it greatly, usually one or two gates being all that are in use from the highway to any farm, while otherwise a crossing must be placed in every field bisected. Another factor is accessibility, the track which is nearer to the highway being more easily reached from houses on either side of the highway, and by passenger or freight which may be brought to it on intersecting highways. It will become a question worthy of much study and careful engineering judgment as to whether it will be more advantageous to locate a right of way parallel with a highway or not, but if the paralleling of the highway is decided upon, many reasons indicate that the right of way should be adjacent to one side of the highway except in exceptional cases, as above cited, for the reducing of grades and curvature. High speed between any two points will, of course, necessitate the adoption of the most direct route grades and alignment will permit. The fact that interurban roads are still dependent upon local traffic in a great measure for their success should be continually borne in mind during the location period.

If the third rail is to be used for the power distribution system, a right of way agent should be employed who is acquainted with third rail operation. Many times a right of way agent, having had no third-rail experience and not understanding the value of an extra foot of rail at a crossing just long enough not to be spanned by one car, will forfeit rights that otherwise would allow the rail to be lengthened, in order to hasten his contract signings. Such a proceeding will be sorely regretted by the management at a later date.

For single track roads the right of way should not be less than 40 feet, and a width of 60 feet can very often be purchased in rural districts for practically no greater expense than a narrow one, the usual amount of compensation for land and damages being fixed arbitrarily and independent of the acreage taken.

The final decision having been arrived at concerning the location of the right of way, next comes the plotting of a map or series of maps showing the right of way from one terminus to another. Such right of way maps must be absolutely correct and show all details and measurements. In fact, the engineer must be able to testify under oath as to their correctness. Fig. 3 shows a special right of way map of a portion of an interurban railway. It was here necessary to take part of the existing highway by furnishing a new one as shown. A book form will be found very convenient for filing these maps if properly indexed, and the drawings so arranged that one will pass continuously from one terminus to another by turning one leaf after the other. These maps are best made to a scale of about 400 feet to the inch. In addition to the reference data they should show the transit line, and different reference points, together with the right of way fences and angles of intersection of the center line of right of way with all other intersecting center lines. From these maps will be written the right of way descriptions for the deeds. These descriptions should not be filed until the construction is well along on the right of way, otherwise much inconvenience may be incurred by a slight change in the location.

For an interesting and instructive article on right of way records see "The Right of Way Map," by John B. Warren, C. E., published in the "Street Railway Review," Feb. 20, 1903, page 67.

Location Survey.

The location survey is made by a transit and level party very similar to that used in the preliminary work. With the line as based on the preliminary survey, and as corrected by the later office work, the transit party will now proceed with the final staking of the center line upon which the track is to be built. This work will be done with a transit, and all details and measurements must be accurate, no guess work or rude approximations are to be tolerated. All transit points will be made as secure and as permanent as possible. Station stakes will be set every 100 feet apart on tangents, and 50 feet apart on curves. The more important ones, such as points of curve and points of intersection, will be guarded by other transit points set in safe positions near by, their distances and directions from the main point being recorded. Station stakes should be neatly made of sawed lumber and planed faces so that they will easily take markings.

By this time the right of way will have been cleared and long sights for tangent work will be permissible. Tangents must be absolutely straight lines. If possible, tangents should be run by method of foresight, it being preferable to thus keep the instrument always pointed at some object on the horizon rather than prolonging by a line of back sights. If a tangent is produced from point to point by back sights, the fore sight observations should be repeated in each case with the instrument reversed, thus eliminating any accidental error or incorrectness of adjustment. In passing obstacles the location line should be prolonged by two independent methods serving to check each other.

A level party follows the transit party in location work, the same as on the preliminary work. The leveler selects permanent bench marks at close intervals, say every 1,500 feet, along the work, taking care that these are placed in localities which will not be disturbed during the construction period. A bench should be placed at every waterway, to be used later for foundation work.

The rod is read and recorded for every station and at all points on the center line where the slope changes, so that there will be shown on the profile a correct surface line. On turning points and bench marks the rod should be read to thousandths of a foot, but only to tenths of a foot elsewhere. Level notes for turning points are kept by both the instrument man and the rod man, and at the close of each day notes are checked, compared and the profile obtained is plotted.

As previously mentioned, the fixing of the grade lines upon the profile should be done by the engineer in charge of the location party because the controlling features of this most important operation are best understood by him. The maximum gradients and rate of curvature generally will have been determined at the office during the study of the preliminary data, but each detail as to these items will be left at the discretion of the locating engineer. The fundamental idea in placing grade lines is the attempting to equalize the cut and fill while securing the best possible grade and alignment. There will occur many instances in which one of these items can economically be in excess of the other. The embankment will be in excess in flat or wooded country in order to keep the road-bed well drained, or in approaching a stream where it is necessary to raise the grade to the level of a bridge, or in a rocky district it may be found cheaper to borrow dirt and thus make an embankment in order to do away with an expensive rock cut. The possibility of the road being blocked by snow drifts or land slides, must be kept in mind when placing grade lines.

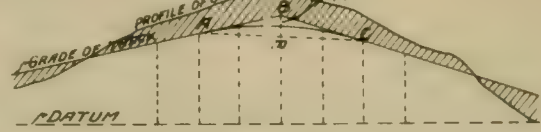


Fig. 4

For a single track interurban road having a narrow right of way, say 40 feet in width, and desiring to plan for double track, yet to build only one track, which track would have its center say 15 feet from the right of way fence lines, the author has used the following method to advantage for setting location stakes. For this work the transit line is run about one foot distant from the fence line on the side towards the center of the right of way. Stakes approximately two feet long and two inches square were set at each station. Upon the rear side of each stake was marked the station number. Such stakes can now be used as a basis for all other construction lines parallel with them, the offset distances being easily laid off with a tape. A sketch is made and given to each foreman, this sketch showing a cross section of the entire right of way with the distances from the reference stakes to the two fence lines, and the track center pole line, etc., clearly shown. When the location levels are run, the elevation of the top of these stakes is taken along with that of the track center profile, and in computing the cut and fill measurements for the track center profile the engineer will also compute and record on the same page in his note book, the difference in elevation between the top of the reference stake and the finished sub-grade, this difference being

New Publications.

MANUAL FOR ENGINEERS. Compiled by Charles E. Ferris, B. S., professor of Mechanical Engineering, University of Tennessee. 240 pages, including 85 pages of advertisements, flexible leather covers, gilt edges, vest pocket size. This is the fourth edition of a very handy little book of tables and other data for engineers and business men. It is conveniently indexed. Published by the University of Tennessee, Knoxville. Price, postpaid, 50 cents.

FACTS ABOUT RAILROAD BONDED INDEBTEDNESS. This is what is known as Poor's Ready Reference Bond List, and is published as a supplement (January, 1904) to Poor's Manual of Railroads. It contains all important facts required by investors, bond experts, bankers and others relative to the bonded indebtedness, interest charges, etc., of the leading railroad systems of the United States. It contains an index to all bonds listed in the compilation. Pamphlet form, 94 pages, 6 x 9 in. Published by Poor's Railroad Manual Co., 68 William St., New York.

THE ENGINEERING PRESS MONTHLY INDEX REVIEW, formerly the "Index of the Technical Press," is printed in three separate editions each month—English, French and German. The first number in its new form is the April issue, which is also the first number of the fourth volume. Besides brief reviews of recent papers and articles of note, the index contains about 2,000 index notes, or records, of the world's engineering literature for the preceding 30 days. The references are classified under the different headings usually employed by engineers, so that it is exceedingly convenient. Published by the Technical Press Association, 20 Rue de la Chancellerie, Brussels. Price one shilling.

CLARKSON BULLETIN, FEBRUARY, 1904. VOL. 1, NO. 1. Issued quarterly by the Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y. The contents of this number are as follows: "The Success of the Educated Man", Founder's Day Address, 1903. By Frederic A. C. Perrine, D. Sc.; "The Thomas S. Clarkson Memorial School of Technology, Its Foundation, Charter and Dedication"; "Technological and Technical Education", Abstract of Dedicatory Address, 1896. By Francis A. Walker, Ph. D.; "Work of the Clarkson School of Technology, Its Object, Equipment, Methods of Instruction, Location"; "Fourth Annual Commencement, Degrees Conferred and Certificates Awarded, June 19, 1903". The Clarkson Bulletin will be mailed upon application to the Director, Clarkson School of Technology, Potsdam, N. Y.

READY REFERENCE TABLES. By Carl Hering, M. E., past president American Institute of Electrical Engineers and president Engineers' Club of Philadelphia. This is a handy publication of conversion tables, pocket size, 196 pages, including a comprehensive alphabetical index, gilt edges, bound in leather. It is the first of several volumes in preparation by the author which are intended to contain collections of data conveniently arranged for ready reference. In this first volume all the various measures used in practice, more especially by engineers and physicists, are given with their values in terms of as many of the others as they are likely to be converted into in practice; the reciprocals of these are also given, and they are stated in such a form that errors due to dividing instead of multiplying are avoided. It has been the intention to include every unit or measure used in practice, besides many that are now obsolete. The more usual foreign units or measures have been added, also. Published by John Wiley & Sons, New York. Price $2.50.

MODERN ELECTRICITY. By James Henry, M. E., and Karel J. Hora, M. Sc. This book, which is designated as "a practical working encyclopedia and a manual of theories, principles and applications," has been prepared with great care and is, in reality a practical encyclopedia of all that the electrical engineer, artisan, apprentice or student may desire to know regarding electricity and its applications. Without sacrificing clearness or accuracy the information has been simplified, so that the beginner can acquire an excellent knowledge of the fundamental principles and uses of electricity. Many devices, machines and apparatus are described and illustrated, and in addition there are numerous tables which are of practical value. Certain chapters are devoted to practical methods and estimates for the construction of electric railways, the estimates being taken from actual practice, and there are special drawings illustrating construction of plants, stations and method of wiring. The volume contains 355 pages, over 150 illustrations, and exhaustive cross index and appendix. Published by Laird & Lee, Chicago. Cloth, $1.00; leather, $1.50.

AMERICAN STREET RAILWAY INVESTMENTS. This is the 11th annual volume of the Street Railway Journal's "Red Book" which is published for the use of bankers, brokers, capitalists, investors and street railway companies. This year's issue is larger than ever before and contains reports of numerous companies which hitherto failed to furnish financial statements. Several new features have been added to this year's volume, among them the location of power stations and repair shops, parks and pleasure resorts and more complete descriptions of the funded debt of different properties than heretofore. The volume also contains a large number of maps of the principal street railway systems in the country, many of them in two or more colors; also maps showing the interurban railways in New Jersey, Ohio, Indiana and Illinois. The reports in the "Red Book" are arranged by states and cities with a complete alphabetical index to the companies. The date of information is stated definitely at the end of each report. Published by the McGraw Publishing Co., New York. Price $5.00.

STEAM BOILERS, THEIR THEORY AND DESIGN. By H. de B. Parsons, M. E., professor of Steam Engineering, Rensselaer Polytechnic Institute; 375 pages, including alphabetical index. Cloth boards, illustrated. In the preface it is stated that this book comprises a series of lectures delivered to the senior class of the Rensselaer Polytechnic Institute, Troy, N. Y., rewritten and divided into chapters. The only originality claimed for the work is the effort to cover such points as in practical office work may be found to be perplexing. There are 16 chapters and an appendix which treats of superheated steam. The subjects into which the work is classified include combustion, furnace temperature and efficiency of boiler, chimney draft, boiler fittings, mechanical stokers, artificial draft, incrustation, corrosion, smoke prevention, etc. The subject matter is presented in a simple, easy-to-be-understood style and the work should prove of value to the engineering profession, and especially to students. Prominent authorities are quoted and a number of useful tables are given.) The illustrations show the best and most modern practice. Published by Longmans, Green & Co., 91-3 Fifth Ave., New York City.

GENERAL INDEX TO THE STREET RAILWAY JOURNAL BY SUBJECTS AND AUTHORS. October, 1884, to December, 1903, including Vols. I to XXII. As stated in the introductory note, this Index covers the articles in the American Edition of the Street Railway Journal for the period stated, and does not apply to the International Edition. No attempt has been made to preserve the original captions of the articles, and except in the authors' index subjects and not titles have been indexed. In long articles, where different topics have been treated at length, separate entries of the different topics have been made as far as possible. In addition, all articles susceptible of geographical designation have been indexed under the name of the city or country to which the subject has pertained. In the case of nearly all the cities the articles are indexed independently of the names of the street railway companies, except where they refer to corporate events. Owing to the size of the Index certain of the early articles on horse traction have been omitted and there has been some condensation as regards description of apparatus for cable traction. 162 pages, cloth board covers. Published by the McGraw Publishing Co., 114 Liberty St., New York. Price $5.00.

THE THEORY OF THE LEAD ACCUMULATOR (STORAGE BATTERY). By Dr. Friedrich Dolezalek. Translated from the German with the sanction of the author by Carl L. von Ende, Ph. D. (Goettingen), instructor in chemistry, State University of Iowa. First edition, first thousand. Cloth, 221 pages, exclusive of index. Illustrated by diagrams. The author states that this work is a first, if somewhat imperfect, attempt to treat the reactions in the lead accumulator from the standpoint of the new theories of physical chemistry, and it shows that the newer theories have found a more exact application in the case of the lead accumulator than in probably any other instance, and have been of a fruitfulness unprecedented. Perhaps the character of the work could be shown in no better way than by naming the titles of the chapters, as follows: Chemical Theory of Origin of Current; Thermodynamical Theory of Origin of Current; Osmotic Theory of Origin of Current; Variation of Electromotive Force with Acid Concentration; Variation of Electrode Potential with Acid Concentration; Tem-

perature Coefficient; Influence of External Pressure; Behavior During Charging and Discharging; Reversibility; Changes in the Open Cell; Internal Resistance; Capacity; Degree of Efficiency and Working Efficiency; Changes in the Cell During Formation; Methods of Measurement; Table of Density and Percentage Strength of Mixtures of Sulphuric Acid and Water. This work looks to be of scientific and practical importance. Published by John Wiley & Sons, New York. Price $2.50.

BY TROLLEY THROUGH WESTERN NEW ENGLAND-BOSTON, SPRINGFIELD, NEW YORK. Connecticut Valley Edition. Compiled by Robert H. Derrah, Boston, Mass. This is an attractively and instructively compiled book containing 105 pages exclusive of the index and paper covers, artistically illustrated. It comprises descriptive matter relative to trolley trips over trunk and branch lines, or side trips, the main line trips being grouped under the headings, Boston to Worcester, Springfield to Greenfield, Springfield to New York City, and Boston to Fitchburg and Beyond. The side trips treated of include the following: Springfield and About There; South Framingham to Milford, Hopkinton, Westboro, Marlboro and Hudson; Marlboro to Westboro; Worcester to the surrounding towns and villages; Palmer to Monson, South Monson, Bondsville, Thorndike and Three Rivers; Holyoke to Westfield and through the Turkey Pass to Amherst; Northampton to Amherst and Hadley; Hartford and side trips; Southington to Meriden, Yalesville and Wallingford; New Haven, with local lines running to Branford, and East and West Rocks. Mr. Derrah may be called the pioneer publisher of street railway guides. He has been connected with the street railway business for the past 14 years, and published the first map ever issued showing the existing and projected street railway lines in any state in the Union; he originated the first trolley trip from Boston to New York; he has compiled and published Derrah's Official Street Railway Guide for Eastern New England for eight years, and in many other ways has built up a reputation as a responsible publisher of street railway literature. The price of this latest publication is 10 cents.

Nashville Notes.

As the reconstruction work of the Nashville Railway, for which funds were provided and plans made at the time of organization, July 1, 1903, when completed, left several very important lines untouched, the directors of the company at a recent meeting made arrangements to negotiate a loan of $250,000 for one year from the Guarantee Trust Co. of New York, for which the company hypothecated $350,000 face value of its treasury bonds. It is believed that this will provide a sufficient fund with which to entirely complete the system at Nashville.

Having finished reconstruction of the Buena Vista line in North Nashville, the company is now at work on an extension of this line ¾ mile on Buchanan St., making the new terminus at Buchanan and Salem Sts. This extension will be completed within a few weeks, and will give street car facilities to a well populated suburban section, and will also go within about two blocks of Temple Cemetery, to the northwest of the city.

Rebuilding of the Fairfield line in South Nashville has also been in progress for some time, and the improvements to be made on this line will soon be completed. As soon as the work on the lines now being improved is finished, other lines will be taken up and pushed as rapidly as possible. Among the more important lines remaining to be constructed are the Cherry and College in South Nashville, the Meridian and Lischey in Northeast Nashville, the Belmont line in Southwest Nashville, and the Jefferson Street line in Northwest Nashville. Work has already commenced at this writing on the Meridian and Lischey line, and the Belmont and Cherry and College lines will follow in the order named. Work on the company's overhead system has been begun and is being energetically pushed forward, the Glendale Park line now receiving attention.

As a result of the building of the new power house, the company is enabled to make faster schedules on all the rebuilt lines. The time for the round trip to Glendale Park from the transfer station is now one hour, whereas heretofore it was seventy minutes, but the cars seldom made the seventy-minute schedule on account of lack of power, while they now make the 60-minute schedule without difficulty. The turbine ordered the first of the year has arrived and is being installed, the completion of which will greatly strengthen the already fine plant.

The company keeps an accurate account at its general offices of the amount of business on each line, and just as soon as the number of passengers justifies, an increase in cars is made. An important change in this respect has just been made on the Woodland lines; heretofore there have been two cars to Tenth St., and in the future these cars will go to the ends of the lines, one going out the Gallatin Road and the other out Woodland St. There will be six cars on the line, making a seven-minute headway to Tenth St. and fourteen minutes on each line beyond Tenth St., the time being ten and twenty minutes before this change went into effect. After an investigation of the amount of business done, it was found that it was sufficient for an increase of cars, and this progressive spirit of the company in the matter of providing accommodations for its passengers will be carried out on all lines.

On June 14th, 15th and 16th the Nashville Railway & Light Co. easily surpassed all former records in the number of passengers handled, the occasion being the reunion of the United Confederate Veterans in Nashville. Passengers were handled as follows: June 14th, 148,000; June 15th, 175,000; June 16th, 148,000, of which numbers approximately one-third were transfers made in the Transfer Station. The highest number of passengers ever before carried in one day by the company was 127,000. Despite the fact that so many of the passengers were country people, unused to city ways and unaccustomed to riding on electric cars, the crowds were handled most satisfactorily and with no serious accident. It is estimated that between fifty and sixty thousand visitors were in Nashville the three days of the reunion.

Recently the company began the publication of a little four-page leaflet, entitled the "Nashville Railway & Light Company Weekly." An edition of 10,000 copies is got out each week, the leaflets being placed in small receptacles in the cars. The first page is given to an editorial on subjects of interest connected with the business of the company; the second page contains an advertisement setting forth the beauties and attractions of Glendale Park; the Lighting Department covers the third page with an advertisement of electric lights and electric fans, while the fourth page is known as the "Joke" page. The paper is read with much interest by the passengers, and it not only promotes the street car riding habit, but brings the public in closer touch with the company. The scheme is copied from the Birmingham Railway, Light & Power Co., of Birmingham, Ala., which has been getting out such a publication for nearly two years. The Knoxville Traction Co., of Knoxville, Tenn., controlled by the same interests as is the Nashville system, gets out a similar publication weekly, known as the "Trolley," which is being very favorably received.

The Chattanooga Electric Railway Co. has completed and put in operation its new line to Rossville, Ga. This is in the direction of Chickamauga Park, where the United States Government maintains a large army post, and about half way to the park. The Rapid Transit Co., of Chattanooga, already has a line from Chattanooga through Rossville to Chickamauga, but there is such intense rivalry between the two companies that it is thought that it will be only a matter of time until the Chattanooga Electric pushes forward its Rossville line to Chickamauga Park.

M. C. B. Drop Testing Machine.

A recent paper contributed to the American Society for Testing Materials by Prof. W. F. M. Goss, of Purdue University, describes the Master Car Builders' drop testing machine which has been installed in the railroad laboratory of the University, at La Fayette, Ind. This machine was specially designed for testing axles, couplers, and all railroad equipment for which there are recognized specifications for testing under the drop. Large wheels cannot be tested with a blow delivered on the hub, as the distance between the housings of the machine is only 27½ in.

Besides this machine the Master Car Builders' Association has installed in the Purdue laboratory its brake shoe testing machine and an air brake rack.

The University is well equipped to make commercial tests for railroads not having their own laboratories.

The La Fayette (Ind.) Ry. has adopted block signals.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

[The decisions which have been reported in the Legal Department of the "Street Railway Review" since 1893 have been published separately by the Windsor & Kenfield Publishing Co. under the title "Street Railway Law," four volumes of which have been printed. Vol. I covers the period from January, 1894, to January, 1897; Vol. II from January, 1897, to July, 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901, to April, 1903. Vol. V is now in press. Price: Bound in sheep: four volumes, $10.00; single volume, $3.00. Bound in buckram: four volumes, $6.50; single volume, $2.00.]

LABORER RIDING HOME ON WORK CAR AND EMPLOYES IN CHARGE OF CARS ARE FELLOW-SERVANTS.

Indianapolis & Greenfield Rapid Transit Co. vs. Foreman (Ind.), 69 N. E. Rep., 669. Jan. 29, 1904.

Where a common laborer upon the company's tracks was riding home in a work car, after a day's work, and was injured while the car was standing on a switch by a passenger car colliding with it, the supreme court of Indiana holds that the persons in charge of said cars were, regardless of the names or titles by which they were designated, fellow servants of the laborer, and, if he was injured by their negligence, the company was not liable therefor.

DUTY TO EMPLOYE OF CONTRACTOR FOR PAINTING POLES.

Kennealy vs. Westchester Electric Railway Co. (N. Y. Sup.), 83 N. Y. Supp. 823. July 24, 1903.

While in the employ of a contractor who had entered into a contract with the railway company to paint the supporting poles of its trolley system, the plaintiff was severely injured by his arm coming in contact with a feed wire while he was engaged in sandpapering one of the poles preparatory to painting the same. The measure of the obligation of the railway company to a workman under these circumstances, the second appellate division of the supreme court of New York holds, was to use reasonable care for his protection against injury.

CITY CAN ENFORCE AGAINST LESSEE LIABILITY OF LESSOR TO PAY FEE FOR EACH CAR RUN.

Mayor, etc., of Jersey City vs. Consolidated Traction Co. (N. J. Sup.), 57 Atl. Rep. 446. Feb. 29, 1904.

The supreme court of New Jersey holds that, by force of the statutes approved March 14, 1893, which authorize one street railway company to lease its property and franchises to another, and the lease made by the Jersey City & Bergen Railroad Company to the Consolidated Traction Company, in which the lessee assumed all the burdens and liabilities of the lessor, Jersey City can enforce against the lessee the liability of the lessor to pay the city a fee for each car run on the railroad.

THINGS ABOUT SAFETY APPLIANCES NOT MATTERS OF COMMON KNOWLEDGE—BURDEN OF PROOF AS TO ABSENCE OF FENDER CONSTITUTING NEGLIGENCE.

Carney vs. Concord Street Railway (N. H.), 57 Atl. Rep. 218. Dec. 31, 1903.

The character, mode of operation, utility, and extent of use of safety appliances and fenders for street cars operated by electric power, the supreme court of New Hampshire says, are not matters of common knowledge. It cannot be presumed that the jury had knowledge of these matters. The burden was upon the plaintiff to prove that the absence of a fender constituted negligence. This burden was not sustained by simply proving that the car had no fender. It was necessary to prove further that ordinary care required that there should be a fender. This would involve, among other things, a description of the apparatus, the way in which it operates, the result of its operation, etc. Even if expert testimony were necessary (which is doubtful), that circumstance does not avoid the necessity of proof.

ACCEPTANCE OF LOCATION DOES NOT VALIDATE ILLEGALLY IMPOSED CONDITIONS AS TO FARE.

Keefe vs. Lexington & Boston Street Railway Co. (Mass.), 70 N. E. Rep. 37. Feb. 26, 1904.

The acceptance by the company of the locations granted by certain towns, the supreme judicial court of Massachusetts holds, did not make valid conditions as to fare which the towns could not legally impose, but which conditions as to fares that might be charged for the transportation of passengers within the limits of their respective towns they prescribed in granting the locations. Nor did the acceptance of the locations make a contract as to fares between the corporation and the selectmen or the town. The company might, therefore, at least prescribe for its passengers the payment of any fare which was reasonable.

DUTY OF SELECTING CARS TO BE USED—STARTER AND CAR REPAIRER NOT FELLOW SERVANTS.

Quinn vs. Brooklyn Heights Railroad Co. (N. Y. Sup.), 86 N. Y. Supp. 883. Mar. 4, 1904.

It is the duty of the master, the second appellate division of the supreme court of New York holds, to furnish cars which are in proper condition, not alone for the passengers, but for their employes. This necessarily involves the duty of selecting the cars to be used, and whoever makes this selection is performing a duty which belongs to the master, and this duty cannot be delegated in such a manner as to relieve the master from responsibility for negligence in the discharge of this duty.

A starter and a car repairer are not fellow servants, within the rule which exempts the master from liability for the negligence of co-servants.

RISK OF USING SINGLE TRACK WITHOUT SIGNALS ASSUMED BY CONDUCTOR.

Simmons vs. Southern Traction Co. (Pa.), 57 Atl. Rep. 45. Jan. 4, 1904.

While an extra car or tripper on which the plaintiff was conductor was on a single track, in the evening, the trolley slipped from the feed wire, the car stopped, and its lights were extinguished Moreover, an arc street light near the place happened not be be burning. The plaintiff got down on the track in order to replace the trolley, and while standing back of his car he was struck and injured by the car that followed it. He had been in the employ of the company, running extra cars on this part of the road, for 27 days. The supreme court of Pennsylvania holds that whatever danger there was in the use of the single track without signals was obvious, and as fully known to the plaintiff before as after the accident, and the risk was voluntarily assumed by him.

AFTER BEING REFUSED TRANSFER TICKET REMAINING ON CAR UNTIL IT REACHES END OF LINE AND STARTS BACK.

Hoelljes vs. Interurban Street Railway Co. (N. Y. Sup.), 87 N. Y Supp. 133. Mar. 11, 1904.

A passenger on a car going westerly asked for and was refused a transfer. The appellate term of the supreme court of New York says that if he desired to stand upon his rights he should have left the car and sought the remedy the law vouchsafes for such a wrong, in the definite and requisite penalty it fixes for such a transgression. In doing what the record showed he did, riding to

the end of the westerly route, he was within his rights, and to that extent they could not be gainsaid. In remaining aboard the car when it started easterly on its return trip, he was exercising a privilege no one could deny; but when a fare was demanded of him, and he refused to pay, he was transgressing, and he invited the personal encounter which resulted in his forcible expulsion, and the company was not liable for what followed; the complaint should be dismissed.

LIABILITY FOR INJURY TO LIVE STOCK—DUTY OF MOTORMAN.

Anniston Electric & Gas Co. vs. Hewitt (Ala.), 36 So. Rep. 39. Feb. 4, 1904.

The law is well settled, the supreme court of Alabama says, that railroad companies that knowingly run their trains under conditions rendering it impracticable for those in charge to prevent injuring stock straying on their tracks, are accountable for the loss when injury results. This principle applies, when needful for the protection of life and property, to a railroad on which electricity is used as the moving power, as well as to one operated by steam. The law enjoined on the motorman operating defendant's car, the duty to keep a lookout for live stock, and not to run his car at such a rate of speed that he could not stop it within the distance he could see the plaintiff's cow. The only qualification of this rule is, that where—such duties being observed by the engineer or motorman—the animal comes suddenly upon the track, so close to the engine that the engineer cannot stop in time to prevent running over it, in which case its destruction cannot be ascribed to defendant's negligence.

COMPANY OBLIGATED TO PAY ANNUAL FEE FOR EACH CAR RUN—CONSENT MUST FALL ON ANNULMENT OF CONDITION INSEPARABLY CONNECTED WITH IT.

Mayor, etc., of Jersey City vs. Jersey City & Bergen Railroad Co. (N. J. Sup.), 57 Atl. Rep. 445. Feb. 29, 1904.

The provision in the charter of the company, a private act approved March 15, 1859, by which the company was empowered to construct and operate a street railroad in Jersey City, provided that in constructing the railroad the company first obtained the consent of the city council; the ordinance of the council giving such consent on condition that the company should pay an annual fee for each car run on the railroad; the acceptance of the ordinance by the company, and the construction of the railroad in pursuance of the consent; and the supplement to the company's charter approved March 17, 1860, declaring that, in constructing and maintaining its railroad in Jersey City, the company should be subject to the conditions imposed in the ordinance—the supreme court of New Jersey holds placed upon the company a legal obligation to pay the stated fee. It says that if the right of the city to impose such a condition was to be denied, the ordinance should not have been accepted, but should have been attacked directly, for, if the council had not that right, the consent which was given on this condition, and was inseparably connected with it, must fall on its annulment.

FAILURE TO GIVE TRANSFERS ON ACCOUNT OF CONDUCTOR BEING OUT OF THEM—RIGHTS OF SKYLARKING BOYS AS PASSENGERS.

Rosenberg vs. Brooklyn Heights Railroad Co. (N. Y. Sup.), 86 N. Y. Supp. 871. Mar. 4, 1904.

This action was to recover a penalty upon the refusal of the defendant to furnish a passenger with a transfer ticket. The second appellate division of the supreme court of New York says that it cannot, it thinks, be said that, as matter of law, the company was absolved, even if it were true that the conductor at that time did not have the usual transfer ticket. The purpose of the statute is to assure the passenger a continuous ride. As between the passenger and the company, it was the fault of the company if the conductor did not have the usual transfer ticket, inasmuch as the company was bound, under the statute, to furnish them. In such an emergency, if it existed, no good reason appeared why the conductor could not have furnished a slip, as requested, for use on the approaching car (to which a transfer was wanted), with an oral explanation, to its conductor, or could not, perhaps, have explained the situation to that conductor regardless of any slip. In any event, it would be going too far to hold the company excused upon the bare plea that its agent did not have the tickets which, by the statute, it is required to furnish. It is, of course, immaterial, so far as this action is concerned, that the lads (the plaintiff and others) indulged in skylarking on the car. Nevertheless they remained passengers entitled to the rights assured them by statute.

RIGHTS OF VEHICLES AT STREET CROSSINGS—RIGHTS BETWEEN FIRE ENGINE OR TRUCK AND TROLLEY CARS—LOCAL CUSTOM MUST BE PLEADED TO ADMIT EVIDENCE OF IT.

Knox vs. North Jersey Street Railway Co. (N. J. Sup.), 57 Atl. Rep. 423. Mar. 1, 1904.

The rule of the road with relation to vehicles approaching a street crossing, the supreme court of New Jersey says, is that the first to reach the crossing, traveling at a reasonable rate of speed, has the right to pass over first. This rule is a part of the common law of the state, and applies to vehicles of every character. It may be conceded that the importance of having a fire engine or truck reach its destination as speedily as possible makes it advisable that it should be given superior right in the public streets, and that trolley cars and other vehicles should be required to yield it the right of way at street crossings. Such a right may be granted by legislative enactment, and, to some extent at least, by municipal regulation. It may also, perhaps (although this the court does not decide), grow out of a custom existing in the particular locality where it is sought to be exercised. It is not within the power of the courts to confer it by judicial decision. Whether such a right may grow out of a particular custom was a question which was sought to be raised by the plaintiff at the trial of this case, but the judge refused to permit it to be done. In order to entitle him to prove that a hook and ladder truck had the right of way over the crossing by reason of a local custom, notwithstanding that the trolley car reached it first, the plaintiff was bound to aver in his declaration the existence of such a custom, and that the collision occurred by reason of the failure of the defendant's motorman to observe it, so that the defendant might be apprised of his claim in that regard, and be prepared to controvert it at the trial. No such custom having been pleaded, the trial court properly excluded evidence of its existence.

CLASSIFICATION OF POWER HOUSE FOR TAXATION UNDER STATUTE.

City of Philadelphia vs. Electric Traction Co. (Pa.), 57 Atl. Rep. 354. Feb. 29, 1904.

The supreme court of Pennsylvania says that an act of 1858 provides that "the offices, depots, car houses, and other real property of railway corporations situate in said city, the superstructure of the road and water stations alone excepted, are and hereafter shall be subject to taxation by ordinances for city purposes." Should a power house for the manufacture of electricity, owned and used by a traction motor company engaged in the operation of street railways, be placed in the class of property taxable, or in the class exempted? A distinction had been made by this court between the class of property that was a constituent part of a corporate franchise, and essential to the performance of its duties to the public, and that which was only advantageous and convenient, but not necessary to the exercise of its franchise. The act of 1858 was written in the light of these decisions, and it followed them; preserving the distinction that had been made, but drawing the lines more closely against exemption. Up to this time the offices, depots, car houses, the superstructures of the road, and water stations of a railroad, had all been exempt. The act drew the line at a different place, and exempted only the last two, which were clearly essentials, and formed part of the road itself. There can be no doubt as to the class to which the power house of an electric motor company belongs. As a means of furnishing motive power, it is as essential to the company as is a water station to a railroad company. It does not take the place of anything before taxable, but is a substitute for that which was before expressly exempted, and it comes

within the stringent rule of necessity established by the act of 1858 in exempting the roadway and means of supplying power.

LIABILITY FOR ARREST AND FALSE IMPRISONMENT BY EMPLOYE ACTING AS A RAILROAD POLICE OFFICER.

Cordner vs. Boston & Maine Railroad (N. H.), 57 Atl. Rep. 234. Feb. 2, 1904.

The mere fact that one who arrested the plaintiff was the defendants' servant (his particular employment being that of conductor upon the defendants' street railway), the supreme court of New Hampshire holds, was not sufficient to make the defendants answerable therefor. It says that they were not liable unless they directed him to make the arrest, or unless in so doing he was engaged in their business, and acting within the scope of his employment as their servant, or unless they had ratified his act. It could not be assumed that, by his employment as conductor, it was understood that he should arrest a suspected person in behalf of his employers, when he was not on duty, was not subject to their orders, and the arrest was not made upon view of the offense, but some time after its commission, who the offender was being matter of suspicion merely, and it being for a loss of money which would fall upon him (the conductor) alone. Moreover, assuming that his being sworn as a police officer, under an arrangement made for the purpose by the assistant superintendent, and being furnished with a badge of office, constituted him an officer de facto (in fact), although an attempt to have him regularly appointed a railroad police officer had failed, or, if it did not constitute him an officer de facto, assuming that the defendant were estopped to deny that he was such officer, and was appointed upon their petition, how did the fact affect the scope of his service for the defendants? Manifestly, it could not modify or enlarge the ordinary service of the employe, beyond the inclusion within the service of a performance of the duties imposed by law upon railroad police officers; and it is doubtful if it would have effect even to that extent. And even if he must be regarded as a railroad police officer, so far as the defendants were concerned, his arrest of the plaintiff under the circumstances stated was an act that was outside the duties of the office.

REASONABLENESS OF RULE REQUIRING PRODUCTION OF TRANSFER—CONDUCTOR HAS NO RIGHT TO WAIVE OR DISREGARD RULE—VERBAL TRANSFER FROM ONE CONDUCTOR TO ANOTHER INSUFFICIENT—FAILURE TO PRODUCE TRANSFER EVASION OF FARE WITHIN STATUTE.

Crowley vs. Fitchburg & Leominster Street Railway Co. (Mass.), 70 N. E. Rep. 56. Mar. 2, 1904.

The plaintiff lived on Water street, and got onto a Main street car to go to his home; changing cars at a place called "Depot Square." He offered a $20 bill in payment of his fare. The conductor was unable to change it, but told him that he would change it when he got to Depot Square, and did, taking out the fare. The Water street car was waiting, and the conductor of that car shouted to the plaintiff to "hurry up." The plaintiff turned to the conductor of the Main street car, and asked for a transfer, but the conductor said, "Never mind your transfer," and shouted to the conductor of the Water street car, who was about 20 feet away, to pass the plaintiff; that he was all right, and had paid his fare, and he (the conductor) had no time to give him a transfer.

The supreme judicial court of Massachusetts holds that the rule that a passenger changing from one line to the other should produce a transfer, or pay his fare on the line to which he changed, was a reasonable rule. The conductor had no right to waive or disregard it, and the plaintiff not having paid his fare on the Water street line, or produced a transfer from the Main street line, the conductor of the Water street car was acting within his rights, and in the performance of his duty, in attempting to eject the plaintiff from the car, and was not guilty of an assault in taking hold of the plaintiff's arm for that purpose. It was immaterial whether the conductor of the Water street car heard what was said to him by the conductor of the Main street car or not. If he did hear it, it was said to him by a conductor whose right to disregard the rules was, so far as appeared, no greater than his own; and it gave the conductor of the Water street car no right to carry the plaintiff without the production of a transfer, or the payment, in default thereof, of a fare.

Furthermore, the plaintiff knew that the rules of the road required the production of a transfer or the payment of a fare, and it was an evasion of fare, within the meaning of the statute, to ride without producing a transfer, or paying the fare required in default thereof.

CONSENT OF BISHOP NOT HOLDING LEGAL TITLE INVALID—VALIDITY OF CONSENT OF BENEFICIARY UNDER A TRUST AND RIGHT TO REFUSE SECOND HEARING TO OBJECTORS TO CONSENTS LEFT IN DOUBT.

Shepard vs. Mayor, etc., of City of East Orange (N. J.), 57 Atl. Rep. 441. Feb. 29, 1904.

Upon the application of a trolley company to the city of East Orange for permission to construct, maintain, and operate a street railway on Central avenue in said city, various consents of the owners of property abutting on the avenue were duly presented to the city authorities, pursuant to the provisions of the street railroad act of April 26, 1896. One of the consents was given by John J. O'Connor, bishop of Newark, as owner, or representing the ownership of the Cemetery of the Holy Sepulchre, which had a frontage of 969 feet upon the avenue. If that consent was invalid, there were not consents of the owners of a sufficient number of lineal feet of frontage to give jurisdiction to the city to grant such permission. The cemetery land had been conveyed in 1865 to Bishop Bailey, Roman Catholic bishop of the diocese of Newark, by a deed conveying title in fee simple, with no express declaration of trust, and thereafter it had been conveyed by various conveyances of like character until one was made to Winand Michael Wigger, bishop of that diocese. By his will it was devised to three prelates of that church as joint tenants, and the title thereto was in them at the time of Bishop O'Connor's consent.

Assuming (without deciding) that the evidence was competent to establish and did establish that this land thus conveyed to the ecclesiastical authorities of that church was held upon a trust for the Roman Catholics of the diocese, the court of errors and appeals of New Jersey holds that, at the time of the execution of the consent, Bishop O'Connor, having acquired no legal title to the land, was not a "trustee holding the legal title," nor was he the owner of the land as cestui que trust (the beneficiary under a trust) or otherwise, within the provisions of the act in question, and so his consent was invalid.

Whether a cestui que trust, in possession of land the legal title to which is in a trustee, can give a valid consent under the act, the court leaves as an unsettled question. Likewise, whether municipal authorities may refuse to hear persons desiring to object to the sufficiency of such consents to justify action after all the consents are presented because such persons have been previously heard in opposition to the action, is left a doubtful point.

NO LIABILITY FOR INJURY BY EMPTY REEL LEFT BY SIDE OF ROAD AND ROLLED DOWN THE STREET BY BOYS.

Glassey vs. Worcester Consolidated Street Railway Co. (Mass.), 70 N. E. Rep. 199. Mar. 31, 1904.

A large reel which had had feed wire upon it, and which had been left lying on its side either just outside of the limits of the highway or within the limits of the highway, though outside of the traveled portion thereof, was rolled down the street by some boys, and struck a carriage, injuring a woman who was in the carriage. Then, there was introduced in evidence a by-law of the town forbidding persons to leave obstructions of any kind in the highway without a written license from the road commissioners or other board having charge of the streets, and it was contended that, if the reel was left within the location of the highway, when forbidden by the by-law, that of itself constituted such negligence as rendered the street railway company liable. But, assuming that the reel was left within the limits of the highway, the supreme judicial court of Massachusetts thinks that the most that could be said of this contention, was that the leaving of the reel within the limits of the highway was evidence of negligence, not that in and of itself it ren-

dered the company liable, or should be held, as matter of law, to have contributed directly to the accident.

The question was whether, in leaving the reel lying on its side in the grass, near the road, the company ought reasonably to have anticipated that children passing along the street on their way to school or for other purposes, would take it from the place where it had been left, and engage in rolling it up and down the street, and that travelers on the highway would thereby be injured. The question was not whether a high degree of caution ought to have led the company to anticipate that such a thing might possibly occur, but whether it ought reasonably to have been expected to happen in the ordinary course of events. In the former case the company would not be liable, and in the latter it might be held liable, notwithstanding an active human agency had intervened between the original wrongful act and the injury. But assuming that the reel was left in the highway, and that that was some evidence of negligence, the court thinks that such negligence was the remote, and not the direct and proximate, cause of the woman's injury.

In other words, in order to render the company liable, it must appear not only that it should have been anticipated that, in the ordinary course of events, school children would take the reel from the position where it had been securely left, outside the traveled part of the road, but that they would set it in motion on the highway under such circumsances that it was liable to injure a traveler thereon. It seems to the court that, conceding that there was evidence of negligence on the part of the company in leaving the reel where its servants did, they could not be required to anticipate that this would happen in the ordinary course of events, and therefore that such negligence was too remote.

DUTY TO PREVENT CHILDREN GOING INTO PLACES OF DANGER ON CARS—LIABILITY FOR INJURY TO BOY PERMITTED TO RIDE ON FRONT PLATFORM JUMPING OFF MOVING CAR—NO CONTRIBUTORY NEGLIGENCE—ORDINANCE PROHIBITING JUMPING OFF MOVING CARS NOT ADMISSIBLE IN EVIDENCE.

Denison & Sherman Railway Co. vs. Carter (Tex. Civ. App.), 79 S. W. Rep. 320. Feb. 6, 1904. Rehearing denied Mar. 5, 1904.

There was testimony in this case that some boys got on a car with the permission of the motorman, who also acted as conductor, and were permitted to ride for having turned the trolley pole. One of them, a boy 10 years and 1 month old, who got on the front platform, was injured in jumping off while the car was in motion. The court of civil appeals of Texas says that the company owed the boy, a child of tender years and immature judgment, the duty to exercise ordinary care to prevent him from going into a place of danger upon its car. The verdict included a finding that the boy, by reason of his age and want of intelligence, was not capable of appreciating the danger of riding upon the front platform, and that the motorman permitted him to ride thereon, and that this was a dangerous place for a child of his age to ride, and thus afforded the opportunity for the latter's subsequent act; and that the act of the child in jumping from the front platform was such as the motorman might and could have anticipated. These facts being established, the company must be held liable for the injuries resulting to the boy therefrom.

Again, the court says that it was the act of the motorman in permitting the boy to get upon and ride on the front platform, a place of danger, concurring with the act of the boy in jumping therefrom while the car was in motion, that caused the injury. The boy, by reason of his age and consequent lack of discretion to appreciate the danger, could not be held guilty of contributory negligence in jumping from the car. The act of the motorman in permitting the boy to get on the car and ride in a place of danger induced or afforded the opportunity for the subsequent act of the boy to jump from the moving car, and must be held the proximate cause of the injury. The jury found that the boy, by reason of his age, did not possess sufficient intelligence and discretion to appreciate the danger of jumping from the front platform while the car was in motion, and that the motorman was guilty of negligence in permitting him to get upon the car and ride in a place of danger. These issues being established, the voluntary act of the boy in leaving the car was not an intervening cause.

With reference to the contention that a person who is injured by jumping from a moving street car in violation of a valid ordinance of the city is guilty of such contributory negligence as will preclude his recovery for any injury caused thereby, the court says that it may be stated, generally, that the mere fact that the plaintiff at the time of the injury is engaged in the commission of an unlawful act is not sufficient to relieve the author of the wrong of liability in damages therefor. In this case it was not shown that the boy was capable of forming a criminal intent. It was shown that he was of such tender years and so lacking in discretion that he did not realize the danger of dismounting from a moving car. There was no error in excluding from evidence an ordinance making it a misdemeanor to jump off a moving street car. Clearly the evidence had no application to the facts as presented in this case.

POWER HOUSE MACHINERY TAXABLE AS REAL ESTATE UNDER ORDINANCE PROVIDING FOR PERCENTAGE PAYMENTS AND TAX ON LANDS AND BUILDINGS ONLY.

Detroit United Railway vs. Board of State Tax Commissioners (Mich.), 98 N. W. Rep. 997. Mar 23, 1904.

The ordinance under which the railway is operating provides for the payment to the city of Detroit of a percentage upon its gross earnings and also for the payment to the city of "such taxes for municipal purposes as have been up to this date and shall be hereafter levied or assessed upon the lots and parcels of land and buildings thereon which are the property of the said railway," the above mentioned percentage payments and tax on lands to be paid by the railway and received by the city in lieu of and in discharge of all taxes, license fees and charges of any kind against the property, capital stock, rights and franchises of the company. The general tax law in force when the ordinance was adopted, and in force now, provides that, "for the purpose of taxation, real property shall include all lands within the state and all buildings and fixtures thereon and appurtenances thereto, except in cases otherwise expressly provided by law."

It was insisted that an increase in the assessed valuation of the real estate of the railway objected to was brought about by adding thereto machinery which was personal property, and not properly taxable as real estate. It was contended that the boilers used in the generation of steam, the engines used to drive the dynamos, the dynamos used to generate electricity, the batteries used for storing it, the boosters, the switchboards, and other machinery, were none of them real estate. But, without going into details, the supreme court of Michigan says it is satisfied that, as to the most of this machinery, it was properly assessable as real estate.

At the time the ordinance was granted, the court says, the motive power employed for running the cars was horses. The fixtures attached to the barns and other buildings owned by the company would be of little value. There is nothing in the ordinance, when viewed in the light of the surrounding circumstances which existed when it was passed, indicating the city and the company expected that fixtures attached to the buildings owned by the company would be exempt from taxation. Again, it was suggested that, when this machinery was put in, it was expected that in time it would be supplanted by improved machinery, and provisions were made to make it practicable to remove it, and for that reason it was not to be regarded as real estate. But the court does not see how this differed in principle from the expectation that any manufacturer has to replace his machinery when it has outworn its usefulness, either because it is worn out, or because of improvements made, making new machinery indispensable if he is to compete with manufacturers who do use the improved machinery.

J. P. Hornaday & Co., No. 1108 Traction Building, Cincinnati, Ohio, have as fiscal agents agreed to underwrite one-half of the securities of the Shreveport & Northeastern Ry. extending from Shreveport through Minden, connecting with the Louisiana Northwestern Ry. and several other railway systems in western Louisiana. Construction work will proceed as soon as preliminary arrangements are completed. The road will be, as now laid out, 42 miles in length, and will have first class equipment and terminal facilities at Shreveport. The road traverses a splendid territory, and will originate a large amount of freight.

Financial.

The United Traction Co., of Albany, N. Y., reported a surplus for the quarter ending June 30, 1904, of $114,166, an increase of $75,030.

The Steubenville (O.) Traction & Light Co. reported gross railway earnings for the year ending April 30, 1904, of $70,097, an increase of $7,360.

The Cedar Rapids & Marion City Railway Co., of Cedar Rapids, Ia., reported for 1903 as follows: Gross earnings, $33,265; operating expenses, $17,302; net earnings, $15,962.

The Interurban Railway Co., Des Moines, Ia., reported gross earnings for 1903 of $68,539; operating expenses, $35,361; net earnings, $33,278.

The gross earnings of the Mason City & Clear Lake Traction Co., Mason City, Ia., for 1903 amounted to $44,996; operating expenses, $30,528; net earnings, $10,468.

The Waterloo (Ia.) & Cedar Falls Rapid Transit Co's. gross receipts for 1903 amounted to $85,545; operating expenses, $49,430; net earnings, $36,114.

The gross earnings of the Lake Shore Electric Railway Co., of Cleveland, O., for May amounted to $53,800; operating expenses, $34,723; net earnings, $19,077. This is a gain of 20 per cent over April and a slight gain over May, 1903.

The Cleveland, Painesville & Eastern Railroad Co. reported gross earnings for May of $19,052; operating expenses, $10,597; net earnings, $8,455; fixed charges, $6,738; surplus, $1,716.

The New York & Long Island Traction Co. reported for May as follows: Gross earnings, $6,784; operating expenses, $4,308; net earnings, $2,476.

The gross earnings of the Cleveland & Southwestern Traction Co. for the period from January 1st to July 1st amounted to $204,753, as compared with $196,846 for the corresponding period last year. In June, 1904, the gross passenger receipts amounted to $44,132, an increase of $3,590 over June, 1903.

The Muncie, Hartford & Fort Wayne Railway Co. reported gross earnings for May of $15,505, an increase of nearly $5,000; operating expenses, $6,907; net earnings, $8,598. January 1st to June 1st: Gross earnings, $64,813; operating expenses, $35,310; net earnings, $29,503.

OAKLAND TRANSIT CO.

Following is the comparative statement of the Oakland (Cal.) Transit Co. for May:

	1903.	1904.	Increase.
Gross earnings	$105,370	$113,897	$8,527
Operating expenses	49,539	53,420	3,881
Net earnings	55,841	60,477	4,636

CHICAGO ELECTRIC TRACTION CO.

The comparative statement of the Chicago Electric Traction Co. for the quarter ending March 31st follows:

	1903.	1904.	Decrease.
Gross earnings	$22,561	$21,741	$ 820
Operating expenses	24,816	23,077	1,739
Deficit	2,254	1,335	919

LONDON STREET RAILWAY CO.

The comparative statement of the London (Ont.) Street Railway Co. for May is as follows:

	1903.	1904.	Increase.
Gross earnings	$13,144	$14,454	$1,309
Operating expenses	9,243	9,920	676
Net earnings	3,901	4,533	632
Fixed charges	1,930	2,162	232
Surplus	1,971	2,371	400

NORTHERN OHIO TRACTION & LIGHT.

The comparative statement of the Northern Ohio Traction & Light Co. for May follows:

	1903.	1904.	Increase.
Gross receipts	$74,258	$74,917	$ 659
Operating expenses	40,231	39,614	* 617
Net earnings	34,027	35,303	1,276
Fixed charges	22,427	22,467	40
Net income	11,600	12,836	1,236

*Decrease.

TOLEDO RAILWAYS & LIGHT CO.

Following is the comparative statement for May of the receipts and operating expenses of the Toledo (O.) Railways & Light Co.:

	1903.	1904.	Increase.
Receipts	$135,416	$142,581	$7,165
Operating expenses	70,726	78,864	8,138
Net earnings	64,690	63,717	* 973
Deductions	40,837	41,863	1,026
Net income	23,853	21,854	*1,999
Operating ratio	.5223	.5531	.0308

*Decrease.

INTERNATIONAL TRACTION CO. SYSTEM.

Following is the comparative statement of the International Traction Co., Buffalo, N. Y., for May:

	1903.	1904.	Increase.
Gross earnings	$327,126	$335,691	$8,565
Operating expenses (ex. taxes)	174,458	207,325	32,867
Net earnings	152,669	128,366	*24,303
Fixed charges (int., taxes, etc.)	131,698	132,532	835
Net income	20,971	**4,167	*25,138
Net income July 1st to date	157,208	52,331	*104,877
Operating ratio (ex. taxes)	.542	.625	.083

*Decrease. **Deficit.

AUBURN & SYRACUSE ELECTRIC R. R.

The Auburn & Syracuse (N. Y.) Electric Railroad Co. reported, for the quarter ending Mar. 31, 1904, as follows:

		Increase.
Gross earnings	$37,905	$14,640
Operating expenses	34,204	19,813
Net earnings	3,701	*5,173
Other income	455	292
Total income	4,156	*4,881
Fixed charges	15,082	5,855
Deficit	10,926	10,736

*Decrease.

CHICAGO UNION TRACTION CO.

The income accounts of the West and North Chicago systems of the Union Traction Co. for May follow:

	West Chicago.	North Chicago.
Gross earnings	$481,486	$274,707
Operating expenses	344,244	199,177
Net earnings	137,241	75,530
Other income	4,448	1,551
Total income	141,689	77,081
Tax, interest, rent	115,158	61,007
Surplus	26,531	16,074
Consolidated Traction deficit	16,567	9,420
Depreciation	57,057	28,470
Deficit	47,093	21,816
Operating ratio	.7191	.7332

TWIN CITY RAPID TRANSIT CO.

The Twin City Rapid Transit Co., Minneapolis, Minn., reported for May as follows:

		Increase.
Gross earnings	$363,645	$23,910
Operating expenses	170,772	11,444

Net earnings	[illegible]	[illegible]
Charges and pref. div.	[illegible]	[illegible]
Surplus	[illegible]	[illegible]
From January 1st:		
Gross earnings	[illegible]	[illegible]
Operating expenses	[illegible]	[illegible]
Net earnings	[illegible]	[illegible]
Charges and pref. div.	[illegible]	[illegible]
Surplus	[illegible]	[illegible]

NORTHERN TEXAS TRACTION CO.

Following is the comparative statement of the Northern Texas Traction Co. for May:

	1903	1904	Increase.
Gross earnings	$38,278	$50,737	$12,459
Gross expenses	22,982	25,116	2,134
Net earnings	15,296	25,620	10,324
Fixed charges	9,118	12,194	3,076
Net profit	6,178	13,426	7,248
For five months:			
Gross earnings	$166,050	$211,722	$45,672
Operating expenses	93,137	121,945	28,808
Net earnings	72,914	89,777	16,863
Fixed charges	45,107	50,519	5,412
Net profit	27,807	39,258	11,451

ELGIN, AURORA & SOUTHERN TRACTION CO.

Comparative earnings of the Elgin, Aurora & Southern Traction Co. for May are as follows:

	1903	1904	Increase
Gross receipts	$39,148	$38,101	*$1,047
Operating expenses	21,794	23,171	1,377
Net earnings	17,354	14,930	* 2,424
Deductions	9,453	9,451	* 2
Net income	7,900	5,479	* 2,421
For 11 months:			
Gross receipts	$392,422	$416,156	$23,734
Operating expenses	227,888	252,760	24,872
Net earnings	164,533	163,396	* 1,137
Deductions	100,616	101,225	609
Net income	63,917	62,171	1,746

*Decrease.

SYRACUSE RAPID TRANSIT RAILWAY CO.

Following is the statement of the Syracuse (N. Y.) Rapid Transit Railway Co. for May:

Gross earnings	$71,073
Operating expenses	42,817
Net earnings	28,254
Miscellaneous earnings	604
Total net earnings	28,858
Fixed charges	20,243
Surplus	8,816

Following is the comparative statement for 11 months:

	1902-3	1903-4.	Increase
Gross earnings	$662,995	$762,958	$99,963
Operating expenses	383,950	446,618	62,668
Net earnings	299,043	314,340	15,297
Miscellaneous earnings	4,640	4,331	* 309
Total net earnings	303,683	318,671	14,988
Fixed charges	210,685	223,218	12,533
Surplus	92,998	95,453	2,455
Operating ratio	.56	.588	.028

*Decrease.

NEW YORK CITY RAILWAY CO.

The New York City Railway Co. and the Third Avenue Railroad Co. reported for the quarter ending March 31st as follows:

NEW YORK CITY RAILWAY CO.

	1903.	1904.	Changes.	
Gross earnings	$3,573,469	$3,262,844	Dec.	$310,625
Operating expenses	1,835,804	2,052,466	Inc.	216,662
Net earnings	1,737,665	1,210,378	Dec.	527,287
Other income	151,335	190,615	Inc.	39,280
Total earnings	1,889,000	1,400,993	Dec.	488,007

THIRD AVENUE R. R.

Gross earnings	$511,530	$475,092	Dec.	$36,438
Operating expenses	346,990	224,033	Dec.	122,957
Net earnings	164,540	251,059	Inc.	86,519
Other income	128,755	200,188	Inc.	71,433
Total earnings	293,295	451,247	Inc.	157,952

MONTREAL STREET RAILWAY CO.

Following is the comparative statement of the Montreal Street Railway Co. for May:

	1903	1904	Increase.
Passenger earnings	$170,777	$217,341	$46,564
Miscellaneous earnings	2,209	2,813	604
Total earnings	172,987	220,154	47,168
Operating expenses	112,141	126,642	14,501
Net earnings	60,846	93,513	32,666
Fixed charges	20,614	22,641	2,028
Surplus	40,232	70,871	30,639
Operating ratio	.6566	.5827	.0739
For eight months:			
Passenger earnings	$1,341,071	$1,515,507	$174,436
Miscellaneous earnings	21,493	13,800	* 7,693
Total earnings	1,362,564	1,529,307	166,743
Operating expenses	872,072	1,018,348	146,276
Net earnings	490,492	510,959	20,467
Fixed charges	140,470	149,076	8,606
Surplus	350,022	361,883	11,861
Operating ratio	.6503	.6720	.0217

*Decrease. Interest on Montreal Park & Island Railway Co's. bonds owned by this company not included.

CHICAGO & MILWAUKEE ELECTRIC.

Following is the earnings statement of the Chicago & Milwaukee Electric Railroad Co. for June:

	1903.	1904.	Increase.
Gross earnings	$22,483	$40,838	$18,355
Operating expenses	7,743	15,136	7,394
Net earnings	14,740	25,702	10,962
For six months:			
Gross earnings	$93,721	$163,250	$69,530
Operating expenses	39,847	72,587	32,740
Net earnings	53,874	90,663	36,789

Westinghouse Moving Picture Display.

The different Westinghouse companies in the Pittsburg district, which have united with the other Westinghouse interests in the United States and Europe in representation at the World's Fair, under the title of the Westinghouse Companies at the Louisiana Purchase Exposition, recently gave a display at Carnegie Hall, Pittsburg, of "moving pictures" of scenes in and about the Westinghouse works. The pictures were taken for exhibition at St. Louis in the private Westinghouse auditorium on the Fair Grounds and are interesting, not only as one evidence of the active preparations which were made for entertaining visitors to the World's Fair, but as a revelation of an important use of the Cooper-Hewitt mercury vapor lamps in connection with interior photography. The pictures shown include also panoramic scenes and stations along the route of the Pennsylvania R. R., and views of the Westinghouse works at Swissvale, East Pittsburg, Wilmerding and Trafford City. One film six minutes long shows the procession of employes from one of the large doors of the works of the Westinghouse Electric & Manufacturing Co., about one-half of the 8,000 employes being shown. Another picture shows the departure of one of the special Westinghouse trains from the East Pittsburg station. Four striking pictures are those taken in the forges at East Pittsburg and Wilmerding. There are more than 1,000 distinct likenesses of different persons shown in the pictures.

During the recent visit of the Institute of Mechanical Engineers of Great Britain to this country the visitors were guests of the Allis-Chalmers Co., at its Milwaukee plants. President Wicksteed, of the Institution, and others with him said that in the way of industrial sights they had never seen anything more impressive than the huge erecting shop of the Allis-Chalmers Co.

Personal.

DR. SCHUYLER SKAATS WHEELER, president of Crocker-Wheeler Co., sailed July 13th with Mrs. Wheeler, on the White Star liner "Baltic."

MR. POWELL EVANS was recently elected president of the Schuylkill Traction Co., Girardsville, Pa., to succeed Mr. Clarke Merchant, deceased.

MR. A. H. HAYWARD, until recently general manager of the Lehigh Valley Traction Co., Allentown, Pa., has been appointed superintendent of the City Railway Co., Dayton, O.

MR. WALTER H. WHITESIDE has been appointed general manager of sales for all departments of the Allis-Chalmers Co., including the Bullock Electric Manufacturing Co. Mr. Whiteside has recently been manager of the detail and supply department of the Westinghouse company and at the same time manager of the Sawyer-Man Electric Co., of New York. His first business connection was with the Hercules Powder Co. in 1881, when he introduced this company's high explosives into the Lake Superior and other mining districts. Four years later he became associated with the Cleveland Electrical Manufacturing Co., where he remained nearly 12 years, being for the greater part of this time manager of the company's Chicago office. In 1896 Mr. Whiteside was appointed manager of engine sales for the Gates Iron Works, of Chicago, and in 1898 he became manager of the Washington office of the Westinghouse Electric & Manufacturing Co. In that position his engineering work in the installation of electric power in the dry-docks of the navy department was widely recognized, and to him was largely due the credit for effecting the change in the standard from 80 to 125 volts in the electric lighting and power installations on the vessels of the United States Navy. Mr. Whiteside will enter upon his new duties about the middle of July, and takes with him the best wishes of a wide circle of business acquaintances.

W. H. WHITESIDE

THE GALVESTON CITY RAILWAY CO. recently changed hands and the following new officers have been elected: President, B. Adoue; vice-president, J. H. Langbehn; general manager, H. S. Cooper.

MR. C. N. DUFFY, secretary of the Chicago City Railway Co., was on Wednesday, July 6th, married to Miss Clara Cunningham. Mr. and Mrs. Duffy will be at home after September 1st at the Hotel Del Prado, Chicago.

MR. B. M. LATHROP has been appointed superintendent of the Colorado Springs & Interurban Railway Co., vice Mr. D. L. Macaffree, resigned. Mr. Lathrop had acted as assistant superintendent of the company for some time.

MR. GEORGE A. YUILLE, of the Chicago Engineering & Constructing Co., has been retained to advise the city of Chicago as to a universal system of street car transfers that will serve as a basis for the city in its franchise negotiations with the street railway companies.

MR. FRANK G. BOLLES, who was for many years associated with the Bullock Electric Co., and recently connected with Cassier's Magazine, has opened an office at 26 Cortlandt St., New York City, where he will conduct an export business, giving especial attention to electrical and steam machinery.

PROF. GARDNER S. WILLIAMS, M. Am. Soc. C. E., and professor of experimental hydraulics in charge of the hydraulic laboratory of Cornell University, has been appointed to the chair in Engineering at the University of Michigan, made vacant last fall by the death of Prof. Charles E. Greene.

MR. A. L. WATERBURY, who was at one time first vice-president and general manager of the Citizens Telephone Co., of Houston, Tex., has been appointed general manager of the sales department of the American Conduit Co. Mr. Waterbury will have his headquarters at the Chicago office of the company, No. [illegible] Manhattan Building.

MR. D. L. MACAFFREE resigned July 1st as superintendent of the Colorado Springs & Interurban Railway Co. Prior to 1901, when he became general superintendent of the Colorado Springs street car system, he was connected with the Denver Tramway Co. several years in the operating department.

MR. D. H. LAVENBERG has been appointed general manager of the Toledo & Indiana Railway Co., vice Mr. H. C. Warren, resigned. Mr. Lavenberg was for two years chief dispatcher of the Toledo, Fremont & Norwalk Railroad Co., and for the past two years has been superintendent of the Dallas division of the Northern Texas Traction Co.

MR. JOSEPH M'MILLAN has been appointed traffic manager of the Pacific Electric Railway Co. and the Los Angeles Interurban Railway Co. He was formerly passenger agent for the Southern Pacific railroad in Texas, with headquarters at San Antonio. He was connected with the Southern Pacific 20 years, and has been with the Pacific Electric Ry. since April, 1903.

MR. LOUIS TERVEN, E. E., has been appointed chief electrician of the Nernst Lamp Co., Pittsburg, Pa. Mr. Terven was for some time electrician of the United States Navy Yard, Port Royal, S. C., which position he resigned to enter the experimental laboratory of the Nernst Lamp Co. Later he was given charge of the chemical engineering department of this company.

MM. KOHLER AND A. ZIFFER have been unanimously elected vice-presidents of the International Tramway Union, to succeed M. Rohl, deceased. Both of these gentlemen have been prominently identified with the work of the International Union, and their prominence in the electric railway fields of their respective countries makes their selection as officers of the association highly acceptable to the membership.

MR. A. M. MATTICE, chief engineer of the Allis-Chalmers Co., has returned from his European tour of inspection and taken up the duties of his position in Milwaukee. While in Europe Mr. Mattice visited the hydraulic machinery works of Escher Wyss & Co., of Zurich, and arranged important details concerning the manufacture in the United States of their lines of product. He also inspected the Nurnberg gas engine works, at Nurnberg, and, at the well-known engineering establishment of Willans & Robinson, at Rugby, England, he paid particular attention to the products and methods of manufacture of the Steam Turbine Advisory Syndicate, of which organization Allis-Chalmers Co. is the American member. Mr. Mattice had several important consultations in London with Mr. Yarrow, the famous torpedo boat builder, on the subject of turbines for marine purposes, and while on the Continent he made, in the Allis-Chalmers interest, a series of exhaustive tests of the Zoelly steam turbine, of which so much has recently been heard. The results of Mr. Mattice's European visit of inspection will be awaited with a good deal of interest by American engineers.

MR. H. S. COOPER, who was recently appointed general manager of the Galveston City Railway Co., has enjoyed a long and successful career as a street railway man and has held many positions of trust. He will be agreeably remembered by readers of the "Review" as a contributor of numerous able, practical articles on street railway economics. He is particularly well qualified for the position which he now holds, and Galveston is to be considered fortunate in having Mr. Cooper to manage her street railway system. Mr. Cooper was born in Isle of Wight, England, in 1856. In this country his first business connection was with a mercantile house in Philadelphia, and in 1876 he became a manufacturer of agricultural machinery in the South. This brought him in touch with the electrical industry, and having shown a special fitness for reorganization and placing unstable properties on a paying basis, he was requested to take charge as general manager of the Schenectady (N. Y.) properties of the Electrical Development Co., for which a receiver had been appointed. Under Mr. Cooper's management the properties were made to pay handsomely and he next rehabilitated the property of the Ithaca (N. Y.) Railway Co., with equal success. Mr. Cooper has lately been connected with the general engineering business conducted by the Development Co., of New York.

The name of the Evansville & Princeton (Ind.) Traction Co. has been changed to the Evansville, Princeton & Indianapolis Traction Co. Extensions will be built to New Harmony, Petersburg, Hazleton and Vincennes.

Tower Wagon for Huddersfield.

The accompanying illustration shows a motor driven tower wagon recently supplied to the Huddersfield Corporation Tramways, which was built by J. R. McCardell & Co., of Trenton, N. J. The frame on which the superstructure, tower, etc., are built is made of channel steel and mounted on artillery wheels. The wagon is capable of running at a speed of 12 miles per hour on a level with a load of 1½ tons, and from 5 to 7 miles per hour on a gradient of 1 in 12 with the same load. The engine, which is a 20-h. p. petrol motor, is mounted on the steel underframing. The superstructure consists of a telescopic tower capable of being raised to a height of 12 ft. 6 in. above the steel framing. It is in two sections, the upper one sliding inside the lower. It is constructed of ash, reinforced by iron knees and tie rods. The lower section is braced by four iron guys at the corners, which are fitted with turn buckles to take up the slack. The movable upper section is similar to the lower, but somewhat lighter and is raised and lowered within the lower part by means of a steel cable running over a winding drum. The drum is geared so that the tower is easily raised and lowered by one man by means of a crank. In lowering the tower it runs down by its own weight and is controlled by means of a hand brake on a drum. The upper platform revolves through a complete circle, permitting work to be done on the overhead wires without impeding the car traffic. This platform may be fixed in any desired position, and will carry two men at its outer end without undue deflection. The driver's seat accommodates three men and there are seats for four men behind and room for two more standing. The seats also serve the purpose of lockers for tools and supplies.

HUDDERSFIELD TOWER WAGON.

The total weight of the machine is 4,900 lb. without tools or passengers, and the McCardell company is sending a great many of these wagons abroad, both with and without running gears.

New Lines and Extensions Opened.

June 21st that part of the Fort Wayne, Van Wert & Lima Traction Co's. system which is located in Lima, O., was opened to traffic.

June 20th, the first car was run over the Delaware & Magnetic Springs Railway Co's. system, this being the first electric line to open in Union County, Ohio.

The Central Pennsylvania Traction Co. opened its new Linglestown line June 21st, with an excursion from Harrisburg to Linglestown and a banquet at the latter place.

The Media extension of the Media, Middletown, Ashton & Chester Electric Railway Co. was opened July 4th.

The new Ballston line of the Schenectady Railway Co. was opened to traffic June 27th.

The Indianapolis & Northwestern Traction Co. operated its first cars into Crawfordsville July 1st.

The Central Passenger Railway Co., of Atlantic City, N. J., operated its first car over its short line to the beach July 4th.

Regular service was inaugurated on the Green Bay Traction Co's. system, from Green Bay to De Pere, Wis., July 3d.

The Sheffield Co. opened the electric line which connects Sheffield, Florence and Tuscumbria, Ala., last month. This is the first electric road in Colburt County.

By the completion of a bridge across the Iowa River at Iowa City, the Cedar Rapids & Iowa City Railway & Light Co. was enabled to open its interurban line June 28th.

Accidents.

June 23d a Lima (O.) Electric Railway & Light Co. car was struck by a Western Ohio Railway Co. car at Lima, causing the death of a child passanger and, it was thought, the probably fatal injury of three other persons. Several other passengers were less seriously hurt.

June 24th 13 persons were injured, three very seriously, in an accident at 13th St. and Columbia Ave., Philadelphia, caused by collision between a Willow Grove car and a city open car.

July 1st a collision occurred between a local car and an interurban car on the Jackson & Battle Creek Traction Co's. line at the Bear Creek crossing, 1½ miles west of Marshall, Mich. Nine persons were injured, including the president of the road, Gen. C. M. Spitzer, of Toledo.

July 6th there was a collision between cars of the Brighton Heights line of the Richmond Light & Railroad Co., Staten Island, N. Y., and eight persons were seriously injured.

July 8th an open switch at Hunter's, on the Dayton & Western Traction Co's. line caused a head-on collision between a passenger car and a freight car. It was thought that the motorman of the freight car was fatally injured. Three of the passengers were seriously hurt.

Brooklyn Road Terminates Lease.

June 30th, the end of the fiscal year, the lease of the Nassau Electric Railroad Co. to the Brooklyn Heights Railroad Co. was terminated. The lease of the Nassau lines to the Brooklyn Heights company was made April 1, 1900, for 999 years. A clause made the lease terminable at any time at the option of either company, and it is inferred that the action was taken with the intention of evading the effects of a recent decision of the Appellate Division of the Supreme Court, which declared that a railroad company must give a continuous passage over its lines and leased lines for a 5-cent fare. Recently, there has been a great deal of trouble over the charging of 10 cents to ride to Coney Island, and there were hundreds of suits filed because the company refused to give transfers from Brooklyn Heights cars to Nassau line cars.

The White Knob Copper Co., of Mackay, Idaho, operates an electric railway in connection with its mines, having seven miles of road, two electric locomotives and 40 ore cars. The difference in level in the seven miles is 2,100 ft., an average of 6 per cent. Eighty tons of ore are handled by each train. The electric railway department is in charge of Mr. E. E. Slaughter, manager.

The touring car service of the Cleveland Electric Railway Co., which is under the management of Mr. J. W. Butler, was opened for the season on July 1st. The company is distributing advertising blotters calling attention to its two-hour trolley trips in touring cars, which make five trips daily in charge of a competent guide, who calls out the points of interest en route. These cars leave the Public Square daily every two hours from 8 a. m. to 4 p. m., and the fare for the round trip is 25 cents.

Wrinkles.*

CIRCLE DIAGRAMS FOR KEEPING TRACK OF THE ECONOMICAL WORKING OF MEN AND APPARATUS.

BY R. GRIEVES, COLUMBUS, O.

Valuable information for a station manager to have clearly in mind is the arrangement of the different shifts of men in relation to the time of operating different machines and different kinds of apparatus, and it is only after a careful analysis that it will be possible for a manager to know accurately whether or not he is getting the maximum efficiency out of his employes by having their hours of working so arranged that each man is worked to his best ability at all times.

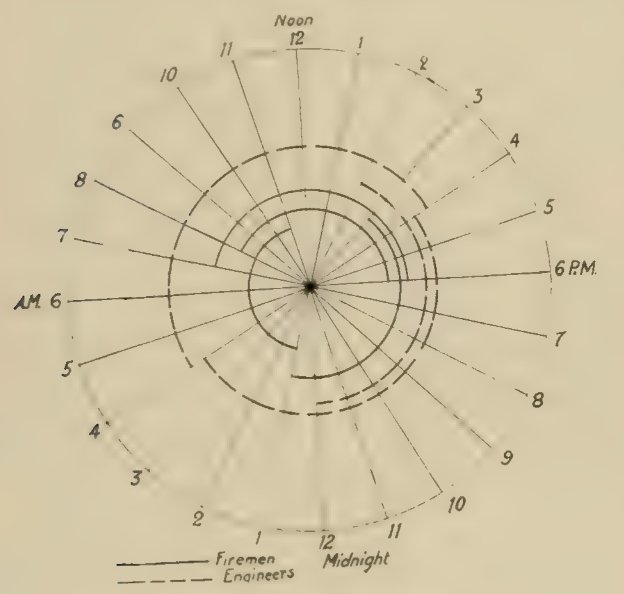


Chart A—Firemen and Engineers

In order that such information may be clearly presented, circle diagrams may be constructed, which will be found to give a comprehensive, graphical statement of the actual conditions that exist. In preparing such diagrams, faint concentric circles are drawn, the number of such circles depending upon the number of men or the number of machines, engines, boilers or generators under consideration, each man or each machine to be considered being given one circle. From the common center radial lines are drawn, 24 in number, representing 24 hours of the day. When several different classes of employes are to be considered, or when different kinds of apparatus or the time of operating different kinds of apparatus are to be shown on one diagram, different kinds of lines are made use of to distinguish one from the other.

Chart B—Engines

Referring to accompanying chart A, the solid lines represent firemen, and the broken lines represent the time of working of the different engineers. For instance, starting at 1 o'clock in the morning, it will be seen that one fireman is on duty from 1 a. m. until 11 a. m. At 8 a. m. another fireman starts to work, and is on duty until 6 p. m. Another fireman starts working at 3 o'clock in the afternoon, and ends his shift at 1 o'clock in the morning, while one coal passer, whose labor is charged to the boiler room as a generating cost, starts to work at 7 o'clock in the morning and works until 6 at night. In the same manner, we have one engineer coming on duty at 2 o'clock p. m. and working until midnight.

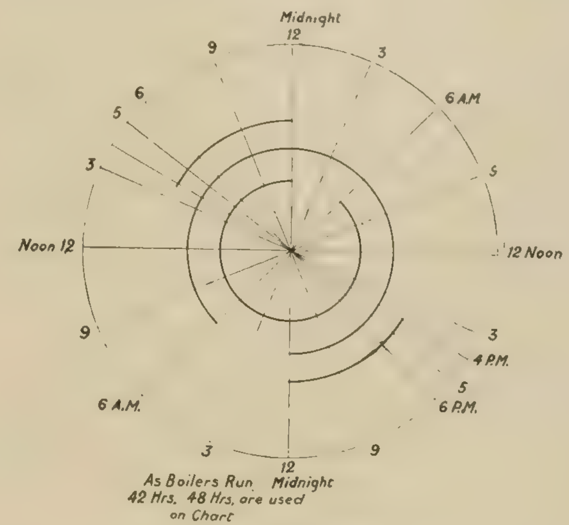


Chart D—Boilers

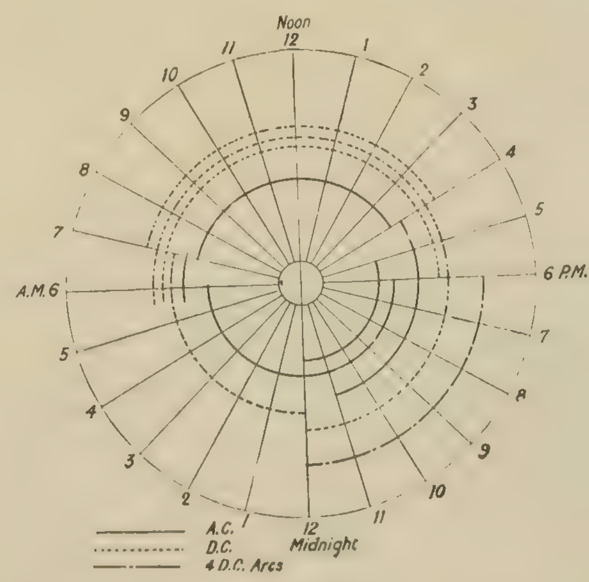


Chart C

Another works from 4 p. m. until 4 a. m., while a third works from 4 a. m. until 4 p. m.

Referring next to chart B, the time of operation of different engines in use is shown. In the station under consideration, the engines (four in number) are numbered consecutively from the center of the circle out. No. 1 engine starts at 5:30 a. m. and runs

*Edited by Charles H. Williams and read before the Boston Convention of the National Electric Light Association, May 24-27, 1904.

continuously until 1 o'clock the following morning; No. 2 runs from [illegible].45 a. m. until 7.30 a. m.; No. 3 from 5 p. m. to 12 midnight; No. 4 from 6.45 a. m. until 4 p. m.

Referring to chart C, we find the time of operating the individual generators; the solid lines representing alternating-current machines, the dotted lines the 500-volt direct-current machines and the dash-and-dot lines representing direct-current arc machines.

Referring to chart D, the time of operation of the three boilers is shown.

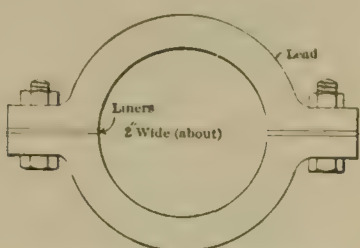
With the four charts before him, the station manager can see at a glance for any hour in the day the number of men who are on duty at the plant, also the number of boilers, engines or generators that are operating, and unless a careful analysis has been made of the work that is required of the different men, it will very frequently be shown that much greater responsibility and much more work is thrown upon one shift than upon another.

Of course, it is necessary in making the comparisons between the shifts to consider the output of the station at the hour under consideration, as well as the other work, such as cleaning and repairing, that is required of station men operating a small plant. This scheme also lends itself as a ready argument against increased help, which is sometimes unreasonably asked for, as it will show quite forcibly the duties required of the individual workman.

TRUING ENGINE PINS.

BY A. GARTLEY, HONOLULU, H. I.

In operating an engine the crank pins, cross-head pins and the pins in the valve gear have a tendency to wear flat, even with the



LAP FOR TRUING ENGINE PINS

best of care, and the difficulty of having a quietly running engine with cool pins can frequently be traced to this cause. Some engineers file their pins and smooth them up, but this requires a very skilled man and is a long and tedious operation. Re-turning the pins in place is difficult and has the disadvantage of materially reducing the size of the pin, as the tool must go under the hard skin to make a perfect cut.

We have adopted the practice of lapping pins that have become flattened. The process is simple, quick, and leaves a smooth and perfect pin.

The lap is of lead or of cast-iron faced with lead and is made in halves with liners, similar to an eccentric strap. The faces of the two halves should be fitted together nicely and the lap be bored to the size of the pin to be lapped, with the liners slotted so as to facilitate their removal without taking out the bolts. For a pin 6 in. long the lap should be 2 in. wide, and should be allowed to move from end to end of the pin. It is made narrow to avoid requiring too much power to work it. In operating the lap the lead is well supplied with emery and oil, clamped on the pin and rotated back and forth, at the same time being moved across the pin at each rotation, as holding continuously in one place has a tendency to make the pin wiry. We have lapped a 7-in. pin, 11 in. long, that was 1-32 in. out of round, fitted the brasses, and been running again in eight hours. This on a very hard nickel-steel pin. We believe this is as quick as the work could be done with a machine, and there was much less reduction in size than would have been possible had the pin been turned, filed or chipped. During the process, of course, the oil holes are carefully stopped and the emery carefully wiped off. We have found absolutely no bad effects in running after the use of emery powder.

SIGNAL DEVICE FOR CIRCUIT-BREAKERS OF SWITCHBOARDS.

BY G. WILBUR HUBLEY, LOUISVILLE, KY.

It has been found desirable that circuit-breakers on switchboards and elsewhere have some means of indicating promptly the instant that breaker "opens," in order that the attendant in charge may be notified and give same prompt attention. This is usually done by connection with a bell circuit.

A very reliable and trustworthy method has been found to be to make use of the current of the same circuit in which the circuit-breaker is installed for a signal-lamp and bell circuit. The necessary number of lamps are connected in series across the bus-bar circuit from which the current passing through the circuit-breaker is supplied. The current to operate a bell circuit is supplied from a shunt around one of the lamps in the signal circuit, or in shunt around a resistance placed in series with lamps of the signal circuit. The bell circuit is then wired in such manner that the opening of the circuit will close the signal circuit, and the bell will continue to ring until the circuit-breaker is closed again. The use of dynamo current in this manner can always be relied upon, and it eliminates unreliability and the troubles usually experienced where batteries are employed.

New Cars for Metropolitan Elevated, Chicago.

Up until the present the two railway companies operating over the inner track of the elevated loop in Chicago have had different systems of electrical control. The Metropolitan, the first of the elevated roads to be operated electrically, has had but a single motor car in each train. The South Side elevated, when it changed its motive power from steam to electricity, adopted the Sprague multiple unit control. The acceleration curves of these two systems are very different, the Metropolitan trains accelerating more slowly to a higher maximum speed, while the South Side trains accelerate rapidly to a lower maximum speed and can coast for a considerable distance before the brakes are applied. The consequence of alternating trains with these different methods of control is an interference resulting in a loss of time in making the loop circuit that is quite a serious matter. The time occupied in passing

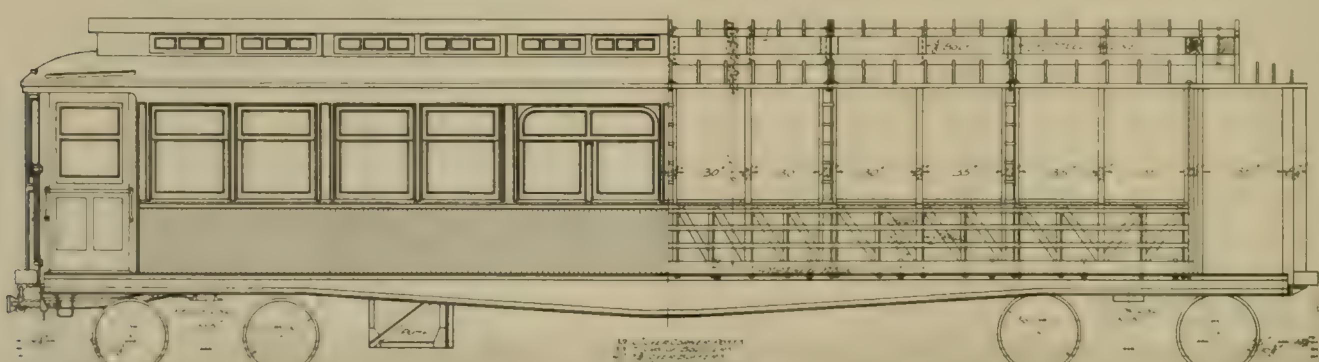


FIG. 1.

around the loop is about 14 minutes and a minute saved in this part of the trip means an increase of 7 per cent in the capacity of the road.

In order to save time on the loop and also to increase the average speed over the whole line, the Metropolitan company decided to adopt the Westinghouse electro-pneumatic system of multiple control. Inasmuch as it is necessary to overhaul and re-equip about 350 cars, it was decided to make such changes as would eliminate all danger from fires due to motor circuits or other electrical causes. In the old equipment this will be done by covering the entire bottom of the car with steel plate ⅛ in. in thickness and placing above this a ¼-in. layer of asbestos. Sixty-eight new motor cars have been ordered by the company and in these the same precaution will be taken, the steel plate, however, being part of the underframe. During the current month an experimental five-car train, having first and last cars equipped with motors, has been operated. This combination of cars, however, may not be adhered to, as the system permits of any combination of motor cars and trailers that may be desired.

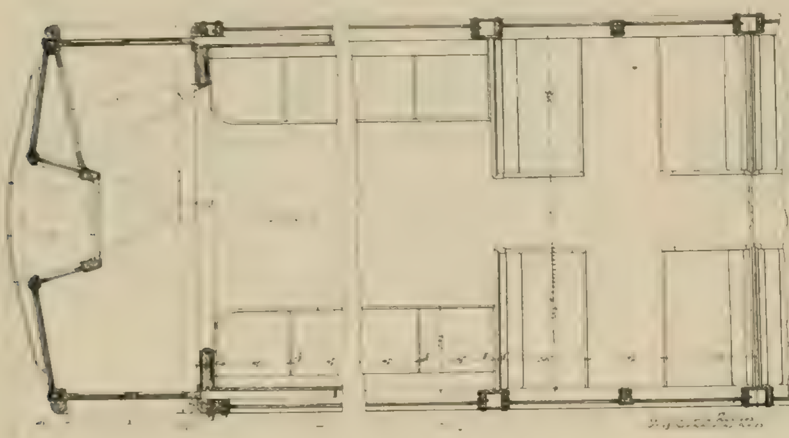


FIG. 2.

The Westinghouse electro-pneumatic control is of the automatic type, that is to say, it is so arranged that the rate of acceleration may be pre-determined and the controlling devices set for this rate, with the result that the motorman cannot change the predetermined rate of acceleration. The operating devices of this system, which are actuated by means of compresed air from the air brake system, operate the main switches in the motor circuit. The valves of the operating devices are provided with electro-magnets having a low tension circuit, 14 volts, obtained from storage batteries, which is entirely distinct from the motor circuit. The only high tension circuit, 600 volts, brought above the car floor are those for the lights and heaters. All the motor circuits except 14-volt control wiring are located beneath the steel covered underframe, which effectually obviates danger of fire from this source. The controlling devices are provided with interlocking switches, which are connected with the magnet valves, so that the closing of one switch energizes the magnet of the next succeeding one A limit switch is provided which cuts resistance out of the circuit at such a rate as to give uniform accelerating current, and this limit switch prevents the motorman from throwing on the power in excess of the pre-determined rate regardless of the speed with which he turn his controller handle.

The new cars, which we have previously mentioned, are now being built by the Jewett Car Co., of Newark, O., and the American Car & Foundry Co., after the designs of the Metropolitan company. The accompanying illustrations, for which we are indebted to Mr. H. M. Brinckerhoff, general manager of the Metropolitan Elevated, and to the Jewett Car Co., show some of the details of the body and under framing.

Fig. 1 is a side elevation of the car with part of the sheathing removed, giving a view of the body framing. The general dimensions of the car are: Length over corner posts, 39 ft.; distance between centers of bolsters, 33 ft. 7 in.; length over buffers, 47 ft. 3¾ in.; length over drawbars, 47 ft. 10½ in.; wheel base of motor trucks, 6 ft. 6 in.; wheel base of trailer trucks, 5 ft. 6 in.; width over corner posts, 8 ft. 7 in.

Fig. 2 shows a partial plan of this car which differs considerably from the conventional design. The usual number of cross seats are in the center of the car, and the rest of the seats are longitudinal. There are no doors at the ends of the seats, leaving the vestibule open into the body of the car and the arrangement of the vestibules, as will be seen, is entirely novel. In the center of the vestibule is a swinging door, which permits passage from car to car, and on either side of the vestibules are sliding doors which are operated by means of compressed air. This is an entirely new departure, for while cars have been built with devices to close the doors by compressed air, we believe these to be the first in which the doors will be both opened and closed by compressed air. On one side of the vestibule is shown the arrangement for motorman's cab. Two doors are arranged to swing inward and when they meet they form a partition, located as shown by the dotted lines. When used as a motor car this compartment serves for the motorman, and when used as a trailer these doors swing entirely out of the way, giving unimpeded access to the side of the vestibule. It is expected that this design of vestibule will be found entirely practicable and will greatly facilitate the loading and unloading of passengers. The curtains are of pantasote mounted on Hartshorn spring rollers and are equipped with Forsyth pinch handle fixtures. The drawbars are of the Van Dorn automatic type. The interior finish of the cars is of mahogany, ornamented with holly and rosewood inlay. The seats are of the Hale & Kilburn type of fireproof construction.

Fig. 3 shows a half plan and elevation of the under framing, which is entirely of steel. The side sills, which are continuous through the car body, are of plate girder construction, riveted, and, as shown on the plan, the entire surface of the underframe is covered with plates of 3-16-in. steel. The construction is stiffened by means of angle irons 2 x 2 in., which are riveted lengthways across the steel plates, and the space between the flooring and the

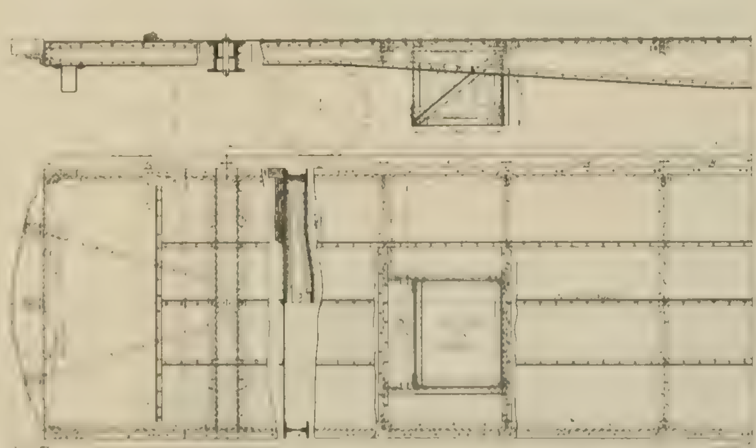


FIG. 3.

steel plates is filled with mineral wool. This is shown in the section taken through the bolster in Fig. 3. In addition to being fireproof, so far as danger from the high tension circuits is concerned, this underframe is believed to make the car absolutely safe in case of a collision.

The cars built by the Jewett company will have hot water heaters, the order for these having been divided between the Peter Smith Heater Co., of Detroit, and Porter & Berg, Chicago, agents for the Franklin Railway Supply Co., maker of the "Western" car heater. The other cars will have Gold electric heaters.

Topeka Railway Employes' Club Rooms.

In the June issue of the "Review" was published an account of the dedication on May 28th of the new club rooms of the Topeka

OFFICE BUILDING, TOPEKA RAILWAY CO.

Railway Benefit Association, together with a general description of the new office building of the Topeka Railway Co., in which the new club rooms are located.

SHOWER BATHS, TOPEKA RAILWAY CLUB.

In this issue of the "Review" we reproduce views showing the exterior of the building, as well as the club's recreation and reading room, the billiard room and the shower bath and lavatory apartment, which are located on the second floor of the building.

As stated in the "Review" last month, the building is built of

GENERAL VIEW IN READING ROOM.

concrete blocks and is very attractive. The interior finish is quartered oak, with hardwood floors. It is one of a group of concrete buildings which the company owns at the corner of 12th and Jackson Sts., Topeka, the other structures including a car barn, a machine shop, carpenter and paint shop, an emergency station and the

A CORNER IN THE BILLIARD ROOM.

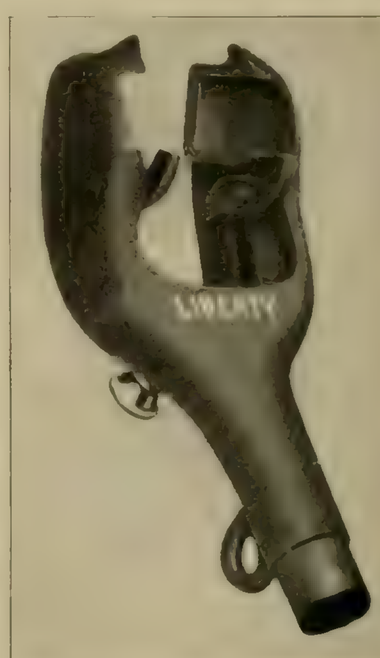
boiler house. The office building is two stories in height, the lower floor being occupied by the general offices.

The club rooms are very popular and are freely patronized by the members of the association and other employes. The members are entitled to all privileges at reduced rates and the rooms are easily self-supporting.

The "Review" is indebted to Mr. L. E. Myers, vice-president of the company, for the very excellent views herewith presented.

The Liberty Trolley Harp.

The Liberty Bell Co., of Bristol, Conn., is bringing out a new trolley harp in which the trolley wheel is so mounted as to permit it to change its plane of rotation when the car is passing around curves, thus preventing binding of the wheel on the trolley wire. The improvement consists in the arrangement of the sockets for carrying the ends of the shaft or bushing on which the wheel turns. Each end of the bushing is provided with a square nut, having its outer face slightly rounded so that when the bushing is placed in the harp it will be free to rock sideways within certain limits, permitting the wheel to follow the plane of the wire without changing the plane of the harp. The bushing is held in place by a simple catch arrangement.



THE LIBERTY TROLLEY HARP.

It is believed this form of harp will be the means of reducing the wear on both wheel and wire, will prevent the wheel from leaving the wire and will tend to prevent damage to the overhead work and to the trolley pole. The harp has been used for some time on cars of the Bristol & Plainville Tramway Co., of Bristol, Conn., and is being tested on a number of roads in New England.

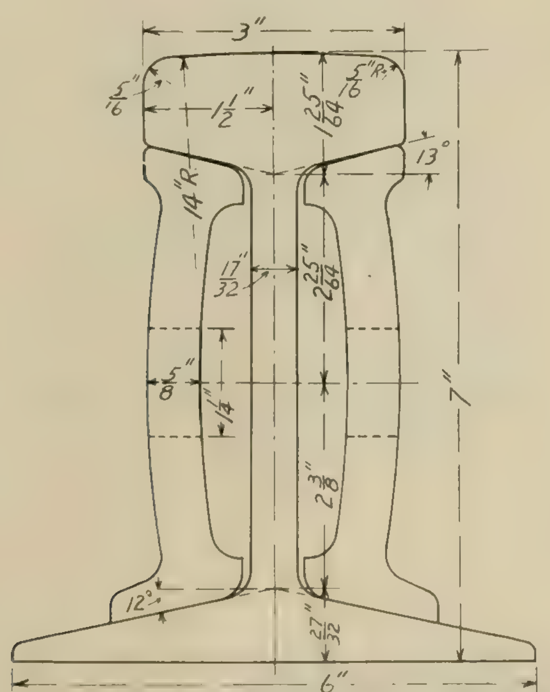
Chicago Traction Question.

But little progress has been made during the past month in reaching a settlement of the traction question in Chicago. The United States Circuit Court has not yet entered its decree in pursuance of its decision as to the validity and scope of the 99-year act and the drafting of this order, which will define just what streets are affected, will doubtless be a subject for argument between attorneys representing the companies and the city.

In the meantime, a suggestion has been made that a practicable basis for agreement might be reached by averaging unexpired terms of the various grants. To reach an equitable basis according to this plan would require the determination of the relative values of a mile of trunk line and a mile of feeder line, and also a very nice determination as to the extent to which the feeder lines and trunk lines each affect the value of the other. The field for argument here is very broad and there appears to be but very little chance of an agreement along these lines being reached at all soon. The city has ordered the companies to remove tracks in certain streets, but this demand has been answered by calling the attention of the city to an ordinance, hitherto overlooked by it, which extends the rights of the companies in the streets in question until 1907.

A New High T-Rail Section.

At the annual meeting of the American Street Railway Association held at Detroit in October, 1902, the Committee on Standards, consisting of N. H. Heft, general manager Electric Division, N. Y., N. H. & H. R. R.; John I. Beggs, president Milwaukee Electric Ry. & Light Co.; E. G. Connette, vice-president Syracuse Rapid Transit Co.; E. A. Newman, general manager Portland (Me.) Rail-



NEW 95-LB., 7-IN. T-RAIL (HALF SIZE)

road Co., and R. T. Laffin, general manager Worcester (Mass.) Consolidated Street Railway Co., made a report recommending the T-section as the most desirable and practicable rail for all purposes and advising its use wherever the consent of the municipality can be obtained; also that an earnest and persistent effort should be made on the part of all electric railways to obtain such consent. The committee further recommended that the Association adopt as standard, a T-rail with a width of head not less than 3 in., in order that interurban car wheels having 3-in. treads can be operated without interfering with the pavements, the height of the rails to be governed by the character of the pavement required by the municipalities.

The experience of the Milwaukee Electric Railway & Light Co. with the use of a high T-rail, covering a period of eight or ten years, has been so satisfactory that Mr. Beggs was very enthusiastic in making these recommendations. The change for his company will be merely from a T-section 6-in. high having a head 2 5-16 in. wide to the section recommended. He has persistently followed up the idea of adopting such a section but met with considerable difficulty in inducing the rail mills to prepare rolls for same. He has, however, finally succeeded in doing so and has placed an order, through D. J. Evans, 1564 Monadnock Bldg., Chicago, for 6,000 tons of rails of the section illustrated herewith. This rail will weigh 95 lb. per yard and is to be furnished in lengths of 60 ft. It will be noticed that the splice bars provide ample space for the protected type of rail bonds, which is very essential, and also have an unusual amount of cambre to prevent buckling, an objection met with in the old form of straight or channel splice bars.

Mr. G. Otto Elterich, representing Lonas, Clendenin & McCord, 42 Broadway, New York, sailed July 16th on the American Liner Philadelphia for Paris, Berlin and London, to close negotiations now pending for the financing of two large steam and one electric railroads, which his firm has taken contracts to finance and build. He will be joined later by Mr. F. E. Lonas, and while abroad they will make permanent connections for the disposition of the securities of such roads as they may hereafter take up and construct.

Steam Turbine Tests.

The Westinghouse Machine Co., of East Pittsburg, is making a practice of publishing in fac simile reports of important certified tests of steam turbines for the convenience of interested parties, and up to the present time over 1,000 of these tests have been made on various sizes of steam turbines. The results are all worked out and recorded in special files kept for the purpose, so that the company has an exact record of the performance of every machine that leaves the works. We are in receipt of one of these fac simile reports of a brake test on a 400-kw. Westinghouse-Parsons steam turbine made by Dean & Maine, consulting engineers, of Boston.

A large number of tests were made on this machine and the results under different conditions are tabulated. The conditions include steam with approximately 100° F. superheat, 180° F. superheat, dry steam and low vacuum, tests at different load, etc. The thermal efficiency of the machine under different conditions varied from 17½ per cent to 19½ per cent.

Rodger Car for Interurban Railway.

We illustrate herewith the latest type car, designed especially for interurban construction and maintenance work by the Rodger Ballast Car Co., and exhibited on Aisle H in the Transportation Building at the Louisiana Purchase Exposition. The four views herewith shown illustrate this car as follows:

First, a top view, as a center-dump Rodger ballast car, designed for distributing ballast in the center of the track according to the Rodger method, dispensing entirely with shoveling;

Second, a side view of the car, arranged as a center-dump;

Third, a top view of the car, with the sides folded down alongside of the car and the convertible floor doors folded down flush with the floor of the car, making an ordinary flat car for construction purposes. As clearly shown in this view, there are no obstructions on the floor of the car and it can be used for any purpose whatever that an ordinary flat car can be used;

Fourth, a side view of the car as a flat car, showing clearly the stake pockets as applied to an ordinary flat car, making this car available for hauling lumber, timber or any other ordinary freight.

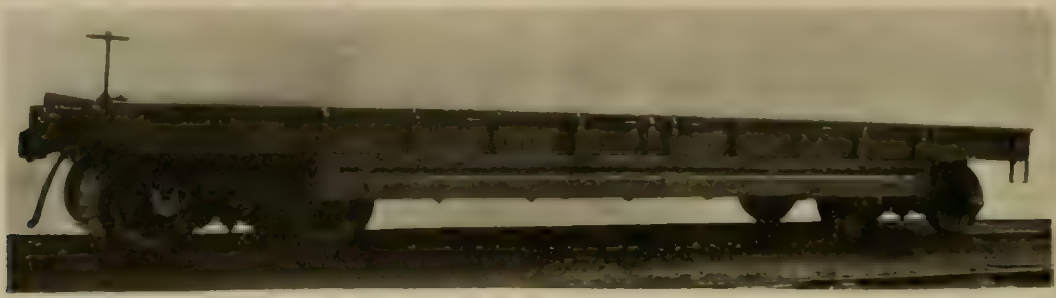
The particular demand which gave rise to the design of this car originated with the interurban roads, which are doing construction work requiring cars for hauling rails, ties, bridge material, etc., used in track laying. The great advantage this type of car offers for interurban construction is that but one type of car is necessary to haul the entire construction material and build the track and the car can then be converted into a center-dump ballast car of the most economical type and ballast the same track.

After this is done, this car is available as a center dump car for

handling coal which use of the car has been thoroughly demonstrated at the St. Louis World's Fair where 150 Rodger convertible ballast cars are handling all the coal used by the Exposition company. These coal cars carry 110,000 lb. of coal and dump the load automatically, with absolutely no shoveling or use of push poles. This type of car will serve all of the freight purposes, with the exception of such as require box cars.

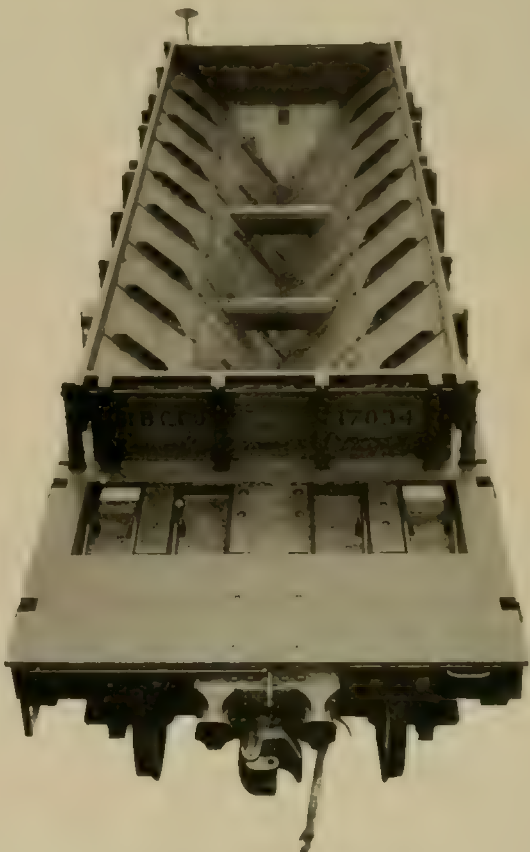
In addition to this car the Rodger Ballast Car Co. shows in its exhibit one of the convertible cars class C S, 30 ft. long, also a class C S car 41 ft. long, with steel underframe, both of which are more particularly designed for steam railway work.

The Rodger company is giving out a small pamphlet at the exhibit which describes these cars and gives information regarding the operation of them. Copies of this pamphlet may be had by addressing the company at its office in the Railway Exchange Bldg., Chicago.



SIDE VIEW OF RODGER BALLAST CAR AS FLAT CAR.

TOP VIEW AS FLAT CAR.



TOP VIEW AS CENTER DUMP CAR.

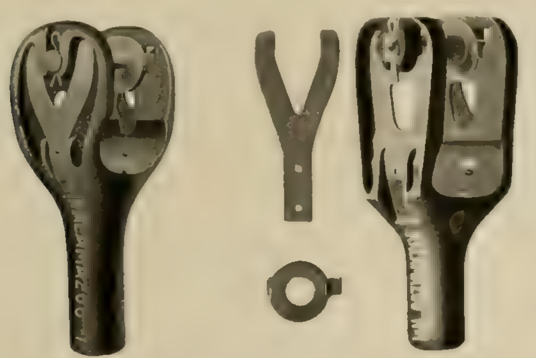
SIDE VIEW OF RODGER BALLAST CAR AS CENTER DUMP CAR.

Automobile-Railway Accidents.

On the last Sunday in June there occurred in or near Chicago three accidents which again emphasized the facts that grade crossings are danger spots and that automobiles are frequently driven in a very reckless manner. The most serious of the three accidents referred to was the collision between a train on the Aurora, Elgin & Chicago Electric Railway and an automobile, the two occupants of the latter losing their lives by reason of injuries sustained in the collision or because of the explosion of the gasoline tank of the automobile. In the second case two automobiles running at high speed struck a car of the Chicago City Railway as it was crossing Michigan Ave., and injured two passengers on the car. The third collision was between a steam railroad train and an automobile, at a grade crossing.

Trolley Harp Decision.

The Star Brass Works of Kalamazoo, Mich., on July 6th, received notice from the clerk of the United States Circuit Court of Appeals for the Sixth Judicial Circuit, advising that the suit of the Star Brass Works against the General Electric Co. had been decided in favor of the Star Brass Works. This litigation was in regard to the Kalamazoo trolley harp, which was alleged to infringe patents owned by the General Electric Co. Last fall a temporary injunction was refused in this case, but in February, 1904, the General Electric Co. secured a permanent injunction, restraining the Star Brass Works from making and selling the Kalamazoo harp. The case was appealed to the United States Circuit Court of Appeals, and on July 6th it was reversed and the bill dismissed, the court



THE KALAMAZOO TROLLEY HARP

holding that there was no infringement against the General Electric patents.

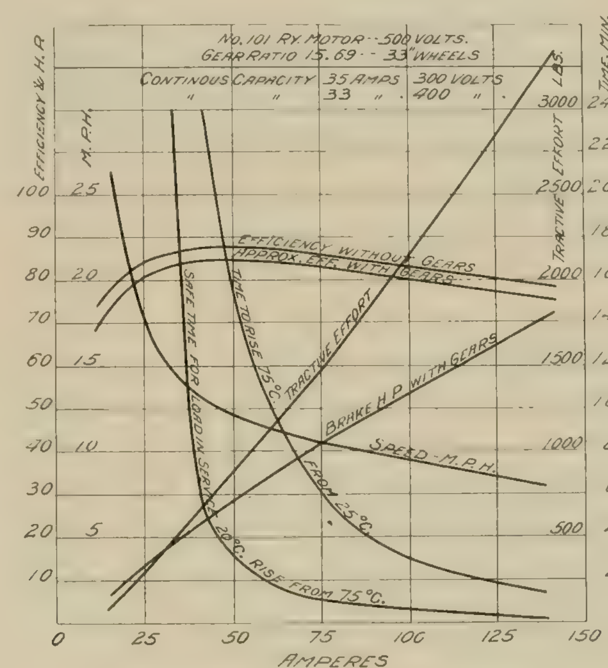
The fight in this matter was on the location of the contact spring. The General Electric patents cover an inside spring, while in the Kalamazoo harp the contact spring is placed on the outside, as shown in the accompanying illustration. An especially strong claim for this design is that the inside springs wear very rapidly from their contact with the wheel while the outside springs do not have to be renewed. In the Kalamazoo harp the spring does not touch a rotating part, but makes contact with lugs on a heavy copper washer which is mounted on the axle of the wheel, the lugs mentioned projecting through the sides of the harp and preventing the washer from rotating while leaving it free to move laterally and take up the lateral play of the wheel. The raised edge on the outer surfaces of the harp project beyond the spring and effectually protect the latter from mechanical injury.

Westinghouse No. 101 Railway Motor.

The No. 101 Westinghouse railway motor, which has recently been put upon the market, embodies the latest improvements in street railway motor construction.

Under ordinary conditions a double equipment of these motors is suitable for single truck cars weighing from 16,000 to 18,000 lb. without equipment or load, or for double truck cars of about the same weight. The quadruple equipment will operate a double truck car weighing about 30,000 lb. This motor has a nominal rating of 40 h.p. for one hour, when operating at 500 volts. The characteristic curves, however, indicate more exactly the performance of the motor under different conditions of load and speed and from these curves the applicability of the motor for any particular service may be determined. The motor has a continuous capacity of 35 amperes at 300 volts, or 33 amperes at 400 volts. At either of these loads, according to a shop run of 24 hours, the rise of temperature of the windings did not exceed 75° C. When under a running car the temperature should not exceed 55° C. on account of the better ventilation.

The frame consists of two steel castings, divided along a horizontal plane and held together by bolts. The lower field may be opened down with or without the armature. The closed frame is approximately cylindrical in shape, and its general appearance is shown in the accompanying illustration. An opening over the commutator is closed by a dust-proof lid, and handholes, with



CHARACTERISTIC CURVES OF NO. 101 MOTOR.

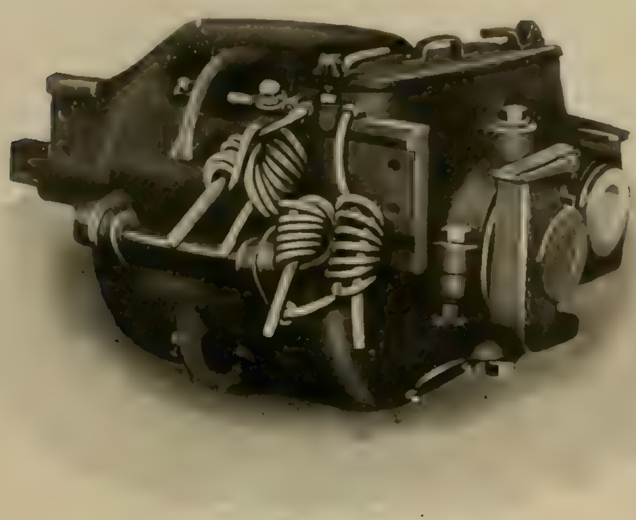
water-tight covers, are located at convenient points. The field contains 4 poles of laminated steel bolted to the frame and projecting inward at angles of 45° with the horizontal. The pole pieces are built of soft steel punchings riveted together between end plates of wrought iron. The holding bolts pass through the frame from the outside and terminate in heavy rivets, leaving the pole faces with smooth unbroken surfaces.

The coils are wound with copper strap insulated with asbestos and mica and protected by heavy wrappings of tape. The armature coil consists of punchings of soft steel built up on a cast iron spider, the latter being pressed on the motor shaft and keyed in place. The commutator is also mounted on this spider, so the shaft may be removed without disturbing any other part. The armature coils are machine wound, embedded in rectangular slots in the core and held in place by retaining wedges of hard fibre. There are no band wires over the core and the retaining wedges slide in grooves in the armature teeth and may be easily withdrawn when it is necessary to replace a coil. The complete armature is 14 inches in diameter.

The brush holders and leads are supported by two cast brass arms, secured to the upper frame in such a manner as to permit of radial adjustment to compensate for wear of the commutator. The holders are of the sliding type with shunts. The armature bearings are solid cast iron shells lined with babbit and the bearing housings are securely held between the upper and lower motor frames and retained in place by finished flanges on the inner ends which fit finished surfaces on the frames. Screw taps are provided, so that the housings may be bolted to either frame, and I-bolts may be inserted in these taps for lifting the armature and

bearings together, without danger to commutator or windings.

The method of lubrication is similar to that used in car journal boxes. The axle bearings consist of cast iron shells, divided horizontally and lined with babbit. These are 8 in. long and may be made for any diameter not exceeding 5 in. Lubrication is obtained by the use of oil and waste, as in the armature bearings.



GENERAL VIEW OF NO. 101 MOTOR.

The weight of the motor complete with gear and gear case is 2,645 lb. The armature complete with commutator and shaft weighs 503 lb.

Mileage and Service of Steel Tired Wheels.

BY KNOX TAYLOR.

The question of mileage of the steel-tired wheel under street cars has been taken up systematically by managers in only a few cases and unfortunately those who have so considered it have stopped short of a practical application of any favorable conclusions that they may have reached.

Data are confusedly meagre, and the regrettable part is that even on those roads where steel-tired wheels are being used few records of the mileage or service are being kept, so that when they are worn out the management will have only an indefinite idea as to the actual service performed. This much can be said, however, and that is that wherever steel-tired wheels are at work their service is reported to be satisfactory and this, being interpreted, may be made to mean that the wear of the wheels is to that of a cast iron wheel inversely in proportion to the price.

In considering the probabilities in any case, a safe basis of calculation is usually to take past performances along lines as nearly parallel as possible. In this instance we have the wheel action under the cars of steam lines. Here, of course, there is a wide variation; wheels under the cars of through express trains will give a higher mileage than those under local or accommodation trains, where the brake action plays an important part in wheel wear. We may, nevertheless, take 50,000 miles as an average for cast iron wheels under passenger cars, and 250,000 as an average for steel-tired wheels. As a matter of fact the ratio that has been found to exist, in the case of one line, has been as 1 to 4.7. Unfortunately, again, little is known as to the actual mileage of cast iron wheels in street car service, but from the best information available it is probable that 30,000 miles is not far from the true average. If this is multiplied by 4.5 we have the probable mileage of 135,000 for a steel-tired wheel. There are indications, however, that the life will be much greater than this. Wheels have been running that, with a wear of ¾ in., indicate a mileage of 240,000. In the case of some fused steel-tired wheels made by the Taylor Iron & Steel Co., of High Bridge, N. J., the rate of wear for each turning has been in some cases over 50,000 miles. Allowing ¼ in. for each turning, and seven quarters on a side, or 1 ¾ in. altogether, if all of this thickness went into wear would be a total mileage of 350,000. In practice it is found that there is more or less flanging which is corrected by turning off some of the thread. Allowing two or three quarters for this, we have left a mileage of 225,000 to 250,000 miles. It is believed that this is well within bounds, but even at 180,000 miles the ratio of steel-tired to cast iron wheels would be as 6 to 1.

If a car makes 100 miles a day, the life of such a wheel under a street car would be nearly five years. The price that could be paid for the wheel in comparison with a cast iron wheel at $6.00 would be $36.00. Against the steel tired wheel there is chargeable, in addition, the compound interest for four years and if this and the turnings are allowed to stand against and balance the charges for several renewals properly made against the cast-iron wheel, it is certainly no injustice to the latter. If these figures are granted as being approximately correct, it follows that whatever savings may be made in the price of the steel-tired wheel, below $36.00, represents a direct saving in wheel costs, and this divided by five would represent the probable annual saving.

In addition to the direct saving in cost, there is the added item of greater safety in operation. It has been shown beyond all doubt that, in the case of high capacity freight cars, the use of the steel-tired wheel has done away with all of the troubles with chipped and cracked flanges. This is one of the greatest evils of street car wheel wear with which the managers have to contend, and one which does not permit the full normal life to be obtained with the cast-iron wheel.

Finally, as to safety, most urban street roads have branches running to resorts out of town, that cannot be strictly classified as interurban lines, and yet where high speeds are maintained, that is to say, speeds of from twenty to twenty-five miles an hour, it is in such places where the greatest danger lies from a flange that has been chipped or cracked by the service to which it has been exposed in the city street, and where a derailment is apt to be the cause of a disaster. It would seem, then, that from the motives, both of a saving in cost of operation and the insurance of reduced liability to accident, the use of the steel-tired wheel in city service should be seriously considered.

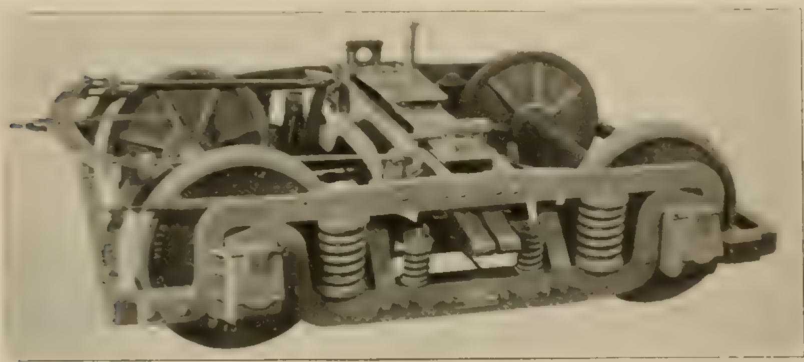
Solid Forged Steel Trucks.

The accompanying illustrations show two new types of trucks which were recently designed by Mr. W. G. Price, and constructed by the Standard Steel Car Co., of Pittsburg, Pa. One view shows the long wheel base or suburban truck now in use on the Youngstown & Sharon Railway. The wheel base of this truck is 6 ft. 4 in. It has 33-in. wheels, and it carries the car high enough so the wheels can swivel underneath the car sills. The novel features are the forming of a side frame of one piece of open-hearth steel, so as to provide outside pedestals but no inside pedestals; the bolting of the equalizer bars directly to the journal boxes, so that inside pedestals are not required; the supporting of the brake shoes and motor suspensions directly from the equalizer bars, so that they have no connection with the truck frame; the arrangement of the brake evener and release springs, so as to give clearance to the car body truss rods in curves, and the new type bolster spring.

The other view shows the short wheel base type of truck in service on the Worcester & Connecticut Eastern Railroad. The wheel base of this truck is 4 ft. 3 in., and it has 30-in. wheels. This truck has the same type of frame as the long wheel base truck. There are no inside pedestals; the equalizer bars are bolted directly to the journal boxes; the brake shoes are hung from brackets, which are bolted to the equalizer bars, so they have no connection with the truck frame.

Another new feature in each of these trucks is the machine finishing of the journal boxes inside to one exact width and the finishing of the journal bearings to a width 1-32 in. less than the boxes. As the boxes are rigidly connected by the equalizer bars, the maximum movement of the axles away from or towards each other is thus reduced to 1-16 in. The idea of this is to give advantage in the adjustment of the brake shoes. As the wheels cannot be pushed towards the brake shoe by the power of the motors more than 1-32 in., the shoes can be given a very close adjustment, and as the wheels cannot give way to the brake shoe pressure, the efficiency

of the brakes is much increased and the amount of air or muscle power required to operate them is much reduced. Although the journal bearings are such a close fit to the boxes, there is ample provision for rotation of the bearings in the horizontal plane and they do not run hot. The supporting of the brake shoes from the



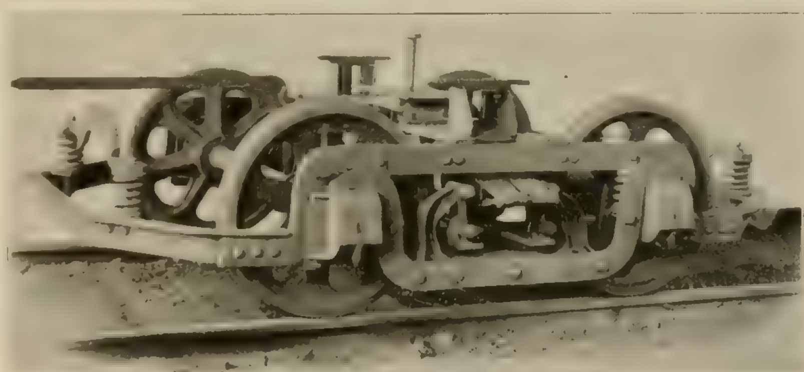
SUBURBAN TRUCK, LONG WHEEL BASE.

equalizer bars gives the shoes a fixed height on the wheels, which also permits of a close adjustment, and it eliminates from the truck frame and car body the noise and vibration due to the application of the brakes. The supporting of the motors from the equalizer bars permits the use of springs for the heaviest motors, which are usually supported by a lug, resting directly upon the transom, and also eliminates from the truck frame and car body the jar and vibration due to the operation of the motors. The use of equalizer bars in a short wheel base truck, suitable for city service where the car bodies are carried low, is a novel feature. The truck frame is carried on the springs, which are located between the equalizer bars and close to the journal boxes. The bolster spring in this truck is a double elliptic, 34 in. long, with four leaves which are 4 in. wide. This arrangement of springs gives a very easy riding truck and one which does not oscillate on a rough track at the highest speed at which it has been tested, which was from 35 to 40 miles per hour. The elliptic spring in the long wheel base truck is a new form designed to go in the space allowed in such trucks, which is usually small owing to the room required by the motors and the limitations of the wheel base. Narrow springs with a large enough number of leaves in order to carry the load are hard riding, owing to the damping effect of too many leaves. This spring is a double elliptic, 37 in. long, with 6 leaves each 3½ in. wide. In order to reduce the damping effect the leaves were divided so as to

WORCESTER CAR WITH SHORT WHEEL BASE TRUCKS

form two independent springs, each with three leaves, one spring of three leaves being outside of the other, but both being secured by the same bands. The riding effect of this spring is the same as if it were a quadruple elliptic 37 in. long with three leaves each 3½ in. wide, which would be a very easy riding spring, similar to what is used in steam railroad practice, but which could not be used in electric trucks, owing to the limited space. The equalizer bars are rigidly connected across the truck, so that they cannot be tilted by the pull of the brake hangers. In both trucks the bolsters are carried on swinging hangers, and there are no spring buffers at the ends of the bolsters. The ease with which these car bodies swing around the curves at high speeds is considered to indicate that the bolster buffer springs are at least unnecessary.

The side frames are protected from wear between the journal box jaws by a covering of steel plate, having a U-shaped section. This plate carries a bolt at the lower end, which acts as a stop to the upward movement of the frame. When designing these trucks the use of both bolts and rivets for connecting the parts of the frame were considered, and it was decided that hydraulic driven rivets were preferable. It is intended to use four of these rivets at each corner of the truck to connect the side frame with the end frame. The king bolt screws into a nut in the bolster so that the car body can not tip off of the trucks. The center plates are lubricated with oil, and the car body center plate is cast hollow so as to hold a surplus of oil. The truck frames are completed and made perfectly square and true before being placed on the wheels. The experience with these trucks has demonstrated that the use of inside pedestals is entirely unnecessary, and by omitting them it is possible to form a superior side frame of one piece of rolled steel without welds, which is lighter and much safer



FORGED STEEL TRUCK, SHORT WHEEL BASE.

than any other form of construction. By tieing together the journal boxes by the equalizer bars the boxes are prevented from being forced against the outside pedestals by the application of the brakes, and much wear of the boxes and pedestals and resultant lost motion is thus obviated. The trucks are made light for the required strength and have no castings under tensile stress. All castings except the wheels and brake shoes are of malleable iron. The brake shoes are carried at the M. C. B. standard height and the hanger bolts and all other bolts in the brake rigging are held by strong springs so that they cannot rattle, which greatly reduces the amount of wear upon them and the shoes do not chatter. This construction is designed to provide nothing on the trucks that can ever rattle.

On the Youngstown & Sharon Railway trucks a brake shoe slack adjuster has been tested which automatically adjusts the shoes to within 1-16 in. of the wheel. With this device the amount of air required for braking is reduced probably as much as three-fourths and the efficiency for emergency stops greatly increased.

The new features in the truck and brake enable this slack adjuster to be used which can not be used in other designs of trucks.

July 17th a special car was run from Erie, Pa., to Cleveland, O., and return, the excursion being conducted by Messrs. A. C. Derry and Elliott G. Getty. There were 50 participants.

The fifth annual commencement of the Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y., was held June 17th. The address was delivered by Mr. Francis Newton Thorpe, Ph. D.

The Blake Signal.

The Blake signal which is illustrated herewith, is designed to be operated by the dispatcher of a railway, enabling him to call any one of the crews on the line to a telephone at any desired point and at that point only. The signal is not an automatic signal and is not designed to cover the field of automatic block signals. It is designed for use in connection with a telephone system and gives the dispatcher the same command of car crews that the steam road dispatcher has by the use of telegraph lines and operators at certain intervals. This system has been in use on the Boston & Worcester Street Ry. since November, 1903, where it has operated successfully during a winter of exceptional severity

The method of operation of the signal is as follows: At all important operating points or turnouts a Blake signal is installed and all telephone and signal stations are furnished with au autographic register making triplicate copies. If the dispatcher wishes to communicate with a car crew approaching a certain station he uses a toothed disk numbered to correspond with the station where he wishes to set a signal. This is slipped on a constant speed motor driven shaft located directly at hand. The revolution of the disk throws the 4-foot semaphore to a "stop" position at the desired station and also illuminates a red lens for a night signal. When the car arrives at this station the conductor unlocks the telephone booth and writes down the dispatcher's orders on the autographic

BLAKE SIGNALS IN "STOP" AND "CLEAR" POSITIONS.

register and then repeats them back to the dispatcher. One copy of the order is held by the conductor, the second is handed to the motorman, while the third copy is wound on a roll within the register. The conductor then pulls a cord which sets the semaphore at "clear". One of the illustrations shows the semaphore set at "clear" and the other at the "stop" position.

The principle of the signal depends on the fact that the time of vibration of a pendulum of a certain length is always the same and that the time of vibration is a function of the length of the pendulum. Each signal box contains an electro-magnet and a pendulum. The electro-magnets are all in series on one wire, preferably with a ground return. The pendulums for each signal are of different lengths and receive impulses from the electro-magnets which may be energized at various intervals to correspond with the periodicity of their respective pendulums. The toothed wheels used by the dispatcher make and break contacts at intervals corresponding with the periods of the respective pendulums. The rotation of the disk sets up impulses at certain intervals in all of the electro-magnets, but these impulses are only cumulative in increasing the arc of vibration of that pendulum whose period is synchronous with the impulses. In from 10 to 20 seconds, depending on the length of the pendulum, it swings through a sufficient arc to trip the lock holding the semaphore, which at once falls to a "stop" position. When the semaphore reaches the horizontal position it automatically closes a lamp switch which illuminates the lens for use at night. Each signal is equipped with two lamps, so that if one is burned out the other is automatically connected to a periodically interrupted circuit and gives a flashing danger signal. The semaphore when in a horizontal position also closes the circuit which gives a magnetic sounder signal to the dispatcher notifying him that the signal is set. A one-sixth h. p. motor is sufficient for revolving the disks in the dispatcher's office, and constant speed of the shaft under varying voltages is obtained by the use of a governor. The use of a master pendulum in the dispatcher's office instead of a motor is recommended, as it removes the necessity of using current to operate the motor and is besides absolutely positive in action.

The Development of the Brake Shoe.

The American Brake Shoe & Foundry Co. is distributing an interesting pamphlet at its exhibit at the Louisiana Purchase Exposition entitled "The Development of the Brake Shoe." Various stages in the development from the time of the wooden brake shoe up to the modern shoe of today are described in this pamphlet. Previous to 1850 wooden brake blocks were in general use; from 1850 to 1860 cast iron and wrought iron shoes were used in connection with wooden brake heads, and it was not until about 1870 that metal shoes and brake heads were in general use The shoes are divided into two general sections, namely, unflanged and flanged shoes.

Under the first section are described the plain cast iron shoe, the Congdon shoe of unchilled cast iron and inserts of wrought iron, the Lappin brake shoe of chilled cast iron, the Corning brake shoe of chilled iron cast about an insert of soft iron in the wearing plates and the "Diamond S" brake shoe made by casting the body metal about a bundle of expanded sheet steel; the Streator brake shoe, having a body of soft iron surrounding a spiral insert of chilled iron and the U shoe consisting of a body of hard iron having tapered ends extending beyond the ordinary length, the extensions being heavily chilled.

The group just mentioned having hard bodies with inserts were structurally weak and liable to be broken, and for this reason a second group succeeded them which were reinforced with the object of strengthening the insert shoes. Six styles of reinforced shoes are described and illustrated many of which are standard on various roads today.

With the introduction of steel tires on railroad equipment the use of a flanged shoe became advantageous on account of its action in wearing down the wheel plate. In the development of the flanged brake shoe similar changes have occurred in the line of developing a wearing face to secure durability as in previous unflanged shoes. The history of this development is shown in a group of five shoes with inserts of various kinds. The last group which are of the most recent introduction show three types of reinforced flanged shoes combining the best features of the preceding types. The pamphlet is handsomely illustrated, the text being printed in red and the illustrations reproduced in green.

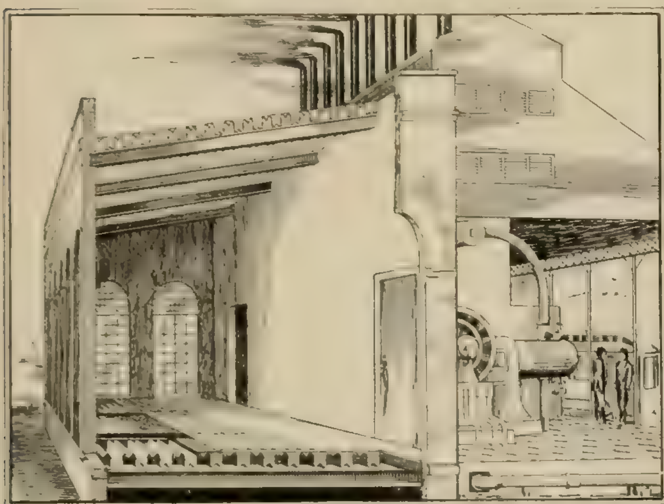
First Electric Line in North Dakota.

The Fargo & Moorhead Street Railway Co., which is building a line from Fargo, N. D., to Moorhead, Minn., 12 miles, plans to begin to operate in August. The road has been constructed by Mr. Thomas F. Deegan, of Philadelphia, who built 150 miles of the lines in that city, and also the Doylestown & Willow Grove line. Associated with Mr. Deegan in the North Dakota project are Messrs. Frank Larned, H. C. Sickler and Christian Walters, of Wilkesbarre, Pa. The new road is the first electric line in North Dakota. The ties used in its construction came from Spokane, the wooden poles from Idaho, iron poles for the towers from Pittsburg, and the cars from Niles, O.

The New Bedford & Onset Street Ry. has decided to increase the fare from New Bedford to Onset from 25 to 35 cents, an excursion ticket for a round trip being still sold for 50 cents. The reason for the increase is said to be that the volume of business is not as great as was anticipated.

The Berger Multiplex System.

The accompanying illustrations show the "Multiplex" method of fireproofing buildings through the employment of specially formed sheet steel, combined with concrete. "Multiplex" plate is made only by the Berger Manufacturing Co., of Canton, O., and the process is patented. It is produced by mechanically forming sheet steel so that it acquires additional strength and resistant qualities. It has



MULTIPLEX AS USED IN ROOFS AND FLOORING.

been successfully applied for strong, light flooring, as well as roofing, in power houses, elevators, mills, factories, etc., and as flooring for roadways of bridges where great strength combined with light construction is required.

"Multiplex" plate has been strongly endorsed by architects, builders and contractors all over the country, it being claimed that it

TEST OF STRENGTH OF MULTIPLEX PLATE.

effects the maximum realization of strength at the minimum expense of weight, labor and safety, and it has always proven eminently satisfactory wherever used.

For several years the Berger company has furnished this special plate to the construction trade, especially to those engaged in power-house and similar work. Where absolute protection and fireproofing of buildings, and strong though light construction, is necessary, "Multiplex" plate is believed to be the most practicable material to be obtained.

The Berger company has issued a handsomely illustrated catalog describing the manner of using this plate, and a copy of the catalog will be sent to those interested.

Benjamin Electric Manufacturing Co.

We illustrate herewith the exhibit at the St. Louis World's Fair of the Benjamin Electric Manufacturing Co., of Chicago and New York. The company's exhibit space is located in Section 25, Palace of Electricity, facing southeast, and consists of a display board on the rear wall, showing the elements of the company's wireless clusters and electrical specialties as they appear in different stages of assembling; also the completed articles with a variety of fin-

EXHIBIT OF BENJAMIN ELECTRIC MANUFACTURING CO. AT WORLD'S FAIR

ishes. A small display board is also provided showing clusters used in street car work.

Immediately above this display board is a window reflector in which are placed two of the company's No. 4 twin sockets, thus forming a four light reflector, and still higher is a sign with the initials, "B. E. M. Co.," made up of the company's No. 6 porcelain receptacles mounted on a polished brass plate.

From the ceiling are suspended a variety of clusters with different makes of shades for both indoor and outdoor lighting. In the center of the booth, dependent from the ceiling, is a 20-light cluster with a large mirror reflector, suitable for lighting large halls, churches and public buildings. At one side of the booth is a brass rail on which are supported a number of cluster fixtures with a variety of finishes. From the center of the arch is suspended a style K cluster with pagoda shades, and on each side of the arch is a No. 19 two-light bracket with individual shades.

In front of the booth at each side of the entrance are brass standards having at their upper ends 11-light spherical clusters with individual shades attached.

The exhibit is under the immediate supervision of Mr. L. G. Kalloch, who is assisted by Mr. G. P. Buckner.

Jacks for Electric Railway Use.

The accompanying engravings show the Buda ratchet jacks, Nos. 1 and 2, made by the Buda Foundry & Manufacturing Co. The No. 2 ratchet jack is the most popular and useful size for electric and traction lines. This jack can also be used as a car jack in emergency

NO. 1 RATCHET JACK.

cases, where it is necessary to lift cars quickly and gradually. With this jack the load is moved up or down one-half a notch each stroke, on the upward and downward motion of the lever (the action being reversed by simply turning thumb nut, shown on the side, half around), while the No. 1 ratchet is a trip jack and lifts on both the up and down stroke. Both of these jacks have a capacity of ten tons.

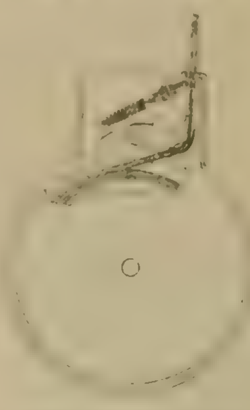
In addition to the ratchet jacks, the Buda Foundry & Manufacturing Co. makes two sizes of friction jacks, the No. 1 having a

NO. 2 RATCHET JACK.

capacity of five tons, weighs 62 pounds and is intended for surfacing and general track repairs, while the No. 2 has a capacity for ten tons, weighs 85 pounds and is intended for heavy ballasting, switch and crossing work and heavy yard work. One of the advantages of the friction jack is that it permits a load to be stopped at any desired height, while with the ratchet jack the load has to be raised or lowered until the clutch catches.

Amet Trolley Catcher.

The accompanying illustration shows a new trolley catcher invented by E. H. Amet, on which a patent is pending. The object of this device, as of all trolley catchers, is to furnish a means of preventing the trolley pole from springing up when the trolley leaves the trolley wire, and to do it quickly enough to prevent the pole from damaging the overhead work. The illustration shows an ordinary drum for taking up the slack of the cord and this drum acts like a self-rolling window shade pole, keeping a slight tension on the cord at all times. The locking device is the main feature of this invention.

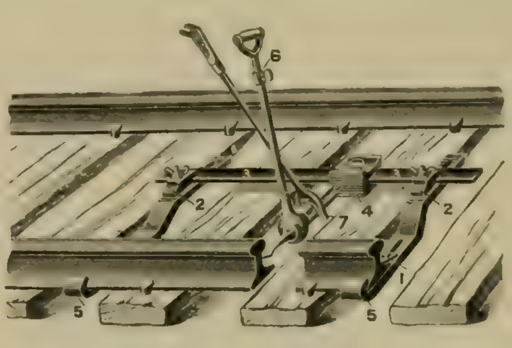


AMET TROLLEY CATCHER.

It will be seen that the cord passes over a small grooved idler which revolves on a bearing mounted on one end of the pawl or dog, and the other end of the pawl is free to engage with the teeth of the ratchet on the winding drum. As long as the trolley wheel remains on the wire the cord passes smoothly back and forth from the winding drum and the spring attached to the pawl prevents it from engaging with the ratchet. When the trolley wheel leaves the wire the sudden upward pull on the idler end of the pawl throws the free end of the pawl into the ratchet and this locks the drum. It will be seen that it is not necessary that the drum should move at all to lock the catcher.

Smith Friction Track Drill.

The Walworth Manufacturing Co., of Boston, is putting on the market a track drill known as Smith's perfected friction drill, which is shown in the accompanying illustration. By means of this device a rail can be drilled with equal facility whether it is fastened to the ties or detached. The drill is held by means of two bars which hook under the base of the rails and which are firmly connected to the rails by an adjustable clamp. These side bars are made with corrugations that mesh with corresponding grooves on the under side of the back bar, the three bars being held firmly together by adjustable clamps. The side bars can be placed further apart or nearer together so as not to interfere with the railroad ties. The drill stock



TRACK DRILL

has an adjustable extension handle giving a leverage to suit the operator.

As the rails to be drilled vary in height a number of grooves are made on the rack rest which slides both ways on the rear bar of the frame. The conical end of the feed screw fits into a groove corresponding to the height of the rail to be drilled, thus holding the rail in a horizontal position. This also saves unnecessary waste of time in centering the drill. The device is very flexible as it can be used at a frog, switch or anywhere where two or more rails come close together, as the bars can be caught on either rail and the back bar can be adjusted to any direction, and so that either long or short drills can be used.

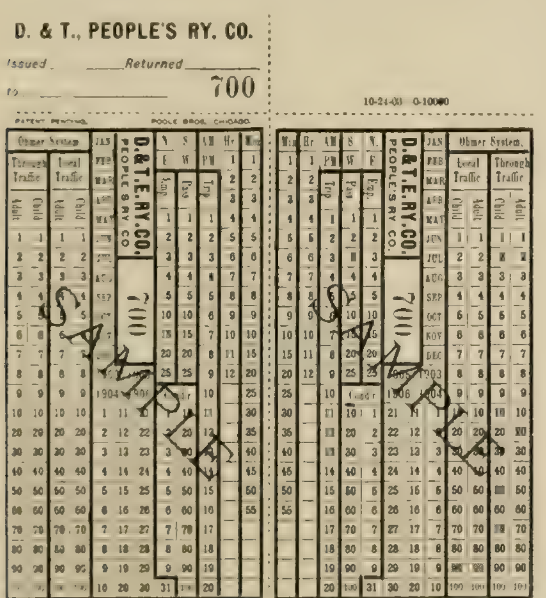
Crocker-Wheeler and Brown-Boveri Alliance.

The Crocker-Wheeler Co. has completed arrangements with Messrs. Brown, Boveri & Cie, of Baden, Switzerland, under which it has secured their alternating current designs, patents and rights to manufacture in America. The Crocker-Wheeler Co. has also retained Brown, Boveri & Cie as consulting engineers. The Crocker-Wheeler Co. will put on the market in America alternating current generators, transformers and accessories of the most perfect design and construction that it is possible to secure, adapting these designs to meet the requirements of American practice.

This move on the part of the Crocker-Wheeler Co. is one that is destined to result in the great extension of its business and furthermore the plan is to be commended from an economic standpoint and it gives opportunity for the application in this country of the inventions of these prominent European engineers without duplicating work of involving costly and harassing patent litigation.

Traffic Ticket System.

Many railroads operating in suburban districts of cities and those operating between various cities operate cars over the tracks of other independent city line companies under a traffic agreement, whereby the suburban or interurban companies pay the city lines for the use of the tracks. This compensation is based on the amount of traffic, and the usual method employed for checking this is for the conductor of the suburban or interurban car to count the passengers and then register the number counted upon the ordinary counting



OHMER DUPLEX TICKET.

machine or register. This operation is crude, annoying, and, at best, is unreliable, and it does not provide means for making the division of account, for example, as between adults and children; neither does it provide a separate accounting for the passengers and for other traffic, such as freight, baggage, express, etc.

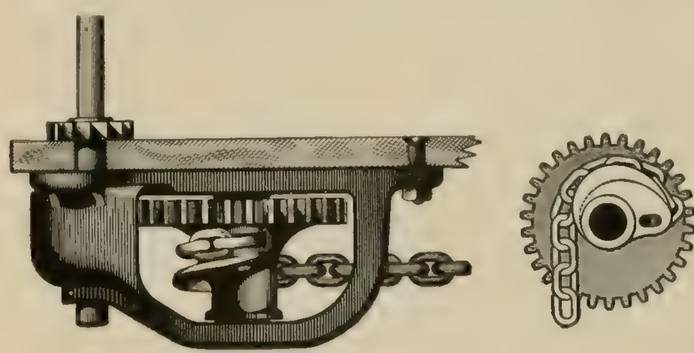
The Ohmer Fare Register Co. has devised and patented a duplex ticket system with which a complete record of the traffic, whether it be adults, children, employes, passenger traveling on pass, freight, express or baggage, can be obtained in a concise form, correctly and expeditiously, and the record made in duplicate, one copy of which may be turned over to the city line over which the suburban cars operate.

There are spaces on the ticket for punching, and thus indicating adults and children, with year, month and day, the direction, and the time by hours and minutes. These tickets are bound in the usual form, and are charged out to the conductors in the usual way. The conductor does not detach any of the tickets, but returns the book when all the tickets therein have been punched, one copy of which may be detached and turned over to the city company each day, if desirable. It is believed that this traffic system will subserve its purpose in the best, quickest and most economical manner. It dispenses with the annoyance of ringing up the number of passengers on a register usually provided for the purpose. If excess baggage, express matter and other traffic are to be accounted for, the ticket will be designed to cover that purpose. As only one ticket is required for each trip, the number necessary for the largest interurban lines would not be many.

The accompanying illustration shows the form of this ticket.

The Peacock Brake.

In a former issue of the "Review" we described the Peacock brake mechanism made by the National Brake Co., of 682 Ellicott Square, Buffalo, N. Y. Some changes have recently been made in the design and the accompanying illustration shows the latest mechanism. The plan in the view of the gear wheel and cam shows the

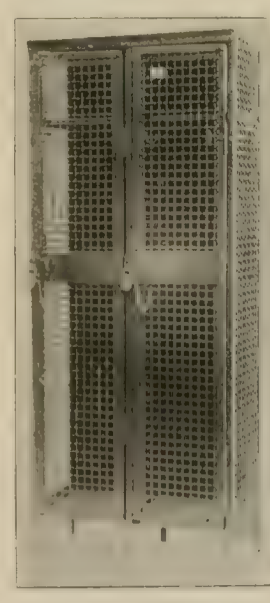


PEACOCK BRAKE.

means by which the rapid motion in the wheel part of the brake application is combined with powerful leverage, as the brakes are pressed against the wheels. It will be noted that the spiral drum which carries the eccentrically-geared cam has been extended in this newer design to take up the surplus chain that may have to be cared for because of carelessness on the part of the barn men in properly adjusting the brake.

Pen-Dar Metal Lockers.

We illustrate herewith one of the several styles of metal lockers made by Edward Darley & Sons Co., of Philadelphia, which are specially adapted for use in machine shops, car barns, power houses, etc. These lockers are built with an angle iron steel frame and the sides and door are composed of woven wire of about 1-in. mesh, the wire being flat. This gives a strong body and renders the contents of the locker visible. A special crimp is used in the wires at each point of intersection, which makes it impossible to enter the lockers by pushing the wires apart.



PEN-DAR LOCKERS.

These lockers are generally finished in black enamel, unless otherwise ordered, but they can also be finished in any color, electro-bronze or nickel-plated, as desired. Each locker is furnished with a special key so that nothing can be taken from it except by the holder of the key. These lockers are now in use in almost all well-equipped manufacturing establishments, and wherever a number of men are employed, and their utility and convenience are too apparent to require further commendation.

Two Interesting Storage Battery Installations in Maine.

BANGOR, ORONO & OLDTOWN STREET RY.

The Bangor, Orono & Oldtown Street Railway Co., owned and operated by the Public Works Co., Bangor, Maine, extends about 14 or 15 miles out of Bangor. It is supplied with power at the Bangor end from the Veazie power station which is about five miles out of Bangor and which furnishes all the light and power for the city, and from the other end by a small water power plant at Milford, just across the river from the end of the line at Oldtown. This plant is equipped with two D-62 generators, driven by two turbines, and an 88-kw. regulating storage battery, recently installed, consisting of 264 cells with "Chloride Accumulator" type F-9 plates in F-13 glass jars, having a capacity of 160 amperes in regulating work.

Before the installation of the battery the road was divided by a section insulator at Orono to prevent overloading the small plant, but it was impossible to obtain satisfactory service or to maintain the cars on time, owing to the poor voltage regulation at the bus bars, due to the effect of the rapid and violent fluctuations of load, which caused the speed of the water wheels to undergo a wide variation. The extreme variations of bus bar voltage touched 700 and 350 volts, because of the inability of the governor to open the gates of the turbines quickly enough to meet the needs of a sudden heavy load or to close them again instantly when that load was suddenly removed. Thus the voltage at a car when climbing Academy Hill, about half a mile from the power station, would be down to 250 or 300 volts on the steepest part. Fig. 1 gives readings of load and bus bar voltage before and after the installation of the battery. Unfortunately, as it was not possible to take simultaneous readings of station load and battery discharge, the comparison of these readings does not do full justice to the station, because the loads in January were heavier than those in September.

The battery is separated from the power station by the Penobscot River, which is about 1,500 ft. wide at this point, and the station is connected with it and with the line and track by copper cables spanning the river. Although no regulating booster is used with the battery, it was not found necessary to modify the compounding of the generators in any way, as the drop in the cables and the natural tendency of the water wheels to change in speed with change in load furnishes sufficient voltage variation at the battery terminals to insure its taking its proportion of the load.

An experiment was recently made looking to the supply of power at the battery terminals by boosting from the Veazie power station instead of from Milford. As Veazie is a water power station, the energy wasted in boosting entails practically no cost and the shutting down of the Milford station effects a considerable saving in labor, and under certain circumstances may save a charge for water power which is now rented.

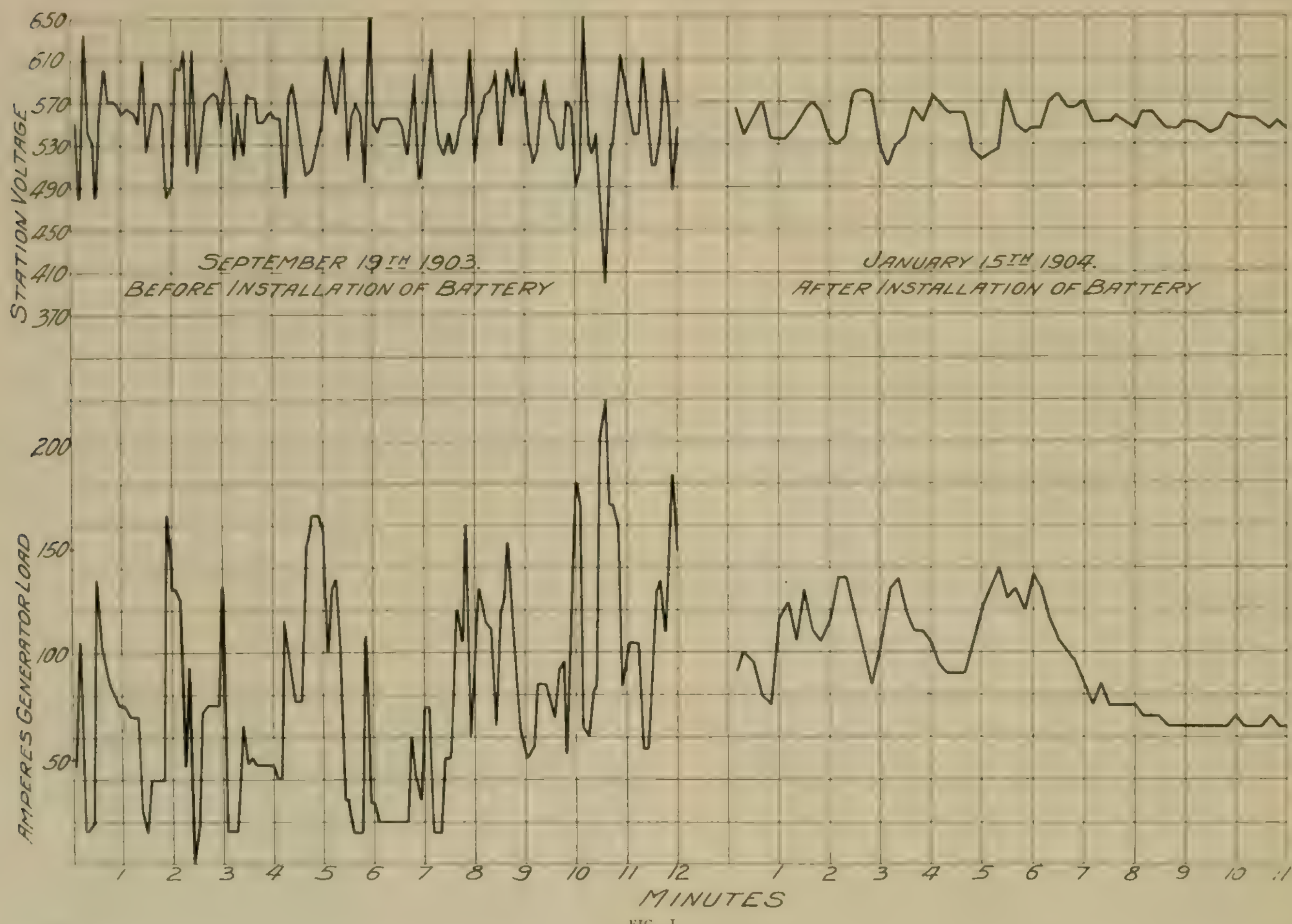


FIG. 1

THE PORTLAND RAILWAY.

The Yarmouth Branch of the Portland Ry. offers a problem in transmission, which has been very interestingly solved by the installation of two storage batteries, one at Underwood Park, about five miles out of Portland, and one at the end of the line, in the Yarmouth carbarn.

The Portland and Yarmouth line, which connects Portland with Yarmouth, 13 miles away, forming a link in the chain of roads between Portland and Lewiston, was built and operated originally as an independent road, having a steam driven power station located a short distance beyond Underwood. The Portland Ry. acquired the road with the intention of reducing the expense of operation as much as possible, and to do this it was necessary to shut down the Underwood power station and operate the whole road from the Portland power station.

The winter service consists of five regular cars and one express car, with one or two extras morning and evening between Portland and Underwood. In summer, in addition to the five through

cars, three are operated between Portland and Underwood, and usually five extras for a couple of hours in the afternoon and evening for the benefit of the crowds going to and from the theater and amusement grounds at Underwood. On holidays, the regular service consists of 16 cars, and 22 or more for two periods of two hours, to accommodate the crowds to and from the park.

The profile of the entire line is extremely uneven, but especially so beyond Underwood. The distance covered by the line is too great to permit of operating it with copper alone, and at first it was operated with a series booster, which entailed practically no extra expense for first cost, as the two 100-kw. machines of the old power station were utilized, one as a motor to drive the other, which was rewound as a series booster. The combination was located in the Portland station and operated in connection with two 0000 wires running to the end of the line and making their first connection with the trolley just beyond an insulating joint placed at Underwood. The section up to Underwood was fed with a 500,000-c. m. feeder directly from Portland, and the section beyond entirely through the booster.

The results, however, were not satisfactory. The loads in the booster section fluctuated very violently, being made sharp and heavy by a number of very steep grades. Near the end of the line there is a grade, part of which is 14 per cent, and which averages 10

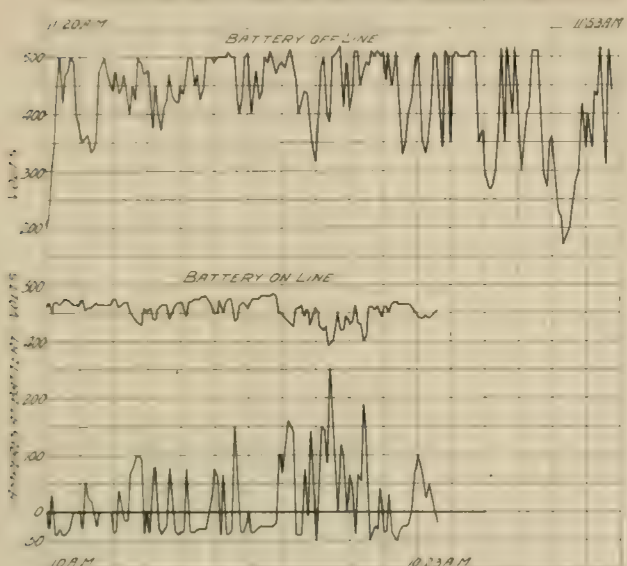


FIG. 2.

per cent. The voltage at this point under ordinary conditions was habitually 200 volts or lower with the car climbing the hill, although the average voltage was about 450, and 700 volts would be observed when the car reached the top of the hill and shut off power.

On holidays, of course, the results were extremely unsatisfactory on the road, and even with moderate holiday loads, such as Sundays, the cars were habitually 30 minutes to 45 minutes behind their schedule. The booster itself was subject to short, but heavy overloads, which produced serious sparking and made it necessary to turn down the commutator frequently. The booster was also found to be sluggish, and though it should have supplied approximately one volt per ampere, the voltage at its terminals was often 50 to 100 volts low when the load lasted but a short time and correspondingly high when the load suddenly fell away, thus causing the high readings noted above, which brought up the average voltage, it is true, but were of no value in propelling the cars.

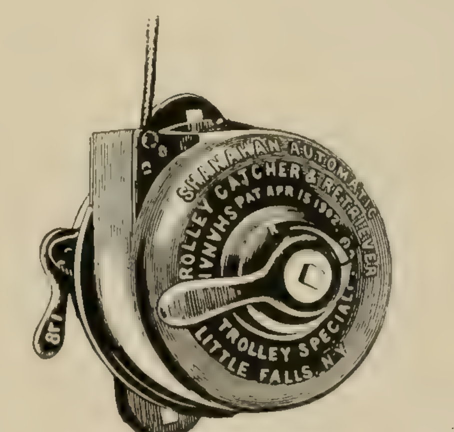
It was decided to add to the equipment a battery of 250 cells, G 17 in G-17 tanks, at Underwood Park, floating at 520 volts and having a capacity of 640 amperes in regulating work, also a battery of 224 cells, F 9 in F 13 glass jars, at Yarmouth, with a capacity of 160 amperes in regulating work at 465 volts. These batteries are of the "Chloride Accumulator" type, furnished by the Electric Storage Battery Co., of Philadelphia, Pa.

The whole line is now operated as a unit, and the booster was rewound as a shunt machine and now operates under a steady load of approximately 25 kw. instead of as formerly under a load averaging about that amount, but fluctuating from 0 to 100 kw., or even higher on holidays. The combined storage capacity of the two batteries when fully charged is sufficient to care for five cars for eight hours, and is sufficient to permit of operating all the extras on the heaviest days without loss of time and without extra drain on the power station. The readings in Fig. 2 were taken at the battery house at the end of the line, and show very clearly the effect of the battery in maintaining the voltage near the average, preventing the excessively low readings encountered when a car is climbing the nearby hill. In snow storms also the batteries have been found of great use in maintaining the service.

Shanahan Trolley Catcher and Retriever.

The Shanahan Trolley Specialty Co., of Little Falls, N. Y., has placed on the market the Shanahan automatic trolley catcher and retriever, for which it is claimed that it has been thoroughly tried and tested and has never been found wanting, but invariably does the work for which it has been designed, regardless of speed, rain, snow or ice. It works entirely automatically, and the instant the trolley leaves the wire, from any cause whatever, it will pull it down from 2 to 6 ft., as may be desired, and hold it there until released. Replacing the trolley and resetting the retriever are accomplished easily and quickly. The motive power of the retriever is a large spring, and this can be adjusted to any tension desired, to correspond with the tension of the trolley pole.

Only one catcher and retriever is required for each car. Two bases are furnished with each retriever, and these are attached to the ends of the car, and by the use of a small locking lever the device can be changed from one end of the car to the other very readily without the use of tools. So convinced is the maker that the Shanahan retriever will do all that is claimed for it, that the company guarantees every retriever and all parts of the same for one year. The company further agrees to send one or more to



SHANAHAN TROLLEY CATCHER

any railway company on trial, and in fact it earnestly requests this privilege.

The device is the invention of Mr. Thomas B. Shanahan, of Gloversville, N. Y., president of the company, who, for the past ten years, has been master mechanic in the electrical department of the Fonda, Johnstown & Gloversville Railroad Co. In this position the necessity for a mechanism that would automatically control the trolley pole became very apparent to Mr. Shanahan, and having, by actual, practical experience, a thorough knowledge on the subject of trolley catchers and retrievers, he was able to originate and produce a device that would fill all the requirements.

The other officers of the company are: John N. Shanahan, vice-president, general superintendent of the Fonda, Johnstown & Gloversville Railroad Co.; Homer P. Snyder, treasurer and manager, president, treasurer and manager of the Homer P. Snyder Manufacturing Co., of Little Falls, N. Y.; secretary, Edward S. Van Valkenburg, assistant manager and secretary of the Homer P. Snyder Manufacturing Co.

To Remove Sleet and Ice from Third Rail.

BY WILLIAM GRUNOW, JR., BRIDGEPORT, CONN.

The accompanying illustrations make clear the third-rail electric heating system which has been devised by the writer for removing, and even preventing, accumulations of sleet and ice upon the third rail. The method is readily applicable to the style of third rail now in use and the temperature of the rail can be quickly raised a number of degrees above the surrounding atmosphere with an economical use of current.

As will be seen by referring to the illustration a steel heating wire extends along the length of the rail, from which it is insulated by porcelain bushings. The wire is held in position close under the rail head by wood strips which also extend along both sides of the rail, enclosing it. One end of the heating wire is directly connected to the third rail, while the other end is connected to the ground by a switch provided with a magnetic blow-out, and which may be operated electrically from any point to open and close the heating circuit. The heating wire is also provided at intervals with tubular telescoping joints which permit of its expansion and contraction when heating and cooling. The wood strips serve to shield the rail from wind effects and also to maintain the raised temperature of the rail for a greater length of time.

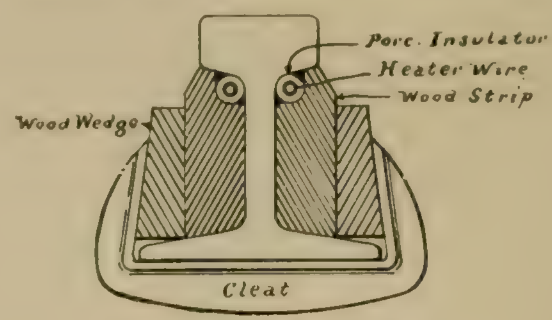
This system of heating the third rail was put to test on different days in February and March, 1904, in the yards of the Connecticut Railway & Lighting Co., at Bridgeport. One heating wire was mounted on a 70-lb. T-rail, 30 ft. long, in the manner described. The wire was connected in series with a water barrel rheostat, the amount of current consumed by the rheostat and wire being equivalent to the amount of current that would be consumed by a similar wire one-half mile long heating one-half mile of third rail. This experimental rail was out doors, where it was exposed to weather conditions similar to an installed third rail, the temperature of the air ranging from 15° to 31° F. At times water was poured over the rail the night before, to produce a thick coating of ice. The writer was assisted in making the tests by Mr. W. T. Oviatt, electrical superintendent, and Mr. R. B. Davis, also an engineer, both employed by the railway company.

The averages taken from all the tests give: Temperature of the air, 23° F.; current consumed, 90 amperes at 500 volts pressure; time wherein ice was melted, 12 to 15 minutes; rise in temperature of rail above 32° F., 2° to 19°. At the time of the tests, when the temperature of the air was 15° F., the temperature of the rail was in 15 minutes raised to 34° F., or 2° above freezing, at which point melting occurred. This condition, however, is not a natural one and would not occur in practice, but it served to demonstrate the efficiency of the system and to what extent the temperature of the rail can be raised within a stated time.

Again, when the temperature of the air was 31° F., the temperature of the rail was raised in 12 minutes to 50° F., or 18° above freezing. The temperature of the one heating wire used in the tests was about 475° F., according to calculation, consuming an electrical energy of 45,000 watts. It was noticed that almost regularly within eight minutes after the heater circuit was closed the ice would crack and loosen from the rail, so it could be brushed off, and at the end of 12 or 15 minutes the ice would disappear. Even thick slabs of loose ice placed upon the rail would quickly melt away.

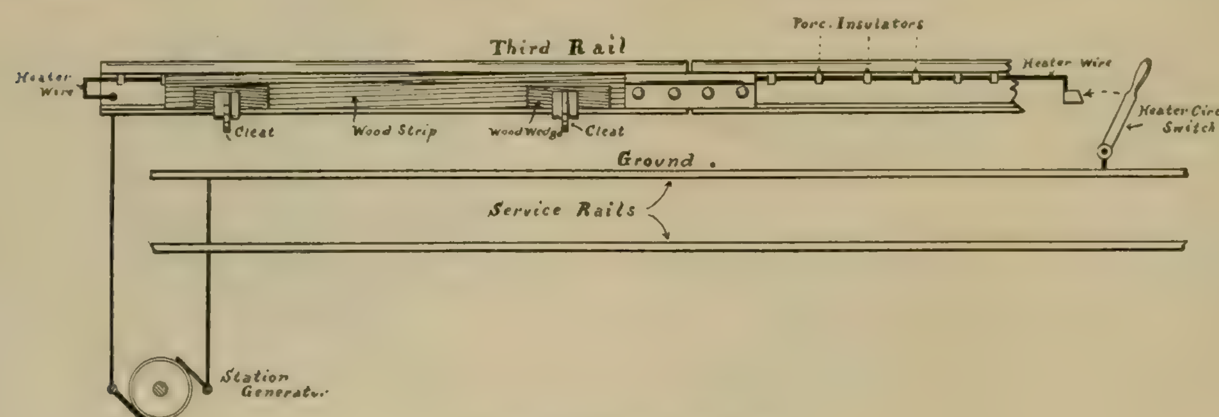
It is assumed that by employing two heater wires, one each side under the rail head, requiring twice the amount of current, like results could be obtained in half the time. During the tests it was noticed that after the current was cut off from the heating wire the temperature of the rail continued to rise, after which it was very slow in dropping to its original condition, and this was attributed to the protection afforded by the wood strips.

For obtaining correct rail temperature readings, the thermometer bulb was inserted in a hole drilled in the rail head, the hole being filled with mercury to afford good metallic conduction to the bulb. A test tube was then slipped over the thermometer to shield it from the air.



CROSS SECTION OF THIRD RAIL.

With this system it is proposed to heat half-mile and single-mile lengths of third rail with a continuous heating wire of corresponding unit length and resistance, whereby the temperature of the wire may be maintained between 450° to 500° with an approximate energy consumption of 45 kw. to 90 kw., respectively, and which at two cents per kilowatt hour for, say, 15 minutes, will represent an approximate cost of 23 cents for the removal of ice from one-half mile of third rail, and 46 cents for one mile. Greater unit lengths of heating wire than one mile are not recommended, the size of the wire that can be insulated and enclosed under the rail head reaching its maximum for that length.



DEVICE FOR HEATING THIRD RAIL.

The system may be applied to any T-rail section without requiring the drilling of holes in the third rail; the rail joints now used can be replaced by a special form having a channel for the reception of the heating wire. The heat radiating from the wire is not likely to discolor or char the wooden strips, but in practice the grooves can be lined with asbestos cement, if desired.

Mr. H. M. Littell, general manager of the Rapid Transit Co. of Chattanooga, recently issued to the employes of the company a circular letter of commendation for services well rendered during what is known in Chattanooga as Spring Festival week. The letter stated that considering the amount of traffic handled the manager never saw a road conducted more smoothly.

Long Scale Portable Instruments.

The Westinghouse Electric & Manufacturing Co. has recently designed some portable instruments, including voltmeters, ammeters, and single phase and polyphase wattmeters. The chief feature aimed at in the design of these instruments is the long scale, by means of which accurate readings may be taken through the whole range of the instrument. The voltmeter is zero reading and each instrument is made in two capacities which in connection with its long open scale enables readings to be taken over a wide range with great accuracy. It is astatic and therefore unaffected by external fields. The regular instrument is made in capacities up to 600 volts, but for higher ranges it may be used with a multiplier.

The ammeter is similar in appearance to the voltmeter and is furnished with coils wound in two sections. These may be connected either in series or parallel, greatly increasing the range of the instrument. The ammeter is for use on alternating current circuits only, but is accurate over a long range of frequencies.

The wattmeters are also provided with coils wound in sections giving each instrument four ranges in capacity, and the scales are uniformly divided from zero to maximum, so that readings may be taken with equal accuracy on any part of the scale. This instrument consists of two single phase mechanisms connected on a single shaft and indicating on a single dial. It may be used for either two-phase or three-phase circuits and will indicate correctly the total energy of a circuit, irrespective of power factor or any unbalancing of the different phases. The mahogany carrying cases for these instruments are highly polished and the general finish and appearance of the different instruments are uniform. Covers are made removable for convenience in use.

Motor Driven Tool Grinders.

The accompanying illustration shows a motor-driven tool grinder which is one of the products of the Western Electric Co., designed for general service, for grinding castings and for miscellaneous work. The motors are for direct current only, wound for voltages

WESTERN ELECTRIC MOTOR DRIVEN TOOL GRINDER.

of 110, 220 or 500 volts, they are shunt wound, to insure a practically constant speed under varying load and the horse power is ample for the service required.

All the motor parts are completely incased, but the commutator and brushes are easily accessible by the removal of dust tight covers on the bearing bracket. The armature is mounted directly on the grinder shaft, which is of the best quality of steel, of large diameter, and especially designed for severe service. The bearings are self-aligning, dust-proof and self-oiling. The larger sizes are provided with oil gages.

Attention is called to the massive construction of the special bearing brackets, the successful operation of the grinding machine depending upon the rigidity of these parts. Each machine is equipped with starter, switch and fuses, and all motor parts are made in quantities to gage, so they may be interchanged. These grinding machines are made in four sizes, designated as 6-in., 12-in., 18-in. and 24-in., and they develop ½ h. p., 2 h. p., 3 h. p. and 5 h. p., respectively.

The 6-in. size is a combination emery wheel and disk grinder, having on one end a 7-in. disk for grinding flat surfaces of small parts, and intended to carry at the other end a 6-in. emery wheel. No speed controller is needed with this machine, as speed changes are not so essential. A hood which in no way interferes with the operator protects the starting equipment from falling particles of emery.

With the 12-in. size detachable wheel guards or protection hoods are provided and are so designed that exhaust pipes can be readily connected, to draw off the dust, if desired. In the 18-in. and 24-in. machines the automatic release starting box is mounted inside of the base of the machine, where it is fully protected from dust and rough usage. The speed variations of these machines is obtained by turning a handle of a controller which is installed in the base. The speed of the 6-in. machine at 500 volts is 3,200 r. p. m.; at 110 and 220 volts it is 2,600 r. p. m. The speed of the 12-in. grinder is from 1,750 to 2,700; the 18-in., 1,100 to 1,700, and the 24-in., from 900 to 1,400 r. p. m.

Advertising Literature.

THE BALDWIN LOCOMOTIVE WORKS, Philadelphia, has issued its Record of Recent Construction No. 47.

THE ARMOUR INSTITUTE OF TECHNOLOGY, Chicago, Ill., has issued the year book for 1904-05. It shows the total number of students to be 1,403.

THE WHEEL TRUING BRAKE SHOE CO., Detroit, Mich., is mailing to the trade an illustrated folder treating of the company's well-known product.

THE BUCKEYE ENGINE CO., Salem, O., has issued a very attractive catalog of 125 pages illustrating and describing the famed Buckeye engines, which are built by this company.

THE NATIONAL ELECTRIC CO., Milwaukee, Wis., has issued Bulletin No. 350, treating of stationary and portable motor-driven air compressors for continuous and intermittent service.

WARREN WEBSTER & CO., Camden, N. J., have issued a bulletin, being part 1 appendix 1 of the general catalog, illustrating and describing the Webster "Star-Vacuum" feed water heater and purifier.

THE THOMAS S. CLARKSON MEMORIAL SCHOOL OF TECHNOLOGY, Potsdam, N. Y., has issued an attractive pamphlet album containing 11 full-page half-tone views pertaining to the institution.

THE GOHEEN MANUFACTURING CO., Canton, O., is sending out to the trade printed directions for applying oxidized carbon cement, which is manufactured exclusively by this company for use in iron and steel work.

THE MAYER & ENGLUND CO., of Philadelphia, has a good many snappy, interesting things to say in the latest issue of the "Keystone Traveler" anent the products for which the company is so widely and favorably reputed.

THE BULLOCK ELECTRIC MANUFACTURING CO., Cincinnati, O., has issued Bulletin No. 1,028 (superseding No. 1,009 A), "Multiple Voltage—The Bullock System of Control for Variable Speed Electric Motors (Patented)."

THE J. G. BRILL CO., Philadelphia, has issued a new catalog treating of the Brill retriever bell, a conductors' bell the clapper of which retrieves the cord and drops back instantly after every pull. It is said to work perfectly through two cars and will retrieve 200 ft. of cord.

THE CROCKER-WHEELER CO., Ampere, N. J., has just issued Bulletin No. 47, "The Power of the Intramural", containing a map in color of the Louisiana Exposition. The company is using this

[illegible] descriptive of principal exhibit at St. Louis, comprising [illegible] type generators.

THE H. W. JOHNS-MANVILLE CO., 100 William St., New York, has just issued a neat and compact catalog covering mica plate, cloth, segments, rings and mica in the various forms required by the electrical industry, also "Vulcabeston", "Transite", "Electrobestos", etc. [illegible] A copy will be sent upon request.

THE STEWART HARTSHORN CO., East Newark, N. J., in the June number of the Hartshorn Roller, maintains the high standard of reading matter and illustrations which has marked this publication from the beginning. It is one of the brightest papers issued by a manufacturing company. It is similar in style and text to "Life."

THE NORTHERN PACIFIC RY. has issued a 22-page illustrated folder describing the Yellowstone National Park, pointing out the best way to get there, and presenting excursion itineraries and side trips. The folder includes also comprehensive railroad and topographical maps and time-tables. The illustrations are colored half-tones.

THE ELECTRIC STORAGE BATTERY CO., of Philadelphia, has issued Bulletin No. 83, treating of "The Operation of 'Chloride Accumulators' in Connection with the Exciter Circuits of Large Alternating Current Generating Stations." Also Bulletin No. 84, "The Installation of 'Chloride Accumulators' in Residential Lighting and Power Plants."

THE OHIO BRASS CO., Mansfield, O., has issued an eight-page illustrated booklet entitled "Connectors for Motor Leads," and treating of the Swain, "Pinlock" and two-way connectors, manufactured by the company. Also an illustrated folder entitled "The Problem Solved—How to Stop a Car at Night", treating of the Haycox electric car signal.

THE PHILIP CAREY MANUFACTURING CO., Lockland, Station R, Cincinnati, O., has issued a 46-page pamphlet, illustrated, treating of Carey's magnesia coverings for steam pipes and boilers. The product is thoroughly described from the ground up, and the catalog contains besides price lists a long list of users. The views show buildings and installations where the company's coverings have been applied.

THE INGERSOLL-SERGEANT DRILL CO., 26 Cortlandt St., New York City, has just issued a new edition of its pneumatic tool catalog No. 5, which shows the Haeseler air hammers and drills, including the latest improvements, and also shows a number of other labor-saving tools operated by compressed air. This catalog first made its appearance at the conventions recently held at Saratoga, where the company had an important exhibit. Especial attention is called to the cover of the catalog, which is unusually attractive.

THE A. H. ANDREWS CO., 174-176 Wabash Ave., Chicago, has issued a very unique folder to advertise its products, such as metal furniture, office furniture, opera chairs, church and school furniture and supplies, etc. The folder is vest-pocket size and contains a number of memoranda pages for jotting down things to be remembered. The contents of the folder embrace the company's products as shown at the World's Fair at St. Louis and on the front cover is the caption, "Good Things at the Exposition; Look Within."

THE JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J., has issued a 26-page pamphlet entitled "Oil vs. Grease Lubrication," and pointing out the special advantages of Dixon's graphite greases. Also a 16-page pamphlet on "Slipping Belts," containing "some observations on leather belting—the causes of its slipping and the conditions which justify the use of a belt dressing." The company is also mailing a card treating of flake graphite for the lubrication of air compressors. "Graphite" for July contains several very interesting and instructive articles bearing on the company's products.

THE UNDER-FEED STOKER CO. OF AMERICA, Marquette Building, Chicago, in the Publicity Magazine for July, published the results of recent boiler trials at the 74th St. and East River station of the Interborough Rapid Transit Co., New York. The firing was by means of a Jones under-feed mechanical stoker under a Babcock & Wilcox 600-h.p. water-tube boiler. There were three trials, the first two of 12 hours' duration each and the third of 8 hours, using Somerset coal. In the first trial the rate of efficiency attained was 76 per cent; in the second, 70.07 and in the third 74.39 per cent.

THE ELMER P. MORRIS CO., of 15 Cortlandt St., New York, has a new catalog, known as "General Catalog No. 6," which deals with wrought iron and steel tubular poles and pole brackets for electric railways, electric lighting, telegraph and telephone service. The catalog contains tables and a number of drawings which will be of considerable service to any one who desires to select the best form of pole for any particular service. Poles constitute but one line of the many specialties handled by the Elmer P. Morris Co. The company also makes a complete line of railway brackets, overhead line material and general railway supplies. It also makes a special business of acting as confidential purchasing agent for foreign firms and corporations, and at present is purchasing for some of the largest corporations in the world. Its experience in this and railway work extends over a period of 25 years. The company transacts the purchasing business in a confidential way, and acts the same in its line as a banker in his.

THE C. & G. COOPER CO., of Mt. Vernon, O., recently issued series of photogravures showing several different types of the Cooper-Corliss engine. The views include 2,500-h. p. cross compound condensing engines, 1,200-h. p. cross compound direct connected engines, cross compound condensing corliss engines direct connected to railway generators, standard girder frame engine, tandem compound corliss engine, heavy-duty corliss engine, 2,500-h. p. complete steam plant installed and equipped by the C. & G. Cooper Co., heavy duty engine direct connected to electric generator, 4,000-h p. twin tandem compound condensing corliss engine, five cross compound condensing corliss engine direct connected to electric railway generators, eight tandem compound corliss engines in railway service, high pressure side of cross compound condensing engine, and cross compound condensing corliss engine direct connected to a three-phase alternating current generator. There are also included in the series two large views, the largest showing a 1,200-h. p. cross compound condensing corliss engine which the company recently installed in the power house of the National Cash Register Co., Dayton, O. The other illustrates the interior of the power house of the Aurora, Elgin & Chicago Railway Co., Batavia, Ill., and shows three 2,500-h. p. cross compound condensing corliss engines operating alternating current generators in parallel.

THE GENERAL ELECTRIC CO., Schenectady, N. Y., has issued the following publications: Bulletin No. 4,374, "Cable Testing Current Transformers." Bulletin No. 4,375 (supersedes No. 4,247), "Sewing Machine Motors." Bulletin No. 4,378, "Pocket Instruments for Direct or Alternating Currents." Flyer No. 2,128, "Flush Wall Receptacle." Flyer No. 2,129, "Switchboard Receptacles." Flyer No. 2,130, "Quick Break Punched Clip Switches for 500 Volt Service." Flyer No. 2,131 (supersedes No. 2,101), "Fuse Wire." Flyer No. 2,132 (supersedes No. 2,090), "Pendant Switches." Price List No. 5,123 (supersedes No. 5,111), "Snap, Pendant and Punched Clip Switches." Price List No. 5,124 (supersedes No. 5,109), "Type H Oil Transformers." Price List No. 5,125 (supersedes No. 5,110), "Type HB Oil Transformers." Price List No. 5,126 (supersedes No. 5,118), "Thomson Recording Wattmeters." Catalog No. 1,123, "General Electric Fan Motors." Catalog No. 1,046, "Lightning Arresters." Folder No. 3,244, "Multiplex Lightning Arresters." Publication No. 9,131, "The Curtis Steam Turbine." Bulletin No. 4,377 (supersedes No. 4,281), "The Sprague-General Electric Type M Control System." Bulletin No. 4,379, "Thomson High Torque Induction Meter." Price List No. 5,122 (supersedes No. 5,112), "Meridian Lamps." Price List No. 5,127 (supersedes No. 5,101), "Lightning Arresters." Price List No. 5,128 (supersedes all previous issues), "Edison Street Series Incandescent Lamps." Price List No. 5,129 (supersedes No. 5,108), "Fan Motors." Price List No. 5,130, "Principal Repair Parts of Form 4, 220-Volt Direct Current Multiple Enclosed Arc Lamp." Flyer No. 2,126 (supersedes No. 2,122), "Punched Clip Spring Switches with Edison Fuse Plugs for 125 and 250-Volt Service." Flyer No. 2,133, "Alternating Current Buzzer." Publication No. 9,132 (supersedes No. 9,114), "Some Facts Regarding Type H Transformers."

Trade Notes.

THE CROCKER-WHEELER CO., of Ampere, N. J., announces that it has retained the engineering firm of Dodge & Day, of Philadelphia, for the purpose of giving to its clients expert advice upon the latest ideas and results in shop practice, in addition to the pure

engineering advice on the design and installation of electrical apparatus.

THE PECKHAM MANUFACTURING CO., of New York, has appointed the Eccles & Smith Co., of 91 Fremont St., San Francisco, and 418 New York Block, Seattle, its agent on the Pacific coast.

THE RAILWAY APPLIANCES CO., Old Colony Building, Chicago, has been appointed exclusive agent for the United States for the railway trade of the Olds Motor Works, Detroit and Lansing, Mich.

THE DE LAVAL STEAM TURBINE CO. made a test at its works at Trenton, N. J., July 16th, of a 150-h. p. De Laval steam turbine direct connected to a Sirocco turbine, giving a pressure of 21 in. of water.

THE HEIL RAIL JOINT WELDING CO., of Milwaukee, Wis., is now engaged in cast welding the tracks of the Cincinnati Traction Co. A large force of men is at work, and the general manager, Mr. Heil, is in Cincinnati giving it his personal attention.

THE FARR & BAYLIES CO. announces that July 1st this concern was consolidated with Stromberg, Allen & Co., and the combined business will hereafter be conducted under the name of Stromberg, Allen & Co., with offices at 302-304 South Clark St., Chicago.

THE EMPLOYES OF THE BERGER MANUFACTURING CO., of Canton, O., in connection with the employes of the Stark Rolling Mill Co., held their annual picnic at Silver Lake July 16th. A fine program of games was enjoyed and a dinner was served.

THE GREEN FUEL ECONOMIZER CO., Matteawan, N. Y., has sold a large economizer to the Wellesley (Mass.) College, to be used in heating the water for domestic purposes and also the feed water for the boilers. The order was placed through the company's Boston office, 1053 Exchange Building.

THE B. F. STURTEVANT CO. announces the removal of its entire plant from Jamaica Plain (Boston), Mass., to its new works at Hyde Park, Mass., where it occupies nine acres of floor space equipped with all the modern appliances for the manufacture of blowers, engines, motors, economizers, forges, steam heating, ventilating and drying apparatus, etc.

THE PNEUMATIC TOOL DEPARTMENT of the Ingersoll-Sergeant Drill Co. has issued an attractive pamphlet containing a full description and excellent illustrations of the construction of the Haeseler "Axial Valve" hammers. Interesting reference is also made as to scope of a recent decision of the Supreme Court bearing on patented features of pneumatic hammer handles.

THE BROWN CORLISS ENGINE CO. stockholders, at a recent meeting, voted on a proposition to increase the working capital $150,000. This will put the company in spendid financial shape and will enable it to carry on some of the largest work on the market. The Brown Corliss company builds an up-to-date engine and has one of the most modern shops in the country at Corliss, Wis

THE D. & W. FUSE CO., of Providence, R. I., has secured a large contract for cut-outs and fuses for the Manhattan Elevated division of the Interborough Rapid Transit Co. The fuses have been delivered and are in service, four fuse boxes being on each car. The D. & W. fuse was chosen for this work after very careful investigation and tests which involved opening dead-short circuits.

THE HEYWOOD BROTHERS & WAKEFIELD CO., Wakefield, Mass., advises us that it is making seats for five cars for the Seattle Electric Co. They are the company's No. 54 Wheeler seats, upholstered in rattan, with adjustable foot rest and pedestal base. The company is to also furnish seats for eight cars for the Iowa & Indiana Railway Co., these seats to be upholstered in Chase leather.

THE VILTER MANUFACTURING CO., of Milwaukee, Wis., builders of refrigerating and ice-making machinery, corliss engines, brewers' and bottlers' machinery, etc., has recently closed a large number of contracts as follows: Twenty-three refrigerating machines, from 9 to 300 tons' capacity; eight corliss engines in sizes from 15 x 36 in. cylinders to 22 x 42 in. cylinders; 22 ammonia piping and ammonia condenser plants.

THE CANADIAN WESTINGHOUSE CO., LIMITED, of Hamilton, Ont., recently closed a contract to furnish the Shawinigan Water & Power Co., Shawinigan Falls, P. Q., with a 6,600-kw., two-phase, 2,200-volt, 3,600 alternations, 180 r. p. m. rotating field alternator, for direct connection with water wheel. Two 2,200-kw. oil insulated water cooled transformers, 2,200-volt primary, 50,000-volt secondary, are included in this contract.

THE BROWNLEE LUMBER CO., now of Chattanooga, Tenn., in order to facilitate the handling of its eastern business, has erected a factory for the manufacture of cross arms at Chattanooga, and on account of the central location has removed its office to that city, where all correspondence should be addressed. The company will continue to operate its factory at Meridian, Miss., and also its warehouse at Cairo, Ill.

KNOX, GEORGE & CO., engineers, of New Orleans, La., advise us that the Banner Lumber Co., of Kentwood, La., has retained them as consulting and locating engineers in making survey and report on 31 miles of road in operation and also on a proposed extension, covering in all about 250 miles. They have also been retained by the city of Opelousas, La., to make a full investigation of the water works and electric light plant with a view to installing some new apparatus and overhauling the present systems.

THE NEW YORK LEAGUE OF HEAT AND COLD INSULATION, representing the steam pipe and boiler covering industry, held its first annual dinner in the Hotel Manhattan, New York, recently, and the enjoyable occasion was rendered more felicitous by the presentation of a beautiful silver loving service to T. T. Lyman, chairman of the executive committee, and manager of the asbestos department of the H. W. Johns-Manville Co. The set comprised a loving cup 18 in. high and a dozen cups.

HAROLD P. BROWN, 120 Liberty St., New York City, has received the following letter from the assistant general manager and engineer of the San Francisco, Oakland & San Jose Ry.: "Regarding tests of your solid copper bonds as applied on our Key Route system, beg leave to state as follows: Using 70-lb. A. S. C. E. section rail double bonded with No. 0000 bonds, moving 300-ton trains of eight cars each, speed 40 miles per hour, we find bonds show practically the same conductivity as the unbroken rail. They are working very satisfactorily."

THE LAGONDA MANUFACTURING CO., of Springfield, O., calls the special attention of steam users and engineers interested in boiler cleaning to an address on "Mechanical Methods of Cleaning Boilers," which was delivered before the Keystone Association, N. A. S., at one of its recent meetings at Pittsburg, by Robert Gregory. Mr. Gregory is himself a practical engineer of many years' experience and the article referred to covers the matter of boiler cleaning very thoroughly. It is published in neat form, and Mr. Gregory will be glad to furnish a copy to anyone interested, who will drop him a card at 112 Wood St., Pittsburg.

THE H. W. JOHNS-MANVILLE CO., of New York, has recently placed a new lining for refrigerator car insulation on the market, known as the "Arctic" brand of Keystone hair insulator. Its distinctive characteristic is that while it possesses the insulating properties of hair felt it combines the papers used in connection therewith, so that instead of involving three operations the "Arctic" can be applied in one. It consists of regular felting hair fastened to and enclosed by two layers of water proof paper. It is furnished in lengths sufficient to reach around a car and wide enough to extend from the sill to the roof plates, thus doing away with joints. For floors and roofs it is furnished to fit the nailing strips and carlines respectively. It is made from 3/8 in. to 3/4 in. thick. The company will be glad to furnish samples and data of tests upon request.

THE ELECTRIC STORAGE BATTERY CO., of Philadelphia, has recently closed contracts for installations of "Chloride Accumulators" for the following railways: With Westinghouse, Church, Kerr & Co., engineers for the Long Island Railroad Co., Hammil, L. I.; Portsmouth, Dover & York St. Ry. Co., Dover, N. H.; California Gas & Electric Corporation for the Petaluma & Santa Rosa Electric Ry. of California; Toledo Railways & Light Co., Toledo, O.; the City Railway & Light Co., Dayton, O. Contracts have also been closed for lighting and power service with the Mutual Life Insurance Co., New York City; Central Oil & Gas Stove Co., Gardner, Mass., and residence plants for Mrs. A. N. Kendle, Lamoille, Ill., Mrs. C. E. Bates, Dalton, Mass. Westinghouse, Church, Kerr & Co. have ordered over 2,000 cells of "Chloride Accumulators" for use in train lighting on the New York, New Haven & Hartford Railroad Co., and over 600 cells have been ordered for the Atchison, Topeka, Santa Fe Railway Co. for signal service. Increases have been made in the plants of the Lancaster Traction Co., Lancaster, O.; the Danville Street Railway & Light Co., Georgetown, Ill., and Rochester Railway & Light Co., Rochester, N. Y.

News Notes.

NEW INCORPORATIONS

*LA SALLE, ILL.—Illinois Valley Railway Co.; capital, $[illegible], to build an electric line from Joliet through Morris, Marseilles, Ottawa, Utica, La Salle and Ladd to Princeton. Incorporators: H. E. Chubbuck, V. J. Duncan, A. F. Schoch, C. E. Hook, Ottawa; F. W. Vedard, La Salle. This is stated to be a reorganization of the Illinois Valley Traction Co., mentioned in the "Bulletin" for Feb. 11, 1904.

*WINONA LAKE, IND.—Winona Interurban Railway Co.; capital, $10,000; to connect Warsaw, Goshen and Wabash. Directors: J. M. Studebaker, South Bend; H. J. Heinz, Pittsburg; E. F. Yamelle, Ft. Wayne; J. F. Beyer, Warsaw; F. L. Marshall, New York; S. C. Dickey, Indianapolis, Thomas Kane, Chicago.

*OMAHA, NEB.—Omaha & Nebraska Central Ry.; capital, $1,500,000; to build an electric railway from Omaha to Hastings. Incorporators: Charles J. Helm, Anthony Texter, Charles H. Deeter, Frank Helm, Anthony G. Buski, Chicago. E. C. Page, Omaha, is attorney.

*BATTLE CREEK, MICH.—Battle Creek & Grand Rapids Inland Lakes Traction Co.; capital, $52,000. Incorporators: Alfred E. Paulen, of Battle Creek, and others.

*TOLEDO, O.—Toledo & Point Place Electric Railway Co., mentioned in the "Bulletin" for June 29, 1904; capital, $30,000. Incorporators: John A. Dunn, William R. Leflet, August Lang, William C. Gertz, Christian F. Yesling.

*WINCHESTER, VA.—The Winchester & Washington Electric Ry. has applied for a charter to build between the cities named. President, N. H. Hansbrough, president of the Shenandoah Valley Na

ALONG THE MAINE CENTRAL R. R.

Maine's rapid growth as a summer resort - perhaps summer home is the better term—affords the most satisfactory illustration of the evolution of the vacation idea. Most clearly it is a case of the selection of the fittest—the fittest place for rest, the recreation, the temporary change of locality, which custom more and more vigorously enforces with the high sanction of common sense, aided, abetted and interestingly encouraged by increased facilities for luxurious travel, facilities which have kept ahead of popular demand rather than followed meekly at its heels. A definite statement of the magnitude of summer travel to Maine is found in the compilation of figures from the business done by the Maine Central Railroad, whose lines of steel connect every section of the state and lead to a greater galaxy of summer resorts than is the portion of any other railroad in America.—New York Herald.

STREET RAILWAY REVIEW

Vol. XIV — AUGUST 20, 1904 — No. 8

Notes on Street Railway Systems of Buenos Aires.

BY GUILLERMO A. PUENTE, MEMBER NATIONAL COMMISSION OF ARGENTINE REPUBLIC, LOUISIANA PURCHASE EXPOSITION.

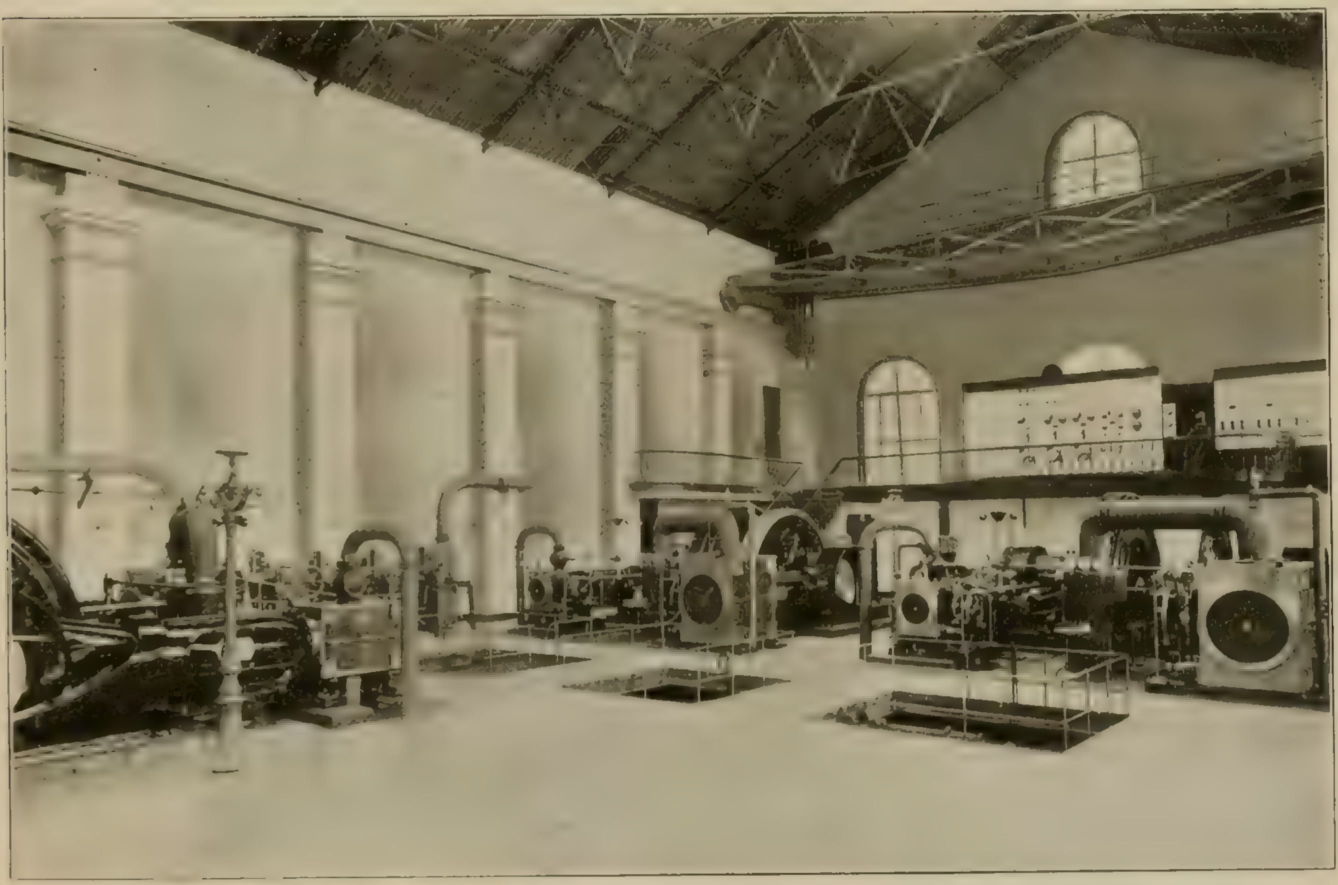
In order to give a correct idea of the development of the street railway systems of Buenos Aires, a brief description of which was published in the "Review" for June, 1904, page 355, I have prepared the statistics furnished in the following tables. The figures quoted are those of the Municipal Bureau and are therefore official. These tables have been extracted from a report of this bureau for the year 1903 and give briefly both the earnings and operating statistics of the several traction companies in Buenos Aires operating both electric and horse traction.

In making comparisons of the earnings of the different companies it should be remembered that the figures given are in dollars of the national currency of the Argentine Republic, one dollar being equal to 42.72 cents American money.

At the present time the total length of the electric lines may be considered as about 28 kilometers more than given in the table, this being the length of the lines of the Metropolitan system which has recently been converted to electric traction. There is also an interurban line 25 kilometers long connecting the town of Quilmes with Buenos Aires, which is just being put into operation, the preliminary trial trips having recently been made. This interurban line is worthy of notice as the principal reason for its being built was to meet the requirements of a large brewery in bringing its products to Buenos Aires. The brewery company considered it would be advantageous to build its own means of transportation for the reason that it could handle its products much cheaper than by forwarding them over the steam railroads on account of the high transportation charges. This line will also operate a regular passenger service.

The projected construction of an underground electric railroad from the central plaza to the several railway terminals within the city has long been discussed and a concession for this road has been granted but owing to its having been undertaken by parties whose financial standing was not of the highest they were unable to raise the necessary capital and in consequence Buenos Aires is still waiting for its tube railway. According to latest advices, however, these financial difficulties have been overcome and there is every hope that the construction of this road will be commenced shortly. The possibilities of the Argentine Republic and the city of Buenos Aires especially, as a field for investment in street railway enterprises, cannot be overestimated.

In Buenos Aires the existing surface lines are inadequate to handle the present traffic in the central part of the city and the



INTERIOR OF POWER STATION OF THE ALLGEMEINE ELEKTRICITAETS GESELLSCHAFT, OF BUENOS AIRES

HORSE TRACTION 1903.

	No. of stations	Length of lines km.	Car mileage km.	Number of cars in service.	Number of horses in service	Number of employes.	Trips per month	Number of passengers.	Total gross receipts.	Trips per inhabitant.
City of Buenos Aires	6	61 051	8,338,864	183	2 670	1,061	788,375	28,421,370	$2,832,254 50	
Anglo Argentine			1,950,094				185 817	5,529,091	579,408 05	...
Gran Nacional	6	90 710	7,989,138	169	1,988	719	568,554	18,847,543	1,914,508 87	
La Nueva	3	35 240	1,788,726	27	419	166	148 587	4,055,836	406,774.96	
La Capital	1	2 900	152,893	3	51	20	61,302	224,652	21 867 80	....
La Rural	2	34 500	3,706,080	64	1,160	355	223 167	9 837 941	1,077 671 70	.....
El Metropolitano	1	27 386	2,019,814	43	645	300	144,526	3,991,981	401,106.28	......
Central Argentine	1	1 808	38,305	2	11	6	20,184	142,505	2,763.73	
Total	20	253 685	25,984 514	491	6,924	2 630	2,137 312	71,050,519	$7,236,375.89	....

ELECTRIC TRACTION 1903.

Buenos Aires & Belgrano Co.	2	57 758	5,164,709	91	......	534	505,711	14,998,367	$1,872,512.90	....
La Capital Co.	3	51 430	4,650,436	55	......	497	340,025	15,699,209	1,596,743.54	......
Buenos Aires Electric Co.	1	16 244	578,454	13	......	103	72 259	2,031,833	212,161 30	.....
Anglo-Argentine Co.	4	104 927	8,076,311	215	......	878	723,998	29,941,370	3,099,485.35	......
Total	10	230 359	18,469,910	374	....	2,012	1,641,993	62,670,779	$6,780,903.09	......

RECAPITULATION.

Horse Traction	20	253 685	25,984,514	491	6,924	2,630	2,157,312	71,050,519	$7,236.375.89	79
Electric Traction	10	230 359	18,469,910	374	.....	2,012	1,641,993	62,670,779	6,780,903.09	70
Total	30	484 044	44,454,424	865	6,924	4,642	3,779,305	133,721,298	14,017.278.98	149

number of cars and their size cannot be increased to any great extent on the present lines. It must be remembered that the natural increase of the population is about 20 per cent per annum exclusive of immigration, and that the city is the capital of the richest agricultural country of the south temperate zone. The mineral wealth of the country is only just being opened up. It has an export trade of $220,984,524 and its imports amount to $131,206,600, leaving a balance in favor of the country of $189,777,924. With its international and internal peace assured its future position will come high up in the list of great cities of the world and it is now well on its way to this end. In considering electric traction enterprises as investments in the Argentine Republic it is worthy of consideration that all material for electric railways, as well as coal, is imported free of duty.

Power for Electric Traction.

Power for electric railway purposes in Buenos Aires is generated exclusively by steam engines as there is no available water power

COMPARATIVE STATEMENT FOR JANUARY, FEBRUARY, MARCH, 1904.

	Horse Traction		Electric Traction	
	1903.	1904.	1903.	1904.
Stations	20	20	10	10
Length of lines	253.685kw	253.685kw	230.559kw	230
Number of cars	1,241	1,241	455	469
Cars in daily use	491	503	374	385
Horses in daily use	6,924	7,017	. .	. . .
Number of employes	2,630	2,731	2,012	2,012
Number of passengers carried	20,155,202	16,751,358	11 251,105	18,744,530
Receipts	$1,685,730	$1,698,046	$1,710,539	$2,030,346

TOTAL FOR THREE MONTHS.

	1903	1904	Increase.
Passengers carried both horse and electric	31,406,307	35,495,888	4,089,581
Total receipts horse and electric traction	$3,396,269	$3,728,392	$332,123

VIEW OF TRAMWAY LINE IN BUENOS AIRES.

within a distance that for the present would render its utilization commercially practicable. The Allgemeine Elektricitaets Gesellschaft of Berlin, Germany, operates in Buenos Aires under the name of Compania Alemana Transatlantica de Electricidad and this company has an entire monopoly of the supply of electric current for lighting, power and traction with one exception, that being the

The power stations of the German company, as it is generally called, are four in number, two of which furnish direct current and two three-phase current. These stations have at present a combined capacity of 16,050 h. p. and to this figure there is being added 3,000 h. p. direct current and 3,000 h. p. alternating current, for which the machinery is now being erected. There is also an-

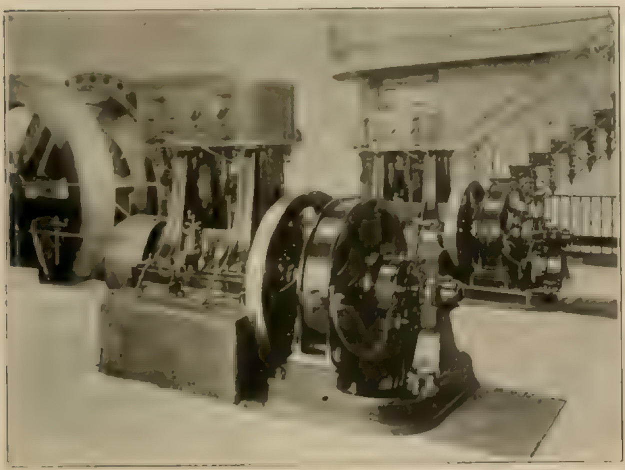
POWER HOUSE OF THE ALLGEMEINE ELEKTRICITAETS GESELLSCHAFT OF BUENOS AIRES.

Capital Electric Tramway Co. and its extensions. The latter company possesses a modern power house designed and erected under the supervision of American engineers and it is equipped with boilers, engines and electrical machinery of American manufacture.

This power station is situated at the extreme eastern end of the company's lines and it is equipped with vertical high speed con-

other power house in the city owned by the Anglo Argentine Tramway Co., but which is operated by the German company, and this brings the total capacity controlled by the latter company up to 32,050 h. p.

These power stations are not advantageously situated with regard to the lines to which they supply power, as their locations were



STEAM DRIVEN EXCITER SETS.

MOTOR GENERATOR SET FOR OPERATING ELECTRIC CRANE.

densing engines direct connected to multipolar dynamos. These generate direct current at 550 volts. This station is also equipped with water tube boilers, a cooling tower, economizers, booster and a battery of accumulators. A second battery of accumulators is installed on the line at a distance of 12 km from the station and it acts as a regulator.

determined by the water facilities for condensation purposes and for convenience in obtaining their supplies of coal. A number of illustrations of one of these stations are shown herewith, from which it may be seen that the building is a very handsome structure of pressed brick. From the general view of the engine room it will be noticed that its interior arrangements are most spacious.

The equipment of this room consists of horizontal cross compound condensing corliss engines direct connected to revolving field alternators. The exciter sets are independently driven vertical high speed compound condensing engines direct connected to multipolar generators. In addition to the steam-driven exciter sets a motor generator, shown herewith, is used to operate the overhead traveling crane and it can also be used in case of emergency for the field excitation of the alternators. The switch board is provided with the usual measuring, controlling and synchronizing instruments as well as switching apparatus and a view of the arrangement of cables in the rear of the switch board is shown in one of the accompanying illustrations.

The boilers are of the water tube type and operate at a pressure of 200 lb. These supply the engines through sets of pressure reducing valves, which allow of great flexibility in the steam pressure for carrying extra loads.

In all of the power stations the different nationalities of the manufacturers of machinery is very striking. For example, in the station illustrated we find the steam engines are of American make, the dynamos German, the boilers French, and the condensers American. From this station current is distributed through underground cables to step-down transformer and rotary converter sub-stations. The current from these sub-stations operates the lines of the Buenos Aires Electric Tramway Co. The voltage of the high tension transmission lines is 6,000. The different stations of the German company are all connected so that each power house may assist the others.

The first power house built by the German company is a steel frame structure filled in with expanded metal and cement. Its capacity is 7,000 h. p., which is generated by horizontal triple expansion cross compound condensing engines with Sulzer valves. These are direct connected to multipolar generators. In this station we again see the cosmopolitan feature of the manufacture of the machinery, the engines being Italian, the dynamos German and the boilers English.

CABLES AT BACK OF HIGH TENSION SWITCHBOARD.

The largest power station in the city is that of the Anglo Argentine Tramway Co., which has been rented to the German company. The latter company operates this station and the tramway company, which owns the station, buys its power at a fixed rate per kilowatt. This station is very similar to the direct current station of the German company, and may be taken as the latest model of continental practice. During the year 1903 the different power stations in the city of Buenos Aires generated 20,049,638 kw. for electric traction purposes.

There are at least six cities in the Argentine Republic that are ready for electric street car service, and, in fact, in some of them preliminary steps have already been taken for the establishment of city and interurban lines. I am convinced that before five years have passed electricity will be doing for Argentine what it has done for its elder sister, the United States of America, to which we come for methods and aids to develop our ideas and resources. Much has already been done, but it can only be considered as the first step. Our desire is that eventually in every city and town of the Republic the traveler, upon alighting from our modernly equipped and managed railroads, shall find electric street car systems ready to transport him quickly and inexpensively to the doors of the merchants to whom he comes to transact business and by whom he is always welcome.

CONDENSING PLANT, SHOWING WHEELER CONDENSER.

Car Repairs on Metropolitan Elevated.

On the Metropolitan Elevated, Chicago, all cars are expected to run for fourteen months without a general overhauling. After this interval the cars are taken into the shops, varnished, floors painted, trucks painted, etc. While the car bodies are in the paint shop being cleaned and repainted, the trucks are taken down to the truck shop and given a thorough overhauling, the brake rigging being adjusted, journal boxes and brasses refitted, and in the case of motor trucks, the electrical equipment thoroughly gone over and put in good repair. In case the wheels show the effect of wear, they are turned to standard M. C. B. gage.

Motor cars make about 4,000 miles per month and trailer cars about 2,600 miles per month, all cars which are motor cars being in constant service while the number of trailers varies from one to four per train; for 16 hours of the day two-car trains are operated, and during the other eight hours, the number of cars per train is three, four, or five, according to the traffic to be handled. On those branches of the line which have a loop at the terminus, the cars are turned end for end once every ten days in order to eliminate the uneven wear of wheels, which might result from moving constantly in the same direction over a closed track. On the lines where there is no loop at either terminus, the cars do not need to be turned as the reversal of direction is effected at the end of each complete round trip.

Mr. A. E. Stillwell, president of the Kansas City & Orient Ry., who has recently made a trip of inspection of the line, reports that the construction work is progressing rapidly and that he expects to have the line to Wichita completed within a very short time.

The Growth of an Electric Railway—III.

BY L. E. GOULD.

No rule can be laid down for specifying the correct weight of rail. The electric railway service has shown itself to be much less severe upon rails than its competitor, the steam road. This is principally due to two reasons. First, lesser weight per axle, electric cars scarcely ever carrying over 12 tons per axle, while steam engines often have a weight of 40 tons, plus the added effect due to the inertia of their reciprocating parts. Second, flexibility, the trucks of electric cars being four-wheeled and pivoted, while steam locomotives often have six and eight rigidly fastened drive wheels, the latter being very severe upon curves. The above comparisons show that other conditions, as ballast, ties, etc., being equal, a lighter rail may be used in electric service, and still maintain the same high standards of alignment and surface as the steam tracks. The writer believes a 65-lb. or 70-lb. A. S. C. E. section of rail is sufficiently heavy to meet all requirements for any electric interurban service, and that many roads now using 80-lb. steel would have found it better economy had they used 70-lb. instead, then spent the difference in the cost between 70-lb. and 80-lb. steel for bettering the quality of their ties and increasing the amount of ballast. In electric construction 60-ft. rail lengths in place of 30-ft. lengths are now much used, thus doing away with the cost of one-half of the joints and one-half of the bonding. These advantages from an operation standpoint are obvious.

The present general use of patented rail joints such as the Weber, Continuous or Atlas, is very widespread. This seems to be a sufficient recommendation for their claimed qualities. The most advantageous detail to be looked for when selecting a joint is its ability to prevent sagging and a permanent bend in rail ends. Care must be taken that the section of the rail and joint are so designed as to leave ample room for the bond wires.

When the rails have been spiked and the track thrown into rough line the ballast will next be unloaded, the track raised to surface, the ties tamped, then given its true lining. The duties of ballast are to furnish the ties, and thus the rails, with a solid, uniform bearing, thus distributing the load upon the roadbed, holding the ties in position and furnishing the track with good drainage. Clean broken stone or washed gravel do these duties best.

Bonding should not be done until the track has been raised, otherwise the racking of the rails in surfacing and lining might tend to weaken the contact. The number of designs of bonds upon the market is large, each maker claiming special advantages for his peculiar type. Two general designs are mainly prevalent, namely, those having compressed and those having soldered terminals. General practice seems to favor the bond made by fusing a terminal on the ends of a number of flexible strips or wires of copper. These terminals are expanded by hydraulic or screw pressure into holes punched or drilled through the web of the rail, between the joint bolt holes. Care should be taken that both the holes and the bond terminals are bright and dry at the time of compression. Two bonds, placed on opposite sides of the rail, should, for safety's sake, be used at each joint. It is customary to install No. 0000 cross bonds at intervals of about 1,000 ft. and at each end of special work. The last-mentioned cross bonds should be joined by a copper cable of cross section equal to the conductivity of the track, thus shunting the special work and insuring as high conductivity as any in remaining portion of track.

As earlier mentioned, one of the advantages of a private right of way is the permissibility of using standard steam railway special work. This advantage should not be neglected, because present interurban practice seems to favor standard M. C. B. flanges, thus necessitating plenty of room in the frog throat and switch. At sharp curves, where the line of sight ahead of the motorman is obstructed, it would seem wise to double track the curves. Such a feature may be used as a possible passing point and thus serve a double purpose. The element of safety alone will warrant the extra cost, however.

All bridges and all curves with radii of 500 ft. or less should be guarded with extra rails.

Distributing System.

The correct design of a distributing system for an electric railway is a difficult problem, due to the distance encountered and the changing of the load both in the amount and the position

An electric railway distributing system may be easily divided into three prominent parts, the feeders, the working conductors and the return circuit. We have discussed the bonding of the joints for the path of the return current through the track rails, and next in order will come the feeders, which supply power to the working conductors.

On short city lines it is economically efficient to use direct-current generating apparatus and maintain an approximately equal pressure throughout the working conductor by the use of large feeders tapped in at appropriate intervals. While this method is satisfactory at close distances to the generating station, at greater distances it becomes prohibitive, due to the excessive cost for heavy feeder system and the resistance losses connected therewith. The possible voltage which can commercially be generated by direct-current apparatus is limited to a pressure of about 600 volts. This, therefore, limits the radius over which a direct-current feeder system can reach, hence on longer lines other methods must be resorted to.

With a trolley line say 16 or 18 miles in length, having a power station at one end, the booster system may fill the much-needed want. In this system a separate feeder is installed from the power house to the point of feeding the working conductor. The average load required at the feeding-in point is determined as accurately as possible, and the size of the boosting feeder calculated, which will give approximately from two to three hundred volts drop, for the entire distance between the generating station and this feeding-in point. A booster which is essentially a direct-current generator wound to furnish the desired average current at a voltage equal to the drop in the booster feeder is installed in the generating station. Current is taken from the main bus bar at generator voltage, and led through the booster, where there is superimposed upon the bus bar voltage the voltage of the booster, this being an amount equal to that which will be lost in transmission over the booster feeder from the generating station to the feeding point. The constant losses in such a system are quite large, but when balanced against the cost of sub-station attendance or the excessive first cost and maintenance of very large positive feeders, the booster system shows itself able in many instances to fill a much-needed want.

When feeding distances exceed the limits in which the above methods are applicable, the alternating-current system of distributing best fills the place. In this system there are installed in the power house generators which will furnish three-phase alternating current at pressures in the neighborhood of 2,000 volts. This pressure is raised by means of step-up transformers to as high as 40,000 volts, at which potential it is transmitted along the line with a very small loss, and then lowered at properly located sub-stations to a pressure of about 350 volts, and converted by means of motor generator sets or rotary converters into direct current at about 600 volts pressure, in which form the power is fed to the working conductor.

At the present date several systems using alternating-current motors on the cars, and thus doing away with the rotary converter in the sub-stations and the added cost of sub-station attendance, have been devised and a few brought to such perfection that they are now placed on the market by prominent electric manufacturing concerns. Heretofore the alternating-current motors which could successfully be used on railway systems have been of multiphase type. This, of course, necessitated the use of a complicated working conductor system consisting of two or three overhead trolleys. Lately, however, much interest has been shown and admirable progress been made with the single-phase systems. The car motors for such service are quite similar in design, efficiency and weight, to the present 600-volt, direct-current apparatus. The advantages of such a system, which has only one overhead conductor, of small cross section carrying a high voltage, together with the great reduction in the first cost of construction, as well as the sub-station labor cost in operation, are obvious, and seem to insure for it a bright future.

Upon the stability of the pole line between the power house and the sub-stations depends the continuity of service. With the growth of alternating-current distribution systems, many of the characteristics of the city lighting system pole lines were clung to with much tenacity, but practice in the last few years has stepped forward until now an alternating-current, high-tension railway feeder pole line can be distinguished from any other line of wires nearly as far as it can be seen. Such systems are designed for a loss

between the extreme limits of transmission not greater than 5 per cent of the generated power. Even with this small percentage of loss as compared with direct-current feeders, a seemingly small wire can be used. Wires as small as No. 4 and No. 6 B and S gage can, when properly strung, be used with safety.

In very few instances would it be profitable to string more than one high-tension circuit upon the same line of poles. However, many lines have been built with two circuits of three wires each, upon the same poles and cross arms, the idea of this being that in case of accident to one circuit, current might be shut off from that circuit, and the other circuit used while repairing the first. Such an idea is, in the writer's estimation, a great mistake, because adding a second circuit to a pole only complicates the system, and no man should be sent to repair a circuit on one side of a pole with a second circuit on a pole alive at a pressure of from 10,000 to 30,000 volts, and if there is but a single circuit, then, with storage batteries placed in sub-stations, cars may be kept running for an hour during line troubles, which interval, with cars in operation, is ample time for a lineman to mend any ordinary break which has occurred in the single circuit at the top of the pole. With only a single circuit on a pole a much greater distance between wires can be obtained, and corresponding liability for short circuit obviated. High-tension poles carrying single circuit of No. 2, No. 4 or No. 6 copper or aluminum wire may be safely set at 125 to 140 ft. apart, although on systems using trolley bracket construction this distance will necessarily be cut down, owing to such a great length of trolley span not being mechanically strong.

On lines operating at a pressure of 20,000 to 30,000 volts, care must be used in the choice of insulators. The porcelain insulator for such voltage seems to be most widely used, but the fact that many lines are now operating at pressures as high as 40,000 volts, with wires tied to glass insulators, seems to leave the decision as to the relative merits of the two to qualifications other than that of insulation resistance. The writer has noticed the fact that in all high-tension distributing systems, after a time of two or three years has elapsed, all iron work on the pole tops seems to have been affected by small leakage currents. He therefore recommends a pole top construction with as small an amount of metal work as mechanical strength will allow. High-tension lines are usually transposed by revolving the triangle of wires through 120 degrees. This may best be done in two pole lengths by changing the relative position of the cross arms, on the pole between the two spans. Double poles should be set at all angles, and the entire line should be well head-guyed and anchored throughout. At sub-stations and other points where the line is dead ended, arrangements should be made so that the direct strain will be taken up by several insulators, thus doing away with the liability for grounding in case of accident to one insulator.

From the high-tension feeders alternating current, as above stated, is taken into the sub-station through a system of lightning protection and stepped down by means of transformers to a pressure at which it can be safely and economically used in a rotary converter or motor generator set. The rotary converter is essentially an alternating-current motor with a commutating device upon the same shaft, and its operation is in no way different from that of a synchronous motor and a direct-current generator.

Earlier in this article, the use of the storage battery was in general recommended. Such batteries are installed in rotary converter sub-stations, or at some center of distribution where they may be better fed by a separate booster feeder, as was explained earlier, or they may be simply floated upon this line.

The storage battery owes its usefulness to the fact of its being a reservoir for potential energy, and thus energy which is exerted upon it through the battery terminals at one time, will remain unspent, awaiting another time when its usefulness will be of more value, so a battery may be a load at one instant or a feeder at another. Thus we see that a battery becomes of value when the load upon the line fluctuates excessively, when at some time during the day there comes on the line a peak load, which peak is high above the average load and perhaps above the present generator capacity, or when it is desirable to shut down the generating station for a short period during the day and still furnish current.

The arguments against a battery installation are not many. Chief among these has been the time-rooted idea that the depreciation of a battery was high. This is, as a matter of fact, an exploded idea, it having been evidenced in actual practice that the maintenance cost of batteries is not greater than the depreciation that would be charged against generating apparatus. But when we note that by the use of a battery on a railway we cut down the necessary generating capacity by one-fourth to one-third, the sub-station capacity by one-half to two-thirds, and furnish the car motors with practically a constant voltage, besides improving the load factor of the system, and the efficiency of the apparatus, we see that we have lessened the depreciation charges of the above-named items, all of which can be credited toward lowering the depreciation charge of the battery.

If a battery is planned for in the original design of a railway its cost will approximately equal the amount of generating, transmission and distributing machinery which it supplants.

The advantages to be gained by the use of a battery other than the possibility of doing a lighting business from a railway sub-station, as spoken of earlier, are quite numerous. The power station

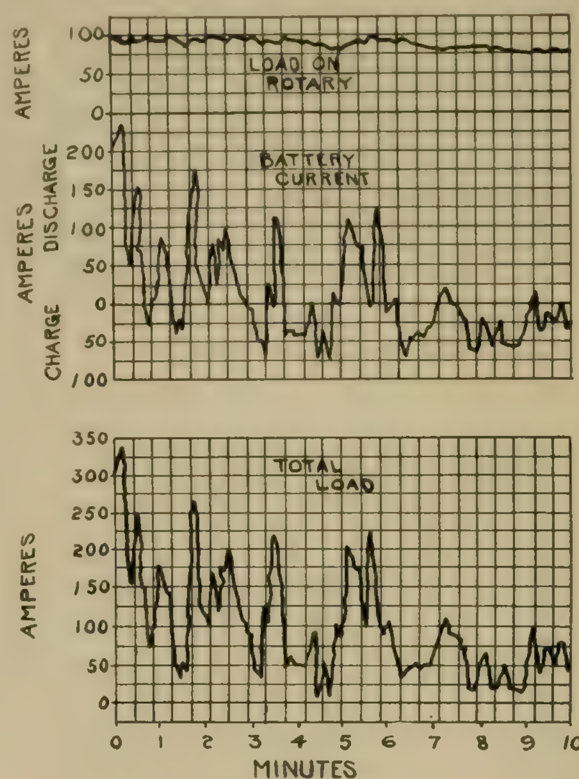


FIG. 6.

generating apparatus is called upon to deliver only a constant load, see Fig. 6; hence we see a large gain in boiler, engine and generator economy, because the plant is working at its most economical load point at all times. The same holds true for the transmission and sub-station apparatus. Still another fact, which would in many instances alone warrant the use of a battery, is the assured reliability of operation; for example, in case of a breakdown in the power-house machinery or transmission line, current will still be available from the battery for some time. The attendance required is but little. These and many other good qualities should be sufficient argument for insuring a careful study of the battery question before completing the design of any road.

All the details of a sub-station should be made as simple and fool-proof as possible, thus insuring better operation with the same class of help as though the sub-station were equipped with many fancy devices. Living rooms should be provided in the sub-station buildings, thus doing away with the extra cost of two shifts in the help required for attendance. To care for the freight and express business, mentioned earlier in the article, an "L" should be added to the sub-station building having ample accommodations for the reception and handling of such traffic. A storage battery room should also be provided on the ground floor or basement, and a ticket office and waiting room for the accommodation of the traveling public.

The motor generator set and switchboard which will be used

for light, if such business is sought, should be located in the same room with the railway converting apparatus, so that one man living in the sub-station building will be able to care for the apparatus in all its details. By means of such arrangement the so-called bugbear of excessive sub-station attendance for direct-current railway distribution may be divided proportionately among four accounts, lighting, railway power, freight traffic and transportation.

Working Conductors.

On leaving the sub-station the current next passes to the working conductor. In direct-current systems today, two general kinds of working conductors are in use. These are the well-known trolley, and its rival, the third rail. In the argument as to which will be used on any proposed road the main determining factor is the amount of probable traffic. For roads upon public highways, trolley construction is, of course, essential. Where the business to be handled is of such an amount that an inexcessive cross section of feeders will economically distribute the current to the working conductor, and the unit loads come within the limits of the capabilities of the common trolley wheel for collecting current, overhead construction will undoubtedly be chosen, but on the other hand if traffic is of such a nature that heavy loads will be handled, and the motors on our cars be called upon for work which will necessitate the collecting at starting of current to the amount of 600 to 1,200 amperes, the small conducting surface of the trolley wheel becomes inadequate. Such an amount of current in attempting to pass one or even two swiftly moving trolley wheels will cause severe arcing, and will greatly lessen the life of both the wheels

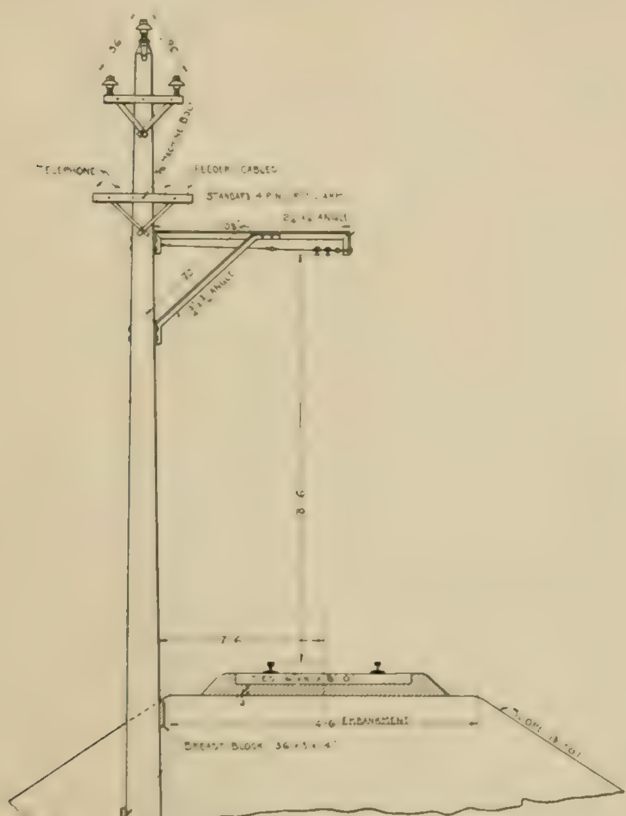


Fig. 7

and the wire, and if the proposed schedule call for high speed, then the trolley wheel can not be made to confine itself to the wire readily without entailing a high maintenance cost for keeping the overhead work in careful alignment. Under the last-named conditions the third-rail method of current collection has shown itself to do the work satisfactorily. Its greatest opposition—namely, that of danger to the public—has been shown to be visionary by the successful operation of several such roads through the densely populated suburbs of different large cities. With the advent of the single-phase system operating with high voltages on a small trolley wire, the third rail has indeed found a worthy rival.

So much has been written of late concerning both third-rail and trolley construction that a discussion here of the relative merits of the two seems unnecessary. Fig. 7 shows a typical view of the embankment, track work and pole line construction of an electric railway on which the working conductor consists of two copper trolley wires.

Fig. 8 is a similar view of a road using third rail.

In estimating the comparative cost of construction of the two systems, it will be found that for equal current carrying capacity the third-rail construction is approximately $1,000 per mile cheaper. In comparing a standard combined a. c. and d. c. distribution system, having rotary converter sub-stations and direct-current feeders, and working conductors, with a purely a. c. single-phase system

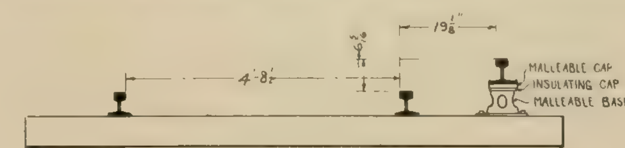


Fig. 8.

having only transforming apparatus in the sub-stations and using a high voltage on the working conductor, a saving in the entire electrical power system of nearly $2,000 per mile in favor of the latter system is found. This fact, together with the greatly lessened cost of operation, indicates a bright future for the single-phase system.

Power House.

The factors affecting the proposed power-house site are the cost of fuel delivered, the quality and quantity of water for boiler and condensing purposes, the location of the electrical center of the system, and the cost of land for the site. Scarcely any proposition will have a location which will answer all these requirements, and as the power house is the heart of any railway, hence we see the need of much careful calculating as to which one of the permissible sites meets the requirements best. In regard to the placing of the power house as near as possible to the center of electrical distribution, the kind of distribution system to be used, a. c. or d. c., will decide largely what weight this factor will have, the a. c. distribution system, of course, allowing a much larger radius of location from the center than does the d. c. If possible the location should be such that the repair shops and general offices of the road may be located very close to the power station. This will not only greatly lessen the cost for repairs and heating in both, but will place all similar work where it can be more easily overseen by one man. Both in design and construction should the future needs be kept clearly in mind, and room and allowances be made for extensions in all directions. If the standard a. c. and d. c. distribution system is to be used, the future possibility of using at some later date a. c. apparatus alone, should be cared for. It is not within the compass of this article to describe the details of a railway power station, but one remark is applicable to them all, and that is to ever bear in mind the true purpose for which the station is intended, namely, to furnish current at a low cost and with absolutely no interruptions. No money should be spent on fancy works which will be pleasing to the eye alone. The station building should be arranged for simplicity. The essential towards this end is that the generated energy should not "double its tracks," but the fuel be delivered into the building on one side, pass to the boiler, the steam from the boiler pass on in the same direction to the engines, the current from the generators pass on in a like direction through the transformers and switchboard, then out of the building on the opposite side from which the fuel entered.

A rough method has been given for determining the amount of power necessary to propel the cars. These data should now be refined and a very close approximation reached, as to the amount of current which it will be necessary for the generating station to furnish. In doing this, typical run sheets will need to be used, these sheets taking into account the characteristics of the equipment and the proposed service over the now determined grades and curves of the line. In this way the average load is found. With no batteries at the sub-stations an extra capacity of from 50 to 60 per cent must be added to the average load, and the fixed losses from generator to motor in determining the total capacity of the station.

The capacity of the engines must be enough greater than that of the generators to allow for the losses in the engines themselves; usually about 10 per cent is the factor used.

The relative merits of steam turbine and engine are being widely discussed at the present time, so no space will be used here, further than to say that the turbine from a great many reasons seems to have a decided advantage for electrical power work, the only unknown factor at the present time being the comparative cost for repairs.

The steam connections between engines and boilers must permit of the supplying of any engine with steam from any group of boilers, this being a large factor toward the assurance of continued operation in time of trouble to boiler, engines or generators. The boiler and grates should be designed for the special kind of fuel with which they are to be fired; they must have capacity for easy and rapid cleaning, and must, for railroad service, be of a quick steaming type. Coal and ash handling machinery will greatly add to the economy of the boiler room. Again let me say that in power station design simplicity, economy and reliability should be the aims.

We now come to the selection of the equipment and rolling stock for our proposed road. From the schedules which have been devised and found to suit the probable traffic of the road, we know the schedule speeds in miles per hour at which our cars must travel. The only accurate method of deciding upon the size and qualities of the proposed electrical equipment is by means of a set of "speed-time curves". From these we obtain the square root of the mean square current per motor, and also the maximum current which will be used. After a careful study we will find these quantities and endeavor to pick out such motors as will most nearly approximate the theoretical conditions. This procedure will undoubtedly be called "fancy work" by the "practical" railway men, but nevertheless had such a study been made on many of the existing propositions of any size, the expenditure of thousands of dollars would have been forestalled, and equal, if not better, results obtained. The arguments as shown on page 470 of the "Review" for July should prove a valuable check on the above work.

If our traffic calls for comparatively high speeds. or the sandwiching of cars to form a limited and local schedule then some multiple unit system of train control will be necessary. Theoretically such control should feed automatically, and thus always start the car with the same rate of acceleration. The traffic conditions will decide the size and style of cars to be used. The car being the part of the railway with which the passenger comes most closely in contact, his wishes here should be carefully observed. Comfort and good appearance should be much in evidence and will be a large factor towards the earning power of the road.

(To be continued.)

Some Methods of Enforcing Discipline.*

On most of our railroads today the division superintendent is charged with the responsibility of conducting investigations and applying discipline; in this he is assisted by the trainmaster. "Blue Monday" or "Court Day" is looked upon by the average employe with fear and trembling. He fears the result if he tells the truth, and he trembles, fearing that he may be found out if he does not tell the truth, so he approaches the superintendent with the full determination of consoling his feelings by telling as little as possible, and accepting the consequences. It has been the observation of the writer that it is at this point where the average disciplinarian fails; not because he is not conscientious in his efforts to do justice, not because he lacks the courage of his convictions, but rather because the truth is withheld, and he must render his decision upon circumstantial evidence.

On other important railroads a board of inquiry is appointed to conduct investigations and apply discipline. This board usually consists of one officer from each department. It is thought that under this plan more facts are gleaned, and under the intelligent questioning of the examining board the employe is made to feel that if he tells the truth, the whole truth and nothing but the truth, he will receive justice. This system also has some objectionable features, the most notable being the disposition on the part of heads of departments to "saddle it onto the other fellow," and many a "Blue Monday" has been enlivened by a struggle between representatives of the transportation, mechanical and maintenance departments. However, the result is usually satisfactory to all concerned, and the employe generally accepts the decision of a board of inquiry with better grace than he would that rendered by any single individual, and there is also less liability of the case being appealed to a higher official.

All investigations, whether conducted by individual or board, should be fair and impartial, the decision reached should be based upon the evidence produced, and the sentence imposed without fear or favor, always, however, tempering justice with mercy. It is at this point that Mr. Geo. R. Brown, until recently general superintendent Fall Brook Railway, comes to our rescue with his plan of "Discipline of Railway Employes without Suspension," which is the first and only radical departure from the old-time methods.

The latest statistics I have been able to get show that the Brown system has been tried on some of our leading railways, representing about 50,000 miles of road. The opinions expressed by those in position to know are varied, and whilst agreeing with Mr. Brown in principle, some differ in opinion as to the methods enployed and results obtained.

I am of the opinion that a most thorough education on the part of employes as to the principle involved is absolutely necessary before the Brown system could be effectually introduced, and to properly educate on these lines railway companies should have the training of their subjects from the day they enter railway service. On roads that select their employes from the farm hands and country boys living along their lines, the matter of education is comparatively easy, and any form of discipline, properly understood, could be intelligently enforced. On roads that are compelled to select their employes from those who have seen service on, or have been dismissed from other railways, and who are also compelled to reinforce their numbers from the floating element of railroad men, many of whom place but little estimate on the value of their positions, the question of education is far more serious, and experience has convinced me that in dealing with this latter class, the manager who insists upon his men being given a fair and impartial trial, and then imposes discipline by actual suspension or dismissal, obtains the best results.

The greatest care should be exercised by the official charged with the duty of conducting investigations. He should be a man of wide experience in railway service, one tireless in his efforts to secure all the facts in the case, willing to go over the ground personally, if necessary, so as to "put himself in the other man's place," and if, perchance, he should discover that the one under suspicion has performed his duty to the best of his ability and understanding, he should not hesitate to overlook the offense, but first have a "heart to heart" talk with his man alone in his office, pointing out to him the effect of the accident on the reputation of his company, and on his own reputation as a railway official. On the other hand, if, after a careful personal investigation it is found that the one being investigated has misrepresented his case, made false statements, or withheld facts, he should be punished by actual suspension, or, if the circumstances warrant such a course, be dismissed. If extreme penalty is imposed it should be final.

*From an address before the Railway Club of Pittsburg, by J. B Yohe, general superintendent, Pittsburg & Lake Erie R. R.

Hotel Rates in St. Louis.

As many of the delegates to the St. Louis street railway conventions will undoubtedly take their families with them on this occasion to visit the World's Fair, they will be interested to know that good accommodations are to be had at reasonable prices without going to the high-priced hotels down town. The Fielding hotel, on Belmont boulevard, corner of Clara Ave., will book rooms for October at $3 per day per room, without bath, to be occupied by two people, and $5 with bath. A good cafe is run in connection with this hotel. On Von Versen Ave., between Nos. 5600 and 5800, there are a great many houses in which rooms can be rented. This is a fine street with nice private houses, and the location is within four or five blocks of the entrance to the Fair. Those going without accommodations secured in advance can secure rooms in this neighborhood on a few minutes' notice. The rates are from $2 to $3 per day for two people and there is a good cafe near by.

The Attractions of the Brockton & Plymouth Street Ry.

The Brockton & Plymouth Street Ry., running from Brockton, Mass., to beyond Plymouth, Mass., receives a considerable portion of its income from that class of riders who may be classified as "seekers after pleasure."

In its location the road is peculiarly favored, as it passes through the "Plymouth country"—a country world-renowned because of its associations with the incidents connected with the birth of the nation. Brockton, the northerly terminus of the line to Plymouth, has direct connection by trolley and steam road with Boston, and with all the cities and towns of importance in southeastern Massachusetts. Cars of the Brockton & Plymouth Street Ry. leave Brockton on a half-hourly schedule during the summer months and make the run to Plymouth Center in two hours.

Leaving Brockton the line passes through South Hanson and Plymouth Woods to Silver Lake, the largest area of water in southeastern Massachusetts, and said to have been first explored by the captain of the Mayflower. The next place passed is Duxbury. This place was settled in 1630-1632 by men of honor and distinction in the civil and religious history of the Pilgrims, and was called Duxbury, after Duxbury Hall, the seat of the Standish family in England, for Miles Standish settled here, as did John Alden, his rival. Here is the place where Miles Standish lived and died, and here is the little burying-ground, recently discovered beneath a tangled waste of weeds, where are the graves of Miles Standish, Elder Brewster, John and Priscilla Alden, and many another of the sturdy Pilgrim settlers. Near the grave of Captain Standish stands the Standish monument and the ruins of the Standish homestead.

The next place of importance is Kingston, so named at the suggestion of Lieutenant Governor Dummer, on the 28th of May, 1717, that being the birthday of his majesty, King George the First.

At Kingston the line passes many interesting landmarks, including the house of Major John Bradford.

The cars next enter the picturesque old town of Plymouth, where almost every other house perpetuates some name prominent on the Mayflower roll, and where even the old elms remind of treaties signed and compacts sealed, every one of which comprises a chapter in the early history of the American people. Of chief interest in the town are the "Faith Monument," erected to the memory of the Pilgrims by "a grateful people in remembrance of their labors, sacrifice and sufferings for the cause of civil and religious liberty;" Pilgrim Hall, containing a choice collection of many and divers objects connected with or related more or less intimately to the history of the town, conspicuous among them being the pewter plate, iron pot and old sword of Miles Standish; residence of Governor Bradford, who was 31 times chosen governor of the colony, and Burial Hill, another of the old burying-grounds. But chief of all attractions is old "Plymouth Rock" itself—a great, smoothly-worn boulder, bearing simply the carved figures "1620"—which lies under a granite canopy close to the spot where the Mayflower company first set foot on the mainland. In the bay off Plymouth is Clark's Island, where the Pilgrims first touched and where they held their first religious service in the new country before going ashore on the mainland.

In addition to these historic attractions, which of course are now mostly sought for by tourists and travelers, the Brockton & Plymouth Street Railway Co. has established for the benefit of the resident population a beautiful park resort, about half-way between Brockton and Plymouth. This is known as Mayflower Grove and is a typical New England family park. Nature has greatly favored this grove, and it was selected by the company as it borders one of the most beautiful lakes in Massachusetts and is surround-

BROCKTON & PLYMOUTH RY.

PLYMOUTH ROCK.

ed with great pines. It has been laid out with wooded paths and cosy nooks and furnished with many attractions, including an open air theater, a restaurant fully equipped where meals are served at all hours, fish dinners and lunches being the special feature, bath houses, launches, canoes and rowboats for rent, a merry-go-round, dance hall, and swings for young and old and spacious

LAKE AND BOAT LANDING, MAYFLOWER GROVE

picnic grounds with tables free to all. Everything is kept in up-to-date order and the grounds are well policed.

Recognizing the fact that the mere existence of these many historic, natural and artificial attractions along the line is not sufficient to guarantee travel, Mr. Anthony J. Bemis, manager of the Brockton & Plymouth Street Railway Co., has succeeded, by clever

RESTAURANT

DANCING PAVILION

advertising, in so forcibly impressing the public with the possibilities for enjoyment and recreation afforded by the company's line, that the receipts have grown steadily and the traffic often taxes to the utmost the carrying capacity of the road. Mr. Bemis has gone on the principle that there is no value in having the greatest

BATH HOUSE

thing in the world if you do not let the public know about it, and induce it to take what you have to offer. He therefore uses every available means for keeping his road and its attractions in the mind of the public. So thorough have been the advertising methods used that it is said, whenever the question is asked on any pleasant evening in any home within the territory, "What shall we do this evening?" the answer is always forthcoming, "Let's take a ride on the Brockton & Plymouth."

One of the most effective means of securing publicity is the illustrated folder. Mr. Bemis uses a 24-page folder of convenient size for the pocket. In the preparation of the reading matter and illustrations he takes full advantage of the material offered by the exceptional historic interest of the Pilgrim country, and the folder sets forth in clear and concise language all that may be seen and done along the line. Care is taken, however, to exclude "extravagant" statements about the country which cannot be corroborated by actual visits, because there is little gained in promising the public more than it actually receives. The folder contains a map of the road and is distributed wherever probable tourists can be reached. The usual edition is 10,000.

A 30-in. window poster in colors is also used with excellent results. It portrays a girl with a car under her arm. The poster is placed in store windows all along the route, the usual arrangement being to give two complimentary street car and park tickets in return for the privilege of showing the poster. These tickets must be renewed each week, this feature having been adopted to prevent the selling of the tickets or their use by anyone except

the owners of the windows. The posters are also placed in all the open cars, one at each end, where passengers cannot fail to see them. About 20,000 posters have been distributed this summer.

The company uses the daily and weekly newspapers freely, taking sufficient advertising space in all of them to insure not only a good presentation of the advertising matter, bu also to secure the good will of the editors and insure proper attention in the reading columns.

At the theater in Mayflower Grove the company is now giving

NORTH ENTRANCE TO GROVE

light operas and minstrel entertainments. Mr. Bemis believes that the public is tiring of vaudeville and is demanding a higher form of amusement than the ordinary run of vaudeville attractions. Stock companies in opera have taken very well this season. The current attractions at the theater are advertised by hand-bills hung in the cars, and by poster announcements on the front dashes, as well as in the newspapers.

HOTEL PILGRIM, PLYMOUTH, MASS.

The Brockton & Plymouth road serves the Hotel Pilgrim, situated on the bluff above Plymouth Bay. This is one of the leading seaside hotels of southern Massachusetts. As the electric cars afford the easiest means of reaching this hotel the road derives a considerable revenue from this source. The Hotel Pilgrim is modern in every respect, and its bed-rooms, halls, public rooms, sun-parlors and broad piazzas command wonderful views of the sea and mountains. The hotel is equipped with bowling alleys, tennis courts, golf links, and has facilities for driving in the pine forests, bathing, sailing, rowing, and fishing in the bay and numerous adjacent ponds.

Recently the lawn of the hotel has been utilized for giving outdoor performances of Shakespeare by "The Woodland Players." The seats were placed on the grass at the back of the hotel, and the trees and sea formed the natural background for the stage. Seats were sold for 50 cents and $1. Special novelties of this kind are always good drawing cards.

The Brockton & Plymouth Street Ry. is owned by Stone & Webster, of Boston.

Power Plant of the Interborough Rapid Transit Co., New York.

The opening of the new Rapid Transit Subway road, which we understand is to take place during November, will at the same time be accompanied by the operation of the new Interborough Rapid Transit Co. power station, which was built for the purpose of furnishing the necessary power for the road. While this plant is by no means completed, at the present time, nor will it be when the road is opened for service, it may be of interest to note the progress of its construction, and to point out some of the most interesting features that appeal to the visitor entering the power station, which is probably the largest plant of its kind in the world.

The plant is located between 58th and 59th Sts. and 11th and 12th Aves., within a few hundred feet of the Hudson River, and the present building is designed to accommodate 72 boilers and 12 power units, aggregating 140,000 horse-power. The present equipment will consist of 60 boilers and 9 engine units, and one turbine unit, four 1,250-kw. turbines occupying the space of one engine unit and being considered as a single power unit, making a total of ten power units in all. Upon entering the boiler room, which is about 700 ft. long, the visitor is at once impressed with the generously wide 20-ft. aisle between the boiler front, the boilers being arranged in two parallel rows on either side of the room. The boilers are of the Babcock & Wilcox type, and are set in batteries of two each, a space of 5 ft. being left between batteries. Each boiler consists of three 42-in. drums, 23 ft. 3 in. long, and 294 4-in. tubes placed 21 high and 14 wide, the tubes being 18 ft. long and the boilers being built to carry a pressure of from 175 to 200 lb. The boilers are rated at about 600 h. p. each, or about 2 h. p. per tube. The absence of mechanical stokers is especially noticeable, as one usually expects to find such features in a plant of this size; but in this case there are only a few of the boilers so equipped, the majority of them being arranged for hand firing. Running in front of the boilers and above the fire doors is a gallery about 4½ ft. wide and 8 ft. above the floor, the galleries of the two rows being connected at frequent intervals by cross galleries, which are provided with steps to the boiler room floor. The object of these galleries is, of course, to facilitate the work of the water tender and allow for easy inspection of the gage glasses. A gallery is also built above the tops of the boilers, the galleries on the same side of the room being interconnected between the boilers. The boilers are operated with forced draft furnished by means of Sturtevant engine-driven blowers, which are located in the basement, under the boiler room, and which furnish air under the grates. In the basement there are also four tracks, for the ash cars, two tracks for each row of boilers, and throughout the whole length of the basement are water storage tanks, which have a capacity of about 500 cu. ft. each and which are filled from the city water supply. Each boiler is connected by two vertical steel flues, which connect on the floor above with a horizontal flue, so arranged with by-passes that the gases may be diverted through an economizer, should one be installed in the future, or may be allowed to enter at once into an intake leading to the stack. The layout provides for two economizers for each three batteries, and a separate stack is built for each group of six batteries. The stacks rest on six structural steel columns, the base of the stack being about 65 ft. above the boiler room floor, and the stacks themselves are 160 ft. high. Between the stacks are built the coal bunkers, of which there are seven, having a capacity of about 2,000 tons each. The coal for the plant is unloaded at a tower on the 58th St. pier and delivered to a Robins belt conveyor, by which it is carried to the power plant in a tunnel under the street. At the power house an inclined belt conveyor carries the coal to the bunkers and distributes it. For feeding the boilers there are two arrangements, one by means of which the coal is first delivered to the economizer floor above the boiler room, and here carried by means of a trough conveyor to pipes which deposit it in front of the boilers. By the second arrangement the coal is delivered directly from the bunkers through 14-in. pipes in front of the boiler, the 14-in. pipe branching into two 10-in. pipes above the boiler drums.

The engine room, as indeed the entire plant, is divided into six sections, of which four sections are to be equipped with two vertical-horizontal twin compound engines built by the Allis-Chalmers Co. and having a normal output of 7,500 h. p. These engines are of the same type as those installed in the Manhattan plant, excepting that in these latter engines the high pressure cylinders are equipped with poppet valves. A fifth section is to be equipped with one engine unit, as described, and in place of the other engine will be installed four 1,250-kw. steam turbines. These turbines are of the Westinghouse-Parsons type, and the results of tests recently made on these machines have been published both in the technical papers and by the Westinghouse Machine Co. The last, or sixth, section has no equipment in place at present. At this time six of the engine units and three of the turbines are in place. In the turbine section are also two exciter engines of 400 h. p. each, direct connected to d. c. generators, and in addition to these there are also three motor-driven exciter sets of about the same capacity. The main engines are equipped with Alberger barometric condensers, which are mounted on a steel framework in front of the engine and close to the 30-in. exhaust from the low pressure cylinder. The condenser sets—there being two condensers to each unit—are connected by an equalizing pipe and to a dry-air pump which furnishes a vacuum. The circulating water is obtained through an intake tunnel, which is built underground on 58th St. and draws the water from the river. There are one circulating pump and one dry vacuum pump provided for each engine. The condensers are provided with a relief valve, which is arranged to open in case of trouble with the condensing system, and allow the steam to exhaust freely to the atmosphere through a 40-in. free exhaust pipe which leads up through the roof of the building, and which is provided with an 8-ft. head. One 40-in. free exhaust pipe serves for two units, each unit being connected to the river by two 30-in. pipes which are run around the foundations. The discharge from the condensers is carried through a tail pipe to two reinforced concrete pits in front of the engine foundation in the basement, and from here the water runs through ducts to a discharge tunnel which is built above the intake tunnel on 58th St. and which runs to the river. Each section of the plant, consisting of two units, is fed by six batteries of boilers, there being two main steam headers for each section, one header for each unit. Each main header is fed by six boilers, which connect to the header by 9-in. pipes. The header, which is 18 in. in diameter, branches into two 14-in. pipes, which drop in large radius bends through the floor and enter a receiver located at the base of the engine foundation. From this point the steam enters through a 14-in. pipe to the throttle valve and thence to the engine cylinder, the steam connection being at the bottom of the cylinder, and the pipe rising from the receiver. A by-pass system is arranged in the 17-in. header before it branches into the two 14-in. engine pipes. The by-pass terminates in a vertical header, to which are also connected three lines of pipe which run throughout the whole length of the building and which are connected to similar vertical headers at each unit. These lines are provided in order to insure as far as possible the continuous operation of the plant, and in case of accident to the steam header of any set of boilers the header may be cut out and the engine, which would otherwise be incapacitated, fed by steam from some other battery of boilers. The steam would be obtained by a proper manipulation of the valves at the connections of the vertical headers.

These auxiliary headers, being of considerable length and subject to the effects of temperature changes, are run throughout their length in the form of sweep reverse curves, while the vertical headers are firmly anchored by straps to the columns. In order to localize the piping, as far as possible, it is run in a special compartment between the boiler and engine rooms, and the valve stems are extended through the engine room wall from this compartment, and are operated from a gallery about 14 ft. above the engine room floor.

The boiler feed pumps furnish the water to the heaters, which are located in the pipe compartment, the piping arrangement being such that the feed water may be delivered to the boilers after passing through the heaters, or may be passed through both the heaters and economizers, should the latter be installed, or may be fed directly to the boilers without passing through either heater or economizers. There are one heater and one boiler feed pump provided for each unit, or for each six boilers. All the pumps are located in the lower part of the pipe compartment, and, with the exception of the dry-air pumps, are placed on raised foundations, so that the cylinders all extend above the level of the engine room floor, the pumps being all steam driven. The turbines are provided with surface condensers and have their own dry vacuum pumps.

The electrical equipment of the plant, with the exception of the generators, is located in an area about 20 ft. wide on the north side of the engine room, and runs throughout the entire length of the building. The oil switches and bus bars are located in brick compartments both below and above the engine room floor level. The switches are operated by electric motors, located above the compartments, and the entire electrical system controlled from a switching room about 30 ft. above the level of the engine room floor. The generators are 5,000-kw. machines, which run at a speed of 75 r. p. m., furnishing three-phase current at 11,000 volts and 25 cycles per second. They are of Westinghouse make, are of the revolving field fly-wheel type and have 40 poles.

The engine room is spanned by two traveling cranes, one of 60 and one of 20 tons' capacity, the 60-ton crane having two trolleys.

The room is amply lighted, due to the skylights in the roof and large windows at the sides, and Nernst lamps are in place for furnishing artificial light. The building is of structural steel construction, the walls being of brick and faced with granite and terra cotta. The style of architecture is that of the Italian Renaissance.

The design and construction of the plant has been in the hands of Mr. John Van Vleck, and Mr. J. E. Thomas is the supervising engineer.

Transit Tidings.

"Transit Tidings" is the title of a new street railway publication, six numbers of which have already appeared. The paper is published by the United Railroads of San Francisco and its object is set forth in the introduction appearing in the first issue, which is quoted as follows:

"This modest publication is intended as a vehicle by which to convey to our patrons and to the public generally useful items of information concerning our street railway service.

"To the stranger such a publication should prove something of a convenience, for it will be a guide to points of interest, and will besides be a directory of current and special attractions.

"The Tidings is, in a sense, a railway folder, and yet its contents will cover a much broader field than a mere time-table announcement.

"The idea of issuing such a publication is not original with this company. In Detroit and other eastern cities the railroads have stood sponsor for similiar prints, where their usefulness has been proved.

"The United Railroads desires the good-will of the people of San Francisco. We are operating a system of street railroads in one of the best cities in the Union, and we want our system to be one of the best. Back in the early eighties the San Francisco street railway system was without a peer or rival anywhere in the world. While New York in 1880, '81 and '82 was depending for its surface transportation on the horse car and omnibus, San Francisco possessed a magnificent cable system that was at once the pride of the citizen and the admiration of every traveler. In some eastern cities cable roads supplanted the horse car, but with few exceptions these roads have been changed to electric power. The hills of San Francisco will always make the cable a necessity here, and hence changes in that respect have been somewhat slow."

The first number was issued April 1, 1904, as "Trolley Tidings," the second number April 15th and since May 1st, when the name was changed to "Transit Tidings," it has appeared monthly.

Chicago Elevated Traffic.

The daily averages of traffic on four Chicago elevated roads for July, as compared with the daily averages for July, 1903, follow: South Side Elevated Railroad Co., 69,899, a decrease of 6,327, or 8.31 per cent.; Metropolitan West Side Railroad Co., 102,142, an increase of 85, or 0.08 per cent.; Northwestern Elevated Railroad Co., 60,816, an increase of 1,423, or 2.4 per cent.; Chicago & Oak Park Elevated Railroad Co., 38,668, a decrease of 517, or 1.32 per cent. The decrease on the South Side line is due to the absence of racing at Washington Park.

The College Man in Business.

BY PROFESSOR HENRY H. NORRIS, CORNELL UNIVERSITY, AND SUPERINTENDENT ELECTRIC RAILWAY TEST COMMISSION, ST. LOUIS PURCHASE EXPOSITION.

During the past few weeks the technical schools of the country have been delivering to numerous young men certain pieces of parchment which certify that a given course of study has been followed and that the examinations held therein have been successfully passed. These young men will apply for positions with business concerns which will, as a rule, give them opportunity to show what they can do, and it is important for the young men, as well as for the employers, to consider the relation between the work done in college and the duties which must be performed in active life.

There has been in the past some misapprehension in the minds of the young men, and of the employers also, as to the purpose of the college training. Frequently both classes have expected too much from the four years' work in school, and they have in many cases expected the wrong kind of product. The schools also have not fully understood their duty and have tried to do work which they were neither required nor qualified to do. Fortunately, this state of affairs is rapidly disappearing, and employer, employe and school are coming to understand one another.

The reasons for the present improved status of the graduates of engineering schools in the business world are worthy of careful attention. The most important of these is that by virtue of the mental discipline and training which the schools have given, technical men by sheer force of ability have secured leading places in many important industries. They fill very largely those positions which require the faculty of grasping the elements of new problems and of facing, without fear, large propositions. Entirely aside from the technical part of their equipment, important as that is, stands the ability to meet men and command respect for their own opinions and conclusions.

It is interesting to note that the attitude of the graduate himself toward his business associates is different from what it was some years ago. In many cases he aroused resentment by an unnecessary and unwarranted display of knowledge. Naturally the men who had achieved success by hard knocks were not in a state of mind to receive condescension from a young man just out of school and with no practical experience. The trouble in this case was due to the fact that the young man, knowing that he had worked diligently for his information, considered that this equipped him for immediate contact with important practical problems, whereas he really had one of his most important lessons yet to learn. This last lesson was to acquire the ability to adapt what he knew to the conditions under which he was to work. The young man was not seriously at fault, as has been proved by the experience of many employers who draw largely upon college men for their assistants. These gentlemen find that after a year or more of contact with real problems the college man learns to adapt himself to his surroundings and in the long run surpasses those of his colleagues who lack special college training. The sooner a young man fresh from school realizes that he must begin at the bottom of the business ladder and climb for himself, the more rapid will be his ascent and the more useful will he be to his employer. The fact that the young men are improving in this respect is shown by a recent experience of the chief engineer of a large engineering firm. This gentleman, after interviewing a large number of young men just about to graduate from a well-known technical school, was surprised and delighted to note what he termed "the uniform modesty" of the young men whom he interviewed. He found that these young men realized that they must make their own places in the business world, and that all they asked was an opportunity to develop along lines which were congenial to them. They were willing to do any and all kinds of work that gave promise of room for development.

The greatest change which has come about in the past few years is in the relation between the technical school and the employer of its graduates. The men who teach in these schools are evidently making a careful study of the conditions in which the young men will find themselves after graduation. This study has required time, because the data used as a basis must come from the experiences of the graduates who have been in business for years. The teachers themselves are also getting out into business from time to time in order that they may learn by actual contact with commercial problems the real state of affairs. They have learned, among other things, that the purely technical part of the college training must be reduced to such a point that the actual manual work will serve to illustrate the theoretical principles, and no more. In other words, the technical school is not a trade school, but a college, and its main function is educational—that is, to furnish mental training, with just enough illustration to make the work interesting and practical.

The training must be practical in its aim, for mental discipline which does not make a man more useful has no place in a technical school. It may be said, therefore, that one of the most important functions of the technical school is to teach a student to use intelligently, in the solution of practical problems, that knowledge which he either already has or may readily obtain.

The employer, on his part, has an important share in the normal development of a young man in business. He should realize that the finished product of the technical school is his raw material. His own welfare depends upon the character of the men whom he selects to be his helpers and every advance made by those under him enhances his own success. Hence, employers are studying more and more to learn the most efficient ways in which to continue and complete the work of the technical school. The most tangible evidence of this is the prevalence of apprenticeship courses among all of the leading electrical companies. In these courses the young men are given every opportunity to learn how and why certain methods are employed and certain results obtained. The time profitably occupied in this manner may amount to two years or more, such time being considered by the students as a continuation of their college courses and by the companies as a necessary introduction to the work which is to follow. The apprenticeship period also allows the student an opportunity to test his fitness for the work to which he is inclined and at the same time enables the companies to select such men for specific duties as have shown themselves capable and worthy. The fact that employers appreciate the importance of the selection of their raw material is indicated by the manner in which they now go about such selection. Their ablest engineers take days of valuable time to visit the schools in person and interview individually the promising young men.

The kind of men needed in the commercial world comprises not necessarily those who know the most, but those who know best how to analyze into their essential elements the complicated problems of business life. They may know much or little, providing that they possess no more knowledge than they can apply. This idea was recently brought out clearly by a well-known business man in a discussion based upon the fact that in certain vocations men were apt, if not very careful, to lose their usefulness while still in the prime of life. The reason alleged for this was that they accumulate more knowledge than they can profitably use, and as a consequence what should be a help to them becomes a hindrance. It is the function of a technical school to prevent this very thing by inculcating in its students the habit of promptly applying what they know and knowing only what they can apply. At the same time the student must learn of the sources of all useful knowledge so that if he needs information outside of his own store, he can readily find it. This sort of man will always be in demand, whether college bred or not, and the work that he does must of necessity be marked by integrity because it consists of well-tested principles logically applied.

New Haven Road Buys More Trolleys.

The New York, New Haven & Hartford Railroad Co., through its subsidiary company, the Consolidated Railways Co., has purchased the New London Street Railway Co., the Norwich Street Railway Co. and the Montville Street Railway Co. Messrs. Tucker, Anthony & Co., of Boston, constructed and financed these roads and have always managed them.

The strike on the lines of the Bloomington & Normal Railway Electric & Heating Co., which has been in progress since January 1st, has been called off. The strikers lost the fight, which was for an advance in wages, recognition of the union and easy runs for the older men in service.

Development of Through Business on New Jersey "Electrics."

An official of the Public Service Corporation of New Jersey, in conversation with a representative of the "Street Railway Review," recently called attention to the remarkable development that has been going on in New Jersey during the past two years in the establishment of through electric railway routes from the large centers of population near New York, such as Jersey City and Newark, to all the principal cities in New Jersey, including Paterson, Passaic, Elizabeth, Plainfield, New Brunswick, and Trenton. It is pointed out that this growth of through routes by electric railway is following along exactly similar lines as the development of steam railroading. At first, journeys of any considerable length by steam railroads were made only by frequent changes from one train to another with all the attending inconveniences, including uncertain connections. Now it is possible to go from almost any railroad center, as Chicago, for instance, to practically every important point in the United States without change of cars.

So it is in electric railway work. In New Jersey, for instance, five years ago it was impossible to make an unbroken trip by trolley of more than 8 or 10 miles at the most. Now there are over a dozen through routes averaging between 40 and 70 miles in length.

To prove that these through routes are popular and profitable the success of the New York-Trenton through line may be cited as a single example. The company began this service by running through cars every two hours between Jersey City and Trenton, connecting at the latter point by boat and rail for Philadelphia. These cars run without change through Newark, Elizabeth, Westfield, Plainfield, Dunellen, Bound Brook, New Brunswick, and over the Trenton & New Brunswick "Fast Line" to Trenton. The traffic over this line has become so heavy that beginning the first of August the company has put on an hourly service of through cars between Jersey City and Trenton from 6 o'clock in the morning to 7 o'clock at night. The distance by trolley to Trenton is 70 miles and the trip is made in five hours.

The Public Service Corporation has recently issued a 30-in. folder showing on one side a map in colors indicating all the suburban and interurban lines of the company. On the reverse side is a description of the country traversed, with schedules and rates of fare. From the introduction to this circular we print the following relative to the Public Service System:

"The Public Service Trolley System embraces all of the traction lines in Northern and Central New Jersey, with two exceptions. It is the greatest interurban system in the world under one management. Over a million people live in the territory reached by the lines of the Public Service. In addition to the interurban lines that stretch from Fort Lee and Paterson on the north, to New Brunswick, Somerville and the Amboys on the west and south, the Public Service operates the local lines in Newark, Paterson, Passaic, Jersey City, Hoboken, Elizabeth, Plainfield, and New Brunswick. Recently the Camden, Gloucester and Woodbury and the Camden and Suburban Railways were acquired. These lines run out of Camden.

"Unbounded opportunities are offered the seeker after rest and recreation in the territory reached by the Public Service system. One can leave the skyscrapers and marts of commerce and industry in Manhattan, and, within an hour, be secluded in a primeval wilderness on the banks of the Hudson. In a little longer time the Orange Mountains can be reached, with their ever cooling breezes and wonderful views.

"There are rides in modern trolley cars, past spots famed in history and story; places that teem with deeds of valor, where our forefathers fought for independence; rides along the historic Hudson on top of the Palisades; rides over the meadows and along beautiful rivers; rides to mountain tops; rides to the seashore and rides through pleasant farming country and beautiful villages and towns."

A handsome itinerary of the trolley trips inaugurated by the Boston & Northern Street Railway Co. and the Old Colony Street Railway Co., of Boston, Mass., which are described on page 536 of this issue, has been published and may be obtained at Derrah's Trolley Information Bureau, 365 Washington St., Boston, Mass.

BIRD'S-EYE VIEW OF THE SYSTEM OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY.

The Accountants' Question Box.

Mr. W. B. Brockway, secretary of the Street Railway Accountants' Association, issued under date of July 28, 1904, Circular No. 28, transmitting to the membership the questions received in response to Circular No. 27 issued May 20th. The recent circular is as follows:

"Since its organization, this association has endeavored to make no move nor establish any customs except those that would be for the benefit of the association as a whole. Therefore, the present effort toward enlarging the opportunity of the members to ask questions and to obtain answers to them is based primarily upon that endeavor.

"In accordance with the Circular No. 27, issued May 20, 1904, giving the opportunity to ask questions, those printed herewith have been received. They are now sent to all the members for their replies. Each member is expected to answer as many of the questions as he can, the idea being to make the replies as comprehensive and valuable as possible.

"Each member is requested to give his answer in the form of a letter, and to identify the reply to a question by quoting the number printed opposite the questions herein. The letter should be addressed to the Secretary. It is proposed to publish the name of the company making reply, but this will be withheld upon request.

"Attention is drawn to the fact that replies must be returned before September 1st, 1904. This is imperative to the success of the plan."

QUESTIONS.

1. Is it proper to register transfers? And what amount of checking is necessary to insure their proper use? No doubt the subject is old, but we want the latest light upon it.

2. In a city of 27,000 people, where car tickets are sold six for 25 cents, what percentage of the total receipts should be cash?

3. To what extent does your company issue advertising mileage in subsidizing newspapers, after paying cash for authorized insertions?

4. Please explain a system which could be made standard, as to the manner of getting the correct and actual monthly operating expenses, to be shown on its monthly report.

Is it not the practice of some street railways to arrive at their operating expenses by classifying the bills according to the standard classification, charging them direct to the operating and construction accounts, and using the totals of the operating account columns in compiling the operating expenses for the month, without considering inventories, shop clerks' or store-keepers' reports?

5. What are your average per cents of cost for maintenance of accounts Nos. 6 and 7 for nine months ending June 30, 1904?

6. How can the ticket accounts be arranged to show each day the exact amount of the different kinds of tickets in the hands of the public not yet used?

7. Is it always fair to consider new paving as a construction charge? It brings additional expense for maintenance. Does it add to the earning capacity or value of the road?

8. When bills are approved and passed for payment by voucher, what records can be kept which will make it convenient for the accounting department to find out quickly if the bill is a duplicate of another bill which has been passed and paid?

9. What method is used in issuing transfers to conductors?

10. Do members generally use a work order system for their expense and construction accounts? We have started this in one department and I have a few questions to ask before adopting in other departments.

11. [illegible] total mileage [illegible] work car, special car and [illegible] added to regular passenger car mileage) in figuring income per car mile and expense per car mile?

12. Is it of sufficient benefit as a record to pay for the extra work necessary to keep a separate ledger account with regular vouchers?

13. In the case of a company reconstructing tracks during operation, and using motor cars for hauling material, is it not proper to charge [illegible] with the current consumed and credit power [illegible]?

14. Should the property of a street railway company—its tracks, for instance—stand on its books forever at its original cost? Or should the account representing its cost be reduced from year to year or month to month, by reason of wear?

15. Should accruals of rental under a lease be treated as a liability of the lessee and appear on a balance sheet as a liability prior to the date such payment is due?

16. What should be the dividing line between "maintenance" and "betterments?"

17. When a piece of track, or a car, is renewed, should the cost of the old track or car be charged to expense, or against income? Would it not be better to make such a charge from month to month, or year to year, estimating the amount from the time the company begins to use the track or car, so as to have it off the books when it is worn out?

18. What is the best method of computing the effect upon net earnings, of an increase in free transfer privileges?

19. If land or other property of a street railway company increases in value, should the appreciation be shown on the books?

20. Should dividends be charged against the net income for the year and the balance of net income be transferred to surplus or should the net income be added to surplus and the dividends charged against the total?

21. What is the usual percentage of passes, and of transfers, to total passengers—or to total cash fares?

Ours are: To total passengers, passes 0.77 per cent, transfers 0.79 per cent; to cash fares, passes 0.829 per cent, transfers 0.844 per cent.

22. Is there any way whereby a correct balance sheet can be prepared, showing receipts and expenses incident to operating a pleasure park? Many managers when asked if it pays to operate a pleasure park in connection with an electric railway line reply "Yes." As a matter of fact, few of them know surely whether it does or not. Please give your experience in handling this matter. Do you attempt to arrive definitely at the increased receipts and expenses properly attributable to the park?

23. In your daily, weekly and monthly reports, to what extent do you make statement of weather conditions? Of special events, as fairs, fete days, parades, special picnics, excursions, etc., which would make sudden changes in receipts or expenses?

The School of Instruction.*

The steam railroads have for many years realized the importance of arranging classes of instruction on the air brake for their trainmen and employes coming in contact with its use or maintenance. Almost every steam railroad has its own instruction car, fitted up with apparatus and piping representing a complete train, which travels from point to point on the system giving demonstrations of the use and availability of the brake under all conditions.

Many traction systems have a school of instruction for their motormen, where a dummy truck is set up, having upon it a motor, or motors, controller, and the various electrical devices for getting the car into motion. But very seldom do these dummy trucks ever have any braking apparatus outside of the ordinary hand brake. In this way the instruction is only half done. The car is in motion, but how about stopping it? Is it not just as important a part of the motorman's duties to know how to stop a car as to start it? In fact, it is more so, for in case of emergency, when the lives of many persons may be in danger, the vital question is to stop the car and not to start it. Those moments when the motorman must act most quickly, unerringly, and even instinctively, are when he is called upon to use the brake to its full efficiency. He must, therefore, know just what that efficiency is and how to obtain it, and for that reason it is indispensable that he should be thoroughly acquainted with its details and the purposes of them.

Another point which traction road managers should readily appreciate is that the braking equipment, although not so expensive as the electrical equipment, still represents an outlay of capital for machinery, which should be maintained just as carefully and just as thoroughly as any of the rest of the mechanical equipment of the road. No mechanism of any value can last long if in the hands of some one who knows little or nothing about it, whereas the small cost of an instruction outfit is scarcely noticeable in comparison with the depreciation in the value of the brake apparatus when used without such instruction.

*Reprinted from advance sheets of copyrighted pamphlet issued by Westinghouse Traction Brake Co.

[illegible] the type of man who today fills the position of motorman [illegible] roving disposition than his confrère on the steam railroads. He is not nearly so likely to stay in one place for any length of time, and consequently the need of training and schooling new men is, at the present time, practically a constant one.

By a school of instruction we do not mean an arrangement where some one may stand before a class and talk on the use of the apparatus; we mean to imply that such a class should have before it an actual working model which will duplicate as nearly as possible the car itself, and which will be supplied with a full set of apparatus to be operated under as nearly the same conditions of actual practice as it is possible to make it. Also, that instruction on the brake should be given regularly by some one who is thoroughly acquainted with the construction and operation of that apparatus, and who can give ocular demonstration of its use and how to handle and take care of it.

This course of instruction should include the necessity of each man being placed upon the dummy and made to operate it under

DIAGRAM SHOWING PROPER AND IMPROPER USE OF AIR IN MAKING A STOP

various supposed conditions as given by the instructor. This should be done till he has shown himself thoroughly familiar with the apparatus, and competent to handle it alone.

Besides the mere mechanical operation of the brakes, instructions regarding the handling of them should be given. For example: it is a common thing for a motorman, in making a stop, to let into the cylinder about 5 lb. first, then afterwards at frequent intervals 5 lb. more, till, when the car comes to a standstill, there is a large pressure in the cylinder. Invariably during such a stop the passengers get a decided shaking up. It becomes the duty of the instructor, therefore, to show that, as the speed decreases, the cylinder pressure necessary to obtain a certain braking power becomes less also; consequently the above mentioned proceeding is exactly wrong. The diagram will make this more clear. The dotted line represents the results due to a serial application as above described; beginning with a small pressure and ending with a large one in the cylinder, the decreasing velocity will follow approximately the dotted curve. If, however, this pressure were made to follow the full line, giving a high initial pressure and gradually reducing it as the speed decreased, the stop would follow closely the full curve and be much smoother and quicker, and, as shown, a considerable gain in the length of stop would result.

Such points as this, and many others, can most readily be brought home to the motorman, by a well-equipped and carefully carried-on School of Instruction, and we most urgently recommend that one be instituted wherever possible. Its cost of installation and maintenance is practically negligible and trifling, and will be many times made up in the better maintenance of the brake equipment which is sure to result.

Robbers entered the office of the Wheeling & Elm Grove Railway Co., at Wheeling, W. Va., August 2nd, pried open the cash box and got away with about $300.

Indications are that there will be a new trolley line in operation between Hartford and Middletown, Conn., in a short time. This will connect with the Hartford Street Railway Co. and the Middletown Street Railway Co. lines and will open up a very large territory of no small commercial value.

Question Box of the Mechanical and Electrical Association.

Mr. S. W. Mower, secretary of the American Railway Mechanical and Electrical Association, has issued the following circular to the members, concerning the question box:

"The accompanying questions have been received in answer to the circular concerning our question box, issued July 12th.

"They are now submitted to the members, with the request that each one will reply to those in which he is especially interested, indicating the questions referred to by their numbers in this circular.

"All answers should be in the hands of the secretary by September 1st.

"Unless instructed to the contrary, the names of those making replies will be published."

1. What is a "frequency changer," and how used?
2. Of what use is a "power factor" on a circuit?
3. What is a reasonable life for brooms on snow sweepers?
4. What is the best material for a gear case, cast iron, steel or wood?
5. Is there any way of telling when a car axle is crystallized and unsafe?
6. What is the best method of preventing car circuit breakers getting out of adjustment?
7. Can satisfactory results be obtained by using a twenty-five cycle machine for lighting purposes?
8. Which is the best material for car axles, common steel, cold rolled steel or forged iron?
9. What is the best water and heat-proof insulation and paint to use in winding field coils?
10. What results have you obtained with asbestos covered wire for winding fields? Have you had any trouble from moisture?
11. Which is the better pinion for length of service, for noiseless running, and for wear on the gear,—machine cut or hot pressed?
12. What head-linings for cars, other than veneered, are on the market, particularly something in which glue is not used, and which are both water and fire proof?
13. Some roads have motor inspectors out on the street, under the mechanical department. Does the benefit derived warrant the expense incurred, and in what way?
14. Which is preferable for lubricating motor bearings, oil or grease? How do they compare for cost? How can oil be substituted for grease in the standard grease boxes of the Westinghouse 12A, G. E. 67, and G. E. 800 motors?
15. What are the relative costs of journal lubrication with regular grease, the Gelena system, and the automatic oil lubricator?
16. What are the comparative merits of steel tired and cast iron wheels for interurban, suburban, and ordinary city service?
17. Is it economical to grind cast iron chilled car wheels with an emery grinder before they are put under a car? By so doing, is their life lengthened or shortened?
18. What has been your experience with rolled steel wheels, as regards wear, after they have been turned down once? Can you explain why the flange on one wheel should wear to a square shoulder, while that on the other end of the axle retains its shape?
19. What is the exact mode of procedure in winding "fire proof" fields that are to be filled with whiting, shellac, or other fire resisting insulations?
20. When babbitt metal is run into an armature shell, in cooling it contracts and pulls away from the shell. By what means could the babbitt lining be made to fit the shell tight?
21. Armature bearing shells become loose in the motor frame. How can this be corrected in old motors, and could not street railway motors be so designed as to prevent it, or to take up the wear?
22. How can flashing or burning be prevented with the K-12 controller on cars equipped with 4 G. E. 1,000 motors, 22-62 gearing, 600 volts on the line and a fast schedule; or any equipment where a heavy fast schedule has to be maintained?
23. What is the best method of testing an armature after rewinding? In using the Conant instrument for testing motor fields, widely different readings are often obtained when a certain coil is tested in the motor, then removed and tested separately. How can such errors be avoided, and by what method can weak fields be positively located?

Guy Morrison Walker.

The article on "The Why and How of Interurban Railways" has attracted so much attention that we are sure our readers will be interested in a short sketch of the author. Mr. Guy Morrison Walker, who is recognized as one of the best electric traction experts, is also a widely known authority on financial matters. Mr. Walker was born in January, 1870, at Fort Wayne, Ind. He is a graduate of De Pauw University, at Greencastle, Ind., and of the law school, and was awarded degrees of A. M. and LL. B. He has been admitted to the bar in Indiana, New York, Michigan, Tennessee and Arkansas. Mr. Walker has traveled extensively in this country and abroad, and for 10 years he resided in China, in consequence of which he is admitted authority on all questions pertaining to that country. He edited all the matter relating to China in Leslie's Weekly during the Chinese-Japanese war, and he was called in consultation by President McKinley during the period of trouble between the Powers in the Chinese Empire. During the winter of 1900-01 he delivered a course of lectures on "China and the Chinese" before the New York Board of Education, and a pamphlet on "China," which he prepared for the "Four Track News" was so well received that it reached a circulation of more than 100,000 copies. Mr. Walker's name is familiar to the readers of the "Review" from the fact that during the past three years he has contributed valuable electric railway articles to this magazine, the more important ones being "The Interurban Railway as an Investment," which was published in the "Review" for September, 1901, and "The Why and How of Interurban Railways," which appeared in the June, 1904, issue. Mr. Walker has published a number of pamphlets pertaining to financial and transportation matters which have been accorded merited commendation, one, on "Interurban Railways," having a circulation of 100,000 copies, and another, on "Railroads and Wages," having a circulation exceeding 200,000 copies and running through several editions. Other articles by Mr. Walker which have been widely read include those on "Municipal Bonds," "What Shall We Buy?" and a study on trust companies, which he also read before the Tennessee Bankers' Association. He has also written treatises on insecure foreign loans which have been floated in this country, quasi-public corporation securities, and similar topics. Mr. Walker is not a theoretician, merely, but has been actively engaged in large practical undertakings. He participated in the organization of the Lake Shore Electric Railway Co.; negotiated the purchase of the Maumee Valley and Waterville Southern railways by the Toledo Railways & Light Co., and sold the Detroit & Toledo Shore Line Railroad Co. to the Grand Trunk and the Toledo, St. Louis & Western roads. As counsel for the Everett-Moore syndicate his services were complimented in the highest terms. In 1894 Mr. Walker was interested in the organization of the Terre Haute Trust Co., the first trust company in Indiana, outside of Indianapolis, and in 1898 he organized the Security Trust Co., of Toledo, O. Afterward he located in New York City, where he has established an enviable record as adjuster of damage claims. In Mr. Walker, the transportation interests of the country, both steam and electric, have one of their ablest advocates and sturdiest defenders.

C. M. WALKER.

A trackless trolley line is being installed at Hull, Mass. This is the first road of the kind in New England.

Two Scioto Valley Traction Co. cars, July 26th, made the run from Columbus to Lancaster, O., 51 miles, in 51 minutes.

Two Houston Electric Co. cars were dynamited July 24th, and eight persons were injured. These explosions make seven which have wrecked cars in Houston since the inauguration of the street car strike about three months ago.

Nashville Notes.

The Nashville Railway & Light Co. has placed an order with the Carnegie Steel Co., and is now beginning to receive 700 tons of 70-lb., 60-ft. A. S. C. E. steel rails, to be used during the remainder of this year in the work of reconstruction already mapped out.

The laying of rails on the Buena Vista line and its extension has been fully completed, and only the ballasting of part of the line remains to be done to entirely finish this route and bring it up to the standard set by the Company.

An important extension of the Nashville Railway & Light Co's. lines in the neighborhood of Vanderbilt University will be made as soon as practicable after obtaining the necessary franchise from the Davidson County Court, application for which is now pending.

Good progress is being made in the reballasting and placing of new ties on the Glendale line, enlarging the radii of curves to better accommodate the large new double truck cars now operated over this route, and replacing old trolley and feed wire poles with larger ones to carry the heavier feeder-wire that will soon be put up on this line. This track was reconstructed about three years ago with heavy rails, only needing the work above outlined to put it in the best of condition.

In the power plant of the Nashville Railway & Light Co. good headway is being made in the installation of the 1,500-kw. turbo-generator, but before it can be completed it will be well loaded, so great has been the demand on the company for electric lights, electric fans and electric signs, as well as power, and to provide for future business an order has been placed with the General Electric Company for an additional 3,000-kw. turbo-generator. The business has grown far beyond the company's anticipations, but it is believed that with the 3,000-kw. machine it can certainly satisfactorily care for all the business offered. An order has also been entered with the Babcock & Wilcox Co. for a new battery of steel header boilers, 450 h. p. each, for early delivery.

So far along has the work of installing the machinery progressed at its new power plant that the company has now abandoned the machinery at the old power plant, has sold the site and buildings and is now negotiating for the sale of the old machinery therein, such as engines, generators, alternators, exciters, switchboards, condensers, heaters, one battery of boilers, stacks, cranes, pumps, piping, belting, etc.

To take care of increased traffic, an order has been placed with the J. G. Brill Co. for twelve vestibuled Brill patented semi-convertible closed motor cars, 34 ft. long over all, with G. E. No. 67 motors, mounted on Brill trucks. Each side of each car will be provided with six Hale & Kilburn seats, No. 99 B walkover pattern, 34 in. long, with reversible backs. These cars are practically duplicates of an order filled by the Brill company last spring for the Nashville company.

The extension recently built by the Chattanooga Electric Railway Co. to Rossville, Ga., is now being operated by that company in competition with the Rapid Transit company's line to the same point on its way to Chickamauga National Park. Nothing further has recently developed as to the Chattanooga Electric pushing this new line on to Chickamauga Park in order to further compete with the Rapid Transit, but it is believed that this will ultimately be done unless the two interests consolidate, of which there now seems to be little or no talk.

The Chattanooga Waft Co., which has received a charter to build an aerial tramway from Broad St. in Chattanooga to the top of Cameron Hill in Boynton Park, with a capital stock of $20,000, has applied to the City Park Commission for the privilege of building a terminal in the park, and it is probable that this permission will be granted. It is proposed by the company to carry passengers in a very novel manner by means of an aerial cableway, about three-fourths of a mile, in one minute. The company will also ask the City Council for a franchise to build the line over certain of the city's streets.

The Buffalo, Gardenville & Ebenezer Ry. and the Buffalo, Hamburg & Aurora Ry. are to be consolidated.

A school for the instruction of motormen and guards of the Interborough Rapid Transit Co. has been opened in the Manhattan Elevated yards in New York City.

CHICAGO THE LONDON

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We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

DOES THE MANAGER WANT ANYTHING?

If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

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SUMMARY OF CONTENTS.

LOCATION OF THE THIRD RAIL.

There are now some 30 or more companies operating electric systems in which current is transmitted to the car through a third rail, but there is no uniformity in the practice as regards the location of the conductor rail with reference to the track rail. The elevated railroads in this country place the center of the conductor rail about 20 in. (from 19½ in. to 22¼ in.) from the gage line of the nearer track rail, and the surface of the conductor rail from 5¼ to 7½ in. above the surface of the contact rail. On interurban roads these dimensions are about 20 in. from the gage line to the center of the conductor rail and from 5¾ to 7½ in. for the vertical distance between the tops of the two rails; the Albany & Hudson R. R. is an exception, as it places the conductor rail 27 in. away instead of 20 in., and makes the height 6 in. above the track rail.

The dimensions adopted for the new work of the Baltimroe & Ohio electric track are 30 in. and 3½ in. respectively. The New York Central, for the electric tracks for its New York terminus has the dimensions 27 in. and 3½ in. respectively. In the New York Rapid Transit subway they are 26 in. and 4 in. The New York, New Haven & Hartford, the Central London Ry. and the Liverpool Overhead Ry. place the conductor rail in the center with the surface 1½ in. above the top of the track rail.

The requirements in locating the conductor rail at a higher elevation than the track rail are principally two; a rail should be high enough so that at crossovers and turnouts the shoe which takes the current will not strike the track rails and second, the conductor rail should be sufficiently high above the ties to permit of satisfactory insulation. Opinion will, of course, vary as to the type of insulator that can be used to advantage.

Inasmuch as with the adoption of electricity for motive power on steam railroads and the further extension of existing electric interurban lines, the time will eventually come when it will be desirable to interchange electric cars to a considerable extent the position of the third rail should be standardized. The present is the proper time to bridge the difference between 20 in. and 27 in. and between 6½ in. and 3½ in. which dimensions now characterize interurban and main line electric third rail practice. Negotiating for a common standard is suitable work for the A. S. R. A. to take up with one of the steam railroad associations.

A GOOD EXAMPLE OF RAILWAY ADVERTISING.

The United Railroads of San Francisco has followed the example of a considerable number of other railway companies and undertaken the publication of a monthly paper, which serves as a convenient and efficient medium for direct intercourse with the company's patrons and the public in general. Experience has demonstrated that such an investment in the nature of advertising is a paying one, and it gives the company opportunity to place before the public facts which are not generally known and which cannot but have an important effect of modifying public opinion, aside from the benefit which the company derives from the publication as an advertising medium. In the "Transit Tidings," which is the name given to the San Francisco paper, we notice a very effective method of calling attention to the opportunity for pleasure riding which the system affords. In the first number of the paper a prize of a book of one hundred tickets was offered for the most interesting ride which a stranger could take over the lines of the company for an expenditure of 15 or 20 cents. A similar prize was also offered for the best name for the paper itself, as the name first chosen—"Trolley Tidings"—was not regarded as suitable for the paper, which also covered the cable lines of the system. No fewer than 1063 suggestions were made regarding the new name and seven prizes were awarded, although only one was promised, and the name was changed to "Transit Tidings" with the third issue of the paper. The competition for the best 15 and 20-cent rides was followed with similar offers for the best 10-cent rides and brought out many suggestions, some of which were really remarkable in the number of points of interest that can be covered. The latest request is for a short rhyme of four or eight lines for each of the rules which the company would like to have observed on its cars Mark Twain's famous "Punch in the presence of the passenjare" is suggested as a model.

The four rules referred to are worth quoting: 1. Ask for a transfer when you pay your fare. 2. Do not block the rear plat-

form or the rear doorway. 3. Do not board or leave a car while it is in motion. 4. Do not quarrel with the conductor or motorman.

Another instructive prize offer was made to school children, who were asked to compute how many passengers the company must carry in order to meet operating expenses and taxes, the necessary data being given. It is apparent that these prize competitions must be very effective as a means of making the public appreciate how much the company is offering in exchange for 5-cent fares and what its burdens are in the way of wages, taxes, etc. The answers received always being well up in the hundreds, and as each contestant has his circle of friends to whom he tells what he is doing, it means that several thousand people are learning something about the United Railroads, which it is of advantage to the company to have known. "Transit Tidings," as it is being conducted, is one of the most efficient means of advertising street railways that we have ever seen.

ELECTRIC RAILWAYS IN GERMANY.

On another page will be found a letter from the United States Consul General at Berlin, in which are discussed the costs and profits of electric railways in Germany. This report is based upon the financial statements and reports of the German railways, which are under the supervision of the public authorities to a very considerable extent. The conclusion that should be drawn from electric traction operation in Germany is practically the same as is found in this country, where we have at hand reports showing similiar data. The result shown is that while the electric street railway serves the public infinitely better than any other system of local transportation, the investments in electric lines are, in most cases, less lucrative to stockholders than were those in horse railways. In America one reason for the very heavy capital expenditure in connection with electric railways has been that the companies had to indulge in considerable experimentation and buy apparatus, which was not only very costly to install but quickly became obsolete. In Germany this has also been the case, except that much of the experimentation was forced upon the companies by municipal authorities and not undertaken voluntarily for the benefit of the public. The most striking example of the imposition of impractical conditions was in requiring storage batteries to be used in the down town districts, these batteries being carried on the car and charged from the overhead trolley line on the outlying portion of the system. In another respect German municipalities have made the financial success of the electric railway difficult, requiring very low fares and heavy expenditures in paving, with limitations on the rate of fare that may be charged.

At the close of 1902, of the 1,906 miles of electric street railway in Germany, 346 miles, or 18 per cent, were under municipal ownership, and of these latter, 65 miles were leased to and operated by private companies. The four longest lines under municipal ownership are those in Frankfort, Düesseldorf, Munich and Cologne, none of which has over forty miles of track in operation. Regarding the municipally operated railways, it is said that the fares charged are higher than those charged on similar lines operated by individuals or companies. The result is stated to be "that experience has not increased public sentiment in Germany in favor of municipal management of street railways." Several cities that have built their own lines are now considering the plan of leasing them to private companies for operation.

HOW SHOULD DEPRECIATATION BE ENTERED ON THE BOOKS.

One of the questions submitted for the Street Railway Accountants' question box is whether the property of the street railway company—its tracks, for instance—should stand on the books forever at the original cost or whether the account representing the cost should be reduced from year to year, or from month to month, to make allowance for wear or other depreciation.

As the question stands, "Shall the account representing cost of property be reduced from time to time to take care of depreciation?" there can be only one answer. Yes, if by account is meant the figures which represent the net cost of the property on the balance sheet. If by the question it is meant to ask whether the track account, for instance, shall be reduced from time to time, there may be two answers and our own opinion is that the correct one is No.

Depreciation is a fact and has to be taken care of at one time or another. Many companies are in financial trouble today that would not exist had the fact of depreciation been recognized and properly provided for. There are two ways to provide for depreciation. One is to reduce the asset from time to time to correspond with the decreased value resulting from depreciation; the other is to enter the amount in a separate account, known perhaps as "Depreciation Reserve," which will show as a liability on the balance sheet.

An account representing an investment can never be satisfactorily closed until the investment is disposed of by sale or otherwise, and then the accountant can tell readily the debit or credit that must be made to profit and loss. If a generator, for instance, costing $10,000, is sold for $5,000 after ten years of service, the depreciation is definitely known to have been 5 per cent per annum, but as very few of the property accounts of an electric railway may be treated in such a summary fashion, the next best thing to do is to estimate what the depreciation should be, and by properly providing for this in the accounts prevent the management and stockholders from deceiving themselves as to the true state of affairs.

Experience will in each case provide some measure as to what is a proper allowance to make for depreciation. Thus, the British Columbia Electric Railway Co. considers that 5 per cent per annum is sufficient to allow for depreciation on its electrical, steam and hydraulic machinery, 3½ per cent for rolling stock, 2 per cent for track, 10 per cent for poles, 3 per cent for overhead lines, etc.

Assuming that these figures be accepted, and it is granted that allowance should be made for this depreciation in the accounts, the next question is what is the best way of doing this. One scheme is at the end of each year, taking the pole account as an example, to debit it with 10 per cent of the then footing. Various additions will naturally be made during the succeeding year, and at the end of twelve months more, 10 per cent of the then existing footing is debited. If it is desired to have the monthly reports show how depreciation has been cared for, the debit of ten-twelfths of 1 per cent could be made each month instead of a single entry at the end of the year. This method is open to two serious objections. The manager thinks that he is taking care of the depreciation by deducting 10 per cent per annum; in point of fact, he is not. If the 10 per cent is written off at the end of the year only, the first year 10 per cent is allowed for depreciation, the second year 10 per cent is allowed on the addition made during the second year, but only 10 per cent of (100 per cent minus 10 per cent) or 9 per cent is allowed as the second year's depreciation on the older material. Similarly the third year the old material received an allowance of only 10 per cent of 90 per cent of 90 per cent of the total or 8.1 per cent. As there is no uniformity in the additions which have been made to the account because of installation of new poles from time to time, one can never tell just what the additional allowance of depreciation is. If it is intended to allow 10 per cent for depreciation, at the end of 10 years all of the material 10 years old should have disappeared from the accounts.

The method described for writing off depreciation does not give this result, as after 10 years there will still remain 34.86 per cent of the amount uncared for; that is the average depreciation was only 6½ per cent per annum. If the deduction be made by entering a credit each month of 10-12 of 1 per cent of the monthly footings, at the end of ten years there would be 36.63 per cent of the ten-years old material yet uncared for; that is, the actual depreciation allowed is 6 1-3 per cent per annum. If it be contended that the figure given of 6½ or 6 1-3 per cent per annum, which results from applying the 10 per cent rule in the fashion described, is in fact sufficient allowance for depreciation, the answer is that the depreciation allowed should be defined as 6½ or 6 1-3 per cent instead of 10 per cent and then the deduction made in a manner to show results that are not misleading.

Assuming 10 per cent as the proper allowance for the depreciation of poles, the better method would be to open a new account to be known, say, as "Pole Depreciation Reserve," and then each year credit this account with 10 per cent of the footing of the pole account or each month credit it with 10-12 of 1 per cent of the monthly footings of the pole account; then at any time the difference between the "Pole Account" and the "Pole Depreciation Reserve Account" will show the value given to the poles as a corporate asset.

Aside from the fact that in practice the latter method gives accurate results and enables one to determine exactly just what allowances have been made for depreciation, which may be considered a practical advantage only, there is considerable to be said in its favor from a theoretical standpoint. No matter how carefully the figures used may have been derived, the fact remains that an allowance for depreciation is more or less guesswork. It is intended to be the average for the life of the material but the losses of one year are seldom identical with those of another. A car, for instance, that should run for twenty years under ordinary circumstances may be wrecked on its first trip. On the other hand, there is never any question as to what the investment has been. Therefore, when the accountant writes off depreciation, which he believes to be a sufficient allowance under average conditions, the entry should be made in such a way that no confusion will arise, and so that the assumed depreciation may be easily separated from the actual investment. In other words, the property account should show what has been invested. That is an actuality and should remain such and not be confounded with estimates when the latter can be quite as easily kept separate.

THE COLLEGE MAN IN BUSINESS.

The article with this title by Prof. Henry H. Norris, Cornell University, which appears on another page, will be found of special interest as one of the most recent statements of the relations which exist between employer, employe and the engineering colleges. While Prof. Norris' article has a somewhat broader title, it deals more particularly with the engineering graduate rather than the college man in general. At the present time the young man who does not definitely know just what his life work will be cannot do better than to pursue a course in engineering, and an employer looking for men to learn his business cannot do better than to pick engineering graduates. This condition results from the development which has made the present a mechanical or engineering age. Engineering enters much more into general business than formerly, and the systematizing of business has led to a new school of salesmen, so that the commercial field offers many opportunities for technical men. Where formerly salesmen were employed because they were 'good fellows", regardless of whether they could discuss the merits of the goods they were handling in other than a parrot-like fashion, today men who understand the business are educated as salesmen; that is, they are chosen for other qualifications and educated as salesmen, and not employed because they have reputations as salesmen regardless of other qualifications.

Professor Norris comments upon the changed attitude which the employer of today has towards the man just out of college, and also upon a corresponding change in the attitude of the young graduate towards the world in general. To what extent the change on the one hand has resulted from the change on the other, or to just what extent the material development of the country has affected both, is difficult to say. The teaching bodies in the technical schools have for some years been making a careful study of the conditions which the graduate has to meet. These conditions, especially in the railroad field, are severe, and in some instances unreasonable. The leading railroads of the country have in the last 10 or 15 years been putting in their shops a limited number of young men, college graduates, who are known as special apprentices. These men, or boys, start in shops and are paid, possibly 50 cents per day, a rate of compensation which is very slowly increased during the two or three or four years of the apprenticeship. The idea is that by getting practical experience these men will, after a few years, be fitted to take responsible positions in the engineering department of the road, and this is in fact the case; however, there is reason for complaint as to the way the employing company treats its special apprentices. Too often they are kept at work on one machine when the idea of their employment was to give them experience as rapidly as possible and not attempt to make them machinists, profitable for the company as such. In other instances after a few months in the shop the young man is taken out and put in the drafting room on some special work or given some other job calling for a high degree of intelligence, but without increasing the compensation. The apprentices which have been put on such special work as a rule acquit themselves in an entirely satisfactory manner, and the employing company secures services that otherwise would have to be paid for at the rates charged by successful practicing engineers.

Such a situation is by no means fair to the apprentice, and the practice must result in making it difficult or even impossible to secure the class of men desired. In fact, one of our largest railroads a few years ago asked the head of an engineering college, which had already sent it a number of special apprentices, for a list of the best ten men in the class of that year. The best ten men, however, had already been picked out by manufacturing concerns who knew the advantages of getting good material, and the railroad in question then called for a list of the ten second best men. The head of the school pointed out the humiliating position the railroad was taking in admitting that second-rate men were good enough for it, and accepting them instead of making conditions that would attract the class of men it really wanted and needed. The colleges formerly made a similar mistake in requiring too much manual work; the tendency now is, as pointed out by Professor Norris, to make this purely illustrative.

The apprenticeship system as applied, even in the manufacturing companies where the conditions on the whole are probably more satisfactory from a pecuniary standpoint, are not all that could be desired, as only a man who has an income other than his wages can afford to go through the two or three years at meager pay before he reaches a position in which he is self-supporting.

At this time only a small minority of those identified with the operation of electric railways are engineering graduates, but the proportion is increasing each year, though perhaps not as rapidly as it should. There are fewer opportunities for apprentices than with steam railroads, and most of the college men who enter electric railway work come from the engineering forces of the manufacturing companies. The demand for men with engineering training is increasing in this field as it is all the time becoming more difficult to secure the required knowledge by means of the old method of growing up in the business.

New Lines and Extensions Opened.

The New York County Traction Co. opened its new line from York to York Haven, Pa., August 1st. It is 10 miles long. Later it will be extended to New Cumberland and Bridgeport, where it will connect with the Harrisburg street railway. It runs through several large towns and is expected to draw traffic away from the Northern Central Ry.

July 24th the Atlantic Shore Line Railway Co., of Biddeford, Me., opened its new line from Kennebunkport to Biddeford, 10 miles.

July 25th the Scioto Valley Traction Co. opened through traffic between Columbus and Lancaster, O.

July 28th the East Shore & Suburban Street Car Co., whose line forms the connecting link between the old and new towns of Richmond, Cal., opened its system with a celebration. Mr. W. S. Rheem, superintendent of the Standard Oil Works, at Richmond, is general manager of the road.

August 7th the Indiana Northern Traction Co. operated its first cars over its new line between Marion and Wabash.

August 8th the initial trip over the line of the Hudson River Traction Co. from Hackensack to North Arlington was made. Here the line connects with the tracks of the Public Service system, thereby affording through service to Paterson, Passaic and Newark.

The York Haven line of the York County Traction Co. was formally opened to traffic on the afternoon of August 6th. The event was celebrated by the officials going over the line with a large number of guests. The new line parallels the Northern Central R. R. and is about eight miles long.

The Roanoke Railway & Electric Co., of Roanoke, Va., has published a number of attractive leaflets to advertise the various branches of its business. These sheets are 6 x 9 in., a size convenient for carrying in receptacles in the cars and are large enough to permit of illustrations that are attractive to the public they are designed to reach. Each sheet calls attention to some special thing. No. 1 illustrates the application of electric motors to driving coffee and spice mills, meat grinders and such apparatus as lends itself to window display; No. 2 is for office lighting; No. 3 deals with electricity in the home for heaters, fans, laundry irons, etc.; No. 4 is a power circular and No. 5 advertises the express line between Roanoke and Salem.

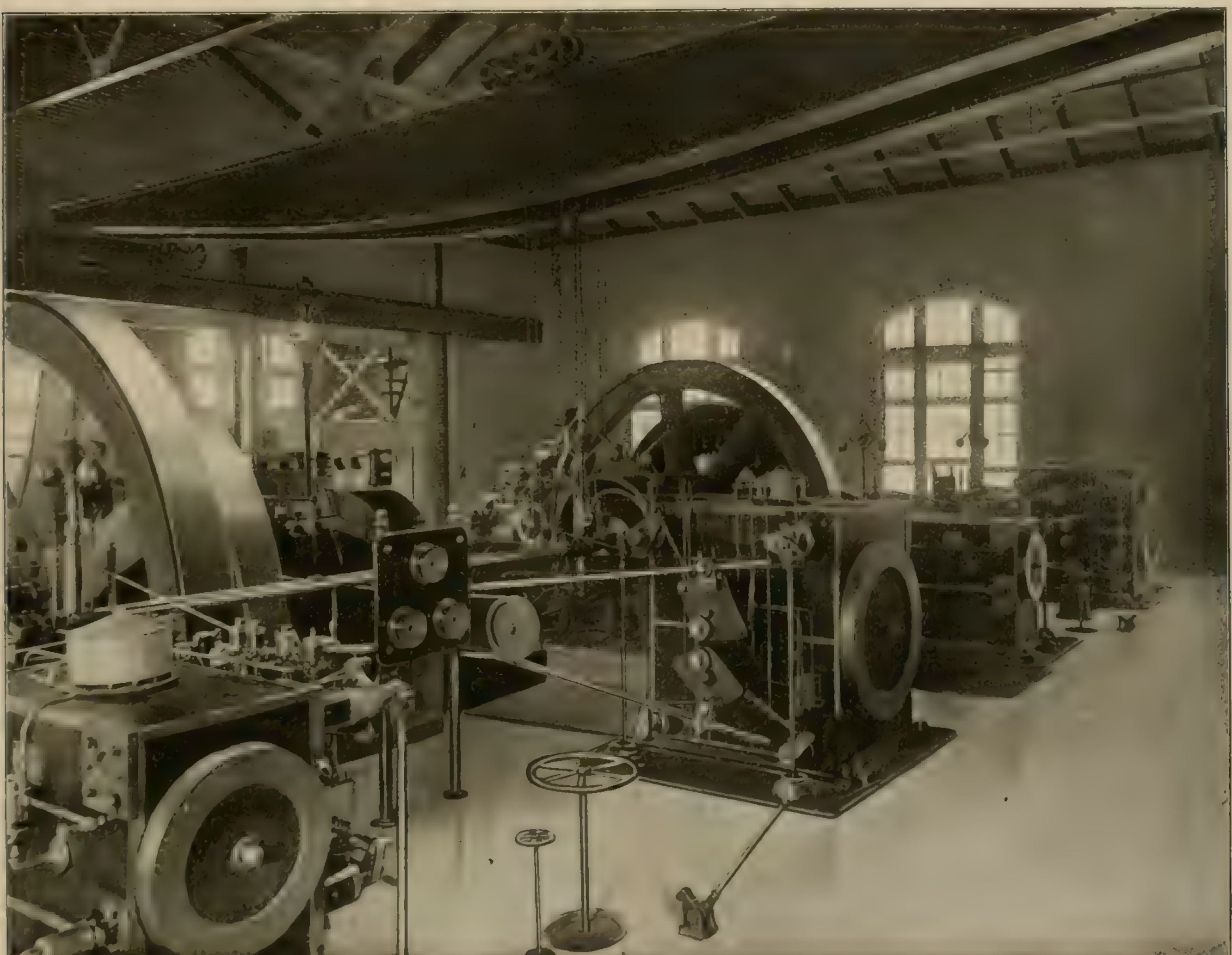
The Springfield, Troy & Piqua Railway Co.

Describing the Line, Power House and Sub-Station Equipments and Rolling Stock of the Most Recently Completed Ohio Interurban.

The Springfield, Troy & Piqua Ry., which was formally opened to traffic on June 8th, is an overhead trolley system at present running between Springfield and Troy, O., a distance of about 29 miles. The route of this road is given on the accompanying map, from which it will be seen that only part of its ultimate length is yet constructed. As shown by the map, a second division of the road running between Christiansburg and Piqua remains to be built and the construction of this part of the line is to be commenced at once. The road runs through a beautiful section of farming country and touches a number of prosperous villages en route. The total population tributary to the road is 71,321, of which 63,100 is the population of the cities and towns and 8,221 the rural population. This gives a gross population of 1,981 per mile of road.

Among the principal cities and towns through which the road passes is Springfield, with a population of 45,000; Lawrenceville, 200; North Hampton, 400; Dialton, 100; Christiansburg, 800; Casstown, 400; Troy, 6,500. This road, unlike many of the Ohio interurbans, has an entire monopoly of the territory which it serves, as it does not closely parallel any existing steam or electric railroad. In addition to the passenger business the company has also prepared to carry on a freight and express business and arrangements are pending for the establishment of a double daily mail service to all villages along the line.

The Springfield terminus of the road is at one side of the Public Square in that city, which is the general terminus of all the electric lines entering Springfield. At this point connections are made with the Springfield & Xenia, the Dayton, Springfield & Urbana, the Columbus, London & Springfield and the cars of the Springfield city system. The cars of the Appleyard system operate around a loop in the Public Square while those of the Springfield, Troy & Piqua and the Springfield & Xenia system have a stub end terminal which extends to the loop but is not connected with it. The road crosses two valleys, one of which is the Mad River Valley just outside of Springfield, and the other the Miami Valley just before reaching Troy. This necessitated grades of considerable extent at these points, the maximum grade being 2.6 per cent for a distance of 8,000 ft., which occurs just outside of the



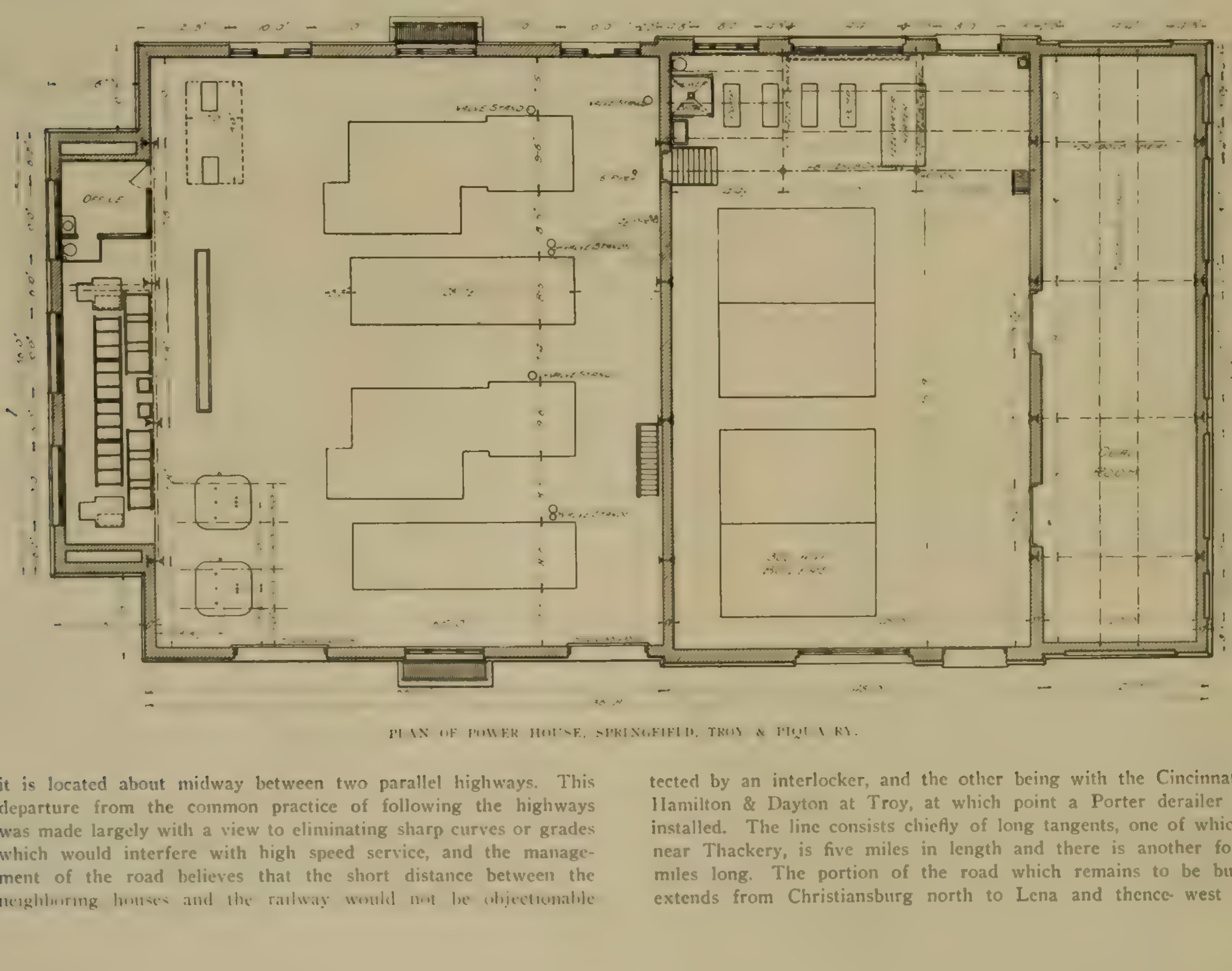
VIEW IN ENGINE ROOM, SPRINGFIELD, TROY & PIQUA RY. SHOWING COOPER CORLISS ENGINES.

city of Springfield. Within the city and on top of the table land which lies between these two valleys, the country is almost absolutely level and as all of the curves on the road are of very long radius except in the city streets no difficulty will be found in operating the cars at as high a rate of speed as may be desired.

The road has been built on private right of way throughout ex-

SIDE ELEVATION OF POWER HOUSE.

cepting within the cities and towns and the private right of way varies considerably in width, the minimum width being 35 ft. and the maximum width 175 ft. While the road follows the highways at a number of places this location has not been generally adhered to, as in other places the road runs at some distance to the rear of the houses along the highways and for a considerable distance

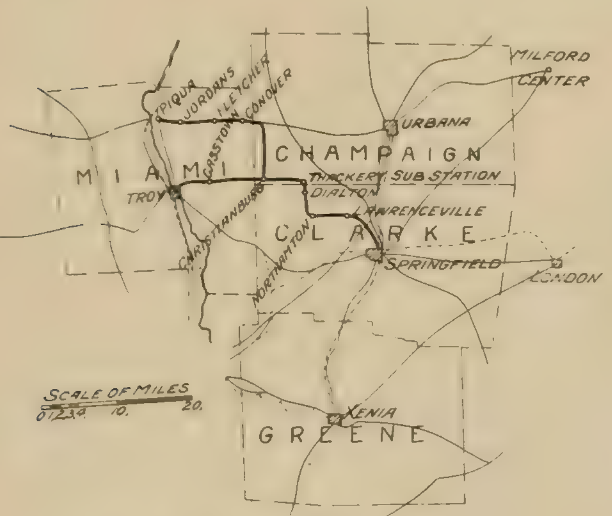


PLAN OF POWER HOUSE, SPRINGFIELD, TROY & PIQUA RY.

it is located about midway between two parallel highways. This departure from the common practice of following the highways was made largely with a view to eliminating sharp curves or grades which would interfere with high speed service, and the management of the road believes that the short distance between the neighboring houses and the railway would not be objectionable or deter local traffic, while at the same time this location leaves the road in a far better position to undertake high speed through traffic than though the highways had been more closely followed. At one point in the city of Springfield a considerable portion of the sidewalk was cut off by agreement of the local authorities in order to secure an easy curve and at another point just on the outskirts of the city where the car barn and freight house are located, as shown in the accompanying illustration, the company purchased a right of way through one of the city blocks in order to eliminate two sharp curves which would have otherwise been unavoidable. There are two railroad surface crossings on the road, one being with the Erie Railroad in Springfield which is protected by an interlocker, and the other being with the Cincinnati, Hamilton & Dayton at Troy, at which point a Porter derailer is installed. The line consists chiefly of long tangents, one of which, near Thackery, is five miles in length and there is another four miles long. The portion of the road which remains to be built extends from Christiansburg north to Lena and thence west to

Piqua. The line between Lena and Piqua passes through the towns of Conover, Fletcher and Jordans and is parallel to the Pan Handle line, but distant a half mile from it, bringing the road in closer connection with the towns just mentioned which are at some distance away from the steam road.

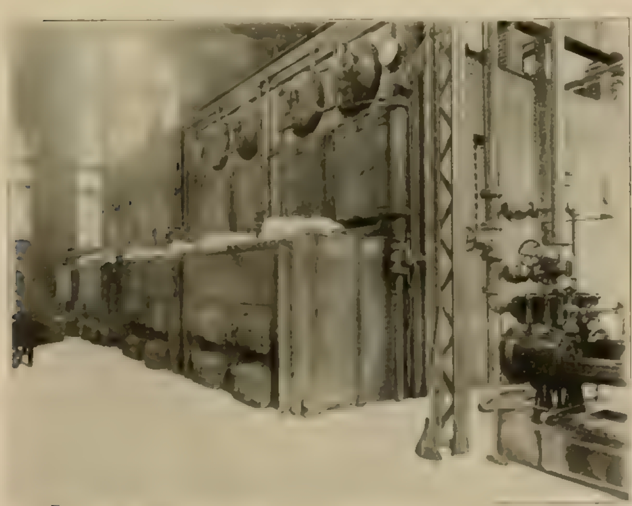
In the paved streets of the city of Springfield the track is laid with 6-in. T-rail made by the Lorain Steel Co., which also furnished all of the special track work in which hardened steel centers are used. Outside of the city limits the road is built of 60-lb. and 70-lb. Carnegie rails of the standard A. S. C. E. section. The rails are laid on white oak ties 6 x 8 in. x 8 ft. in dimensions, which rest on 9 in. of gravel ballast. Six-bolt fish plates are used on the greater part of the line and a few Weber joints are also in use. The rails are bonded partly with Edison-Brown plastic bonds, these being used within the cities and towns and the remainder of the track is bonded with type G all-wire bonds made by the Ohio Brass Co.



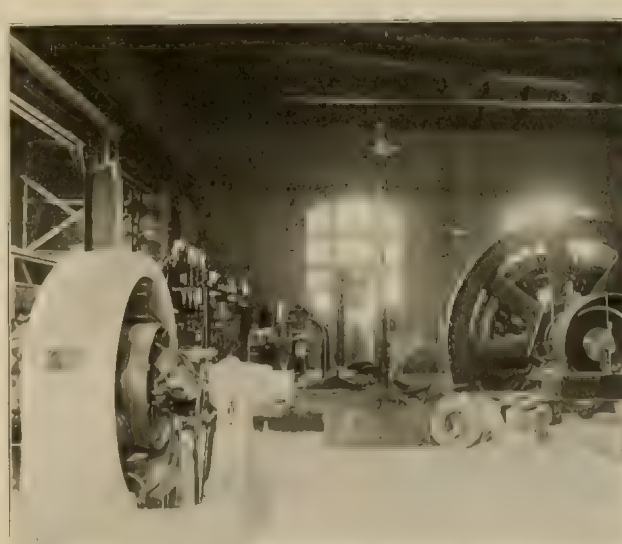
MAP OF SPRINGFIELD, TROY & PIQUA RY.

The overhead work is entirely of side-bracket construction outside of the cities where some span work is to be found, but the pole line on this road is of considerable heavier construction than is usually found. The poles are of juniper and are 35 ft. long with a minimum diameter at the top of 8 in. The overhead work is of the Ohio Brass Co.'s make and a double No. 0000 trolley extends the whole length of the road. The line is single track throughout with turnouts. The power house is just outside of the city limits of Springfield and from here three No. 4 high tension lines run along the road to the Casstown sub-station, a distance of 22½ miles. These high tension lines are carried on Locke No. 103 insulators. These are two-piece double petticoat porcelain insulators of new design and are unusually large. The petticoat which is 7 in. in diameter is made in the shape of an exact half sphere and these are mounted on 11½ x 1½-in. locust pins. There are two cross arms at the top of the poles on which the high tension wires are carried and these cross arms instead of having the usual iron braces have braces of hard wood 20 in. long, which are bolted to the poles and secured to the cross arms by lag screws. The use of wooden instead of iron braces was adopted with a view to having practically no metal on the pole which could possibly occasion short circuits or reduce the insulation of the high tension system. A short cross arm is used lower down on the pole which carries the telephone lines used for dispatching.

VIEW OF LINE IN SPRINGFIELD.



VIEW IN BOILER ROOM—SHOWING EXTENDED FURNACES.



SUB-STATION END OF GENERATOR ROOM.

Power House.

The power house of the Springfield, Troy & Piqua Ry. is located just outside of the city limits of Springfield and is a handsome building of red pressed brick ornamented with gray stone trimmings and having a red tile roof. The building was designed by Samuel Hannaford & Sons, architects, of Cincinnati, and while no special attempt at ornamentation has been made the building presents a very neat and pleasing exterior. A general view of the building reproduced from a photograph is shown herewith and also line drawings of the plan and elevation. It is practically fireproof, no wood being used in the construction except in the roof, doors

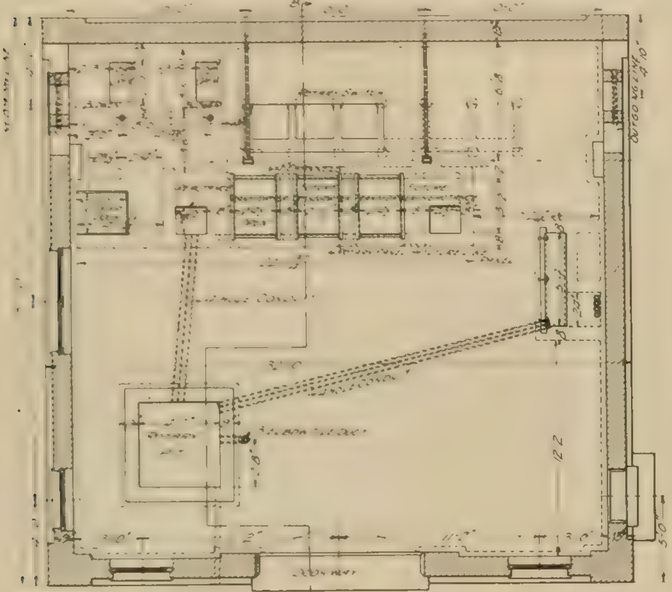
and window frames. Its area over all is 77 ft. 10 in. x 148 ft. 2 in. and it is divided into a boiler room with coal bunkers, engine and generator room, transformer room and engineers' office. The basement extends under the transformer room and engine room and the boiler room floor is 6 ft. below the floor of the engine room. The gallery also extends across one end of the boiler room and upon this are located the feed water heater and pumps. The floor of the engine room is constructed with steel I beams between which is laid slab concrete reinforced with expanded metal. The roof has steel trusses and purlins with 4 x 10-in. yellow pine rafters spaced on 4 ft. centers and with 1¾-in. beaded yellow pine sheathing. The coal bunker which is shown in the righthand end of the plan drawing is 20 ft. x 75 ft. 9 in. in area and in the general view is the engine room floor and by means of this arrangement no steam piping whatever is visible in the engine room. As will be seen from the illustration of the boiler room the boilers are supplied with extended furnace combustion chambers, designed to procure more perfect combustion of the gases in the rear of the furnace under the boiler tubes and reducing the smoke to a minimum. The flue is carried over the rear of the boilers through the side wall of the building to an isolated Custodis stack in which the flue opening is 25 ft. above the level of the boiler room floor. The water for power and condenser purposes is obtained from the Mad River, which is about 1,300 ft. away from the power house. In order to utilize this water supply a pipe line was built between the river and the station, which leads into a well 60 ft. deep and

GENERAL VIEW OF POWER HOUSE, SPRINGFIELD, TROY & PIQUA RY.

that part of the building on which the trestle and track are shown. This track is a branch from the company's line which leads with a 2-per-cent grade to the top of the coal bunkers and the coal cars are run on top of the bunkers and dumped directly into them, thereby avoiding the breaking up of carload lots as well as any carting. The doors to these bunkers open directly in front of the boiler furnaces so that coal is shoveled directly from the bunker into the furnaces. The boiler room is 46 ft. x 75 ft. 9 in. in area and contains four 300-h. p. Babcock & Wilcox boilers in batteries of two each. The rear walls of these boilers are built 7 ft. from the brick partition wall which separates the boiler from the engine room and the steam pipes from the boilers are led back to the header which runs along the wall in this space at the rear of the boilers. This header is located low enough down on the wall so that the branch pipes to the engines are carried out underneath 14 ft. in diameter, and from this well all the water supply for the station is obtained. On a platform at one side of the boiler room are located two boiler feed pumps, two hot well pumps and one Stilwell-Bierce fire pump. The latter has a capacity of 750 gallons per minute and is connected with a stand-pipe system which supplies water pressure for the building. This arrangement was adopted for the purpose of keeping the fire pump in constant operation, so that in case of emergency it would be sure to be in operating condition. The cylinder dimensions of the pump are 16 x 9 x 12 in. and it is supplied with a Davis regulating valve which maintains a practically constant pressure on the stand-pipe system by operating the pump either faster or slower, according to the amount of water used. All of the steam piping is covered with Keasby & Mattison broken joint pipe covering.

The engine and generator room occupies the entire width of the

building and is 66 ft. 5 in. in length. Its equipment comprises two cross compound corliss engines, built by The C. & G. Cooper Co., and having cylinder dimensions of 22 and 44 by 42 in. These engines are rated at 850-h. p. capacity each and are direct connected to two General Electric 600-kw. alternators. These are three-phase

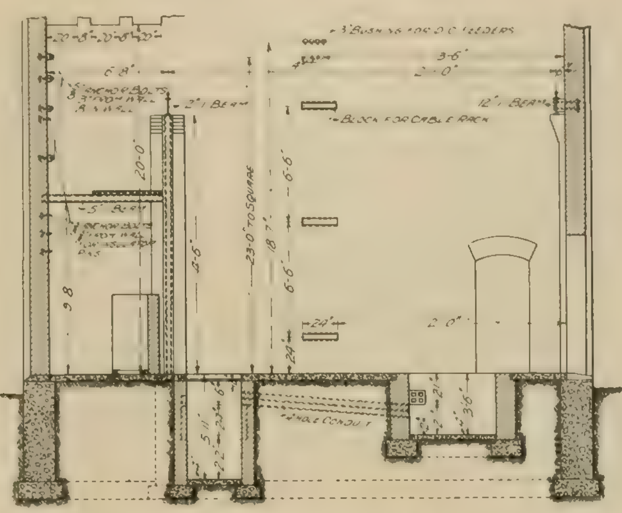


PLAN OF SUB-STATION.

machines running at 94 r. p. m. and generate current at 370 volts. There are two exciters for the alternators which are of 37½-kw. capacity, both of which are driven by General Electric vertical marine type engines. The management of the company favors the use of steam driven auxiliaries for the reason that they involve less complications in the wiring of the power house, are less liable to derangement in case of trouble with the electrical machinery, and further, for the reason that the exciters may be utilized for providing lighting for the building at times when the rest of the station is shut down. The exciters are six-pole machines running

THACKERY SUB-STATION.

at [illegible] r. p. m. and have an output of 280 amperes at 125 volts. The engine room contains a sub-station equipment consisting of two rotary converters, each of 300-kw. capacity, and a low tension switchboard. Part of the current from the generators is led directly to these converters and the rest is led to six air blast transformers, each having a capacity of 180 kw., which step up the current from 370 volts to 26,400 volts, which is the voltage used on the high tension lines. These transformers are situated in a separate room, which forms an extension of the generator room, and beneath this extension is an air chamber which furnishes the necessary air pressure for cooling the transformers. This air chamber is built of brick and contains the high tension wires which are mounted on porcelain insulators held in place by iron brackets built into the wall. The entire engine room is spanned by a traveling crane built by the Case Manufacturing Co., of Columbus, O. At one side of the transformer room there is an engineer's office 11½ ft. square, provided with a toilet room. The oiling of the



SECTION OF SUB-STATION ON B. B.

machinery is accomplished by a gravity system consisting of an elevated tank from which the oil is piped to the various bearings. From these it is piped to the basement under the engine room, where it passes through a "Cross" oil filter and from this it is lifted by means of a small steam pump to the overhead tank. The pressure for the air chamber is maintained by two 50-in. Buffalo fans located in one corner of the engine room. Each of these fans is direct driven by a three-phase General Electric induction motor.

Among the power house auxiliaries may be mentioned the Hoppes feed water heater and 1,000-h. p. live steam feed water purifier, Holly drip return system, a 1,200-h. p. exhaust steam heater and a Worthington elevated cone condenser located outside

CAR BARN AND FREIGHT HOUSE.

of the building above the eaves of the boiler house roof. A useful auxiliary is a shower bath which has been provided for the use of the engineers and firemen. It is located in one corner of the boiler room.

In addition to the sub-station contained in the power house, there are two others, one of which is located at Thackery near the center of the present line, and the other at Casstown, a short distance from Troy. The general exterior view of the Thackery sub-sta-

tion is shown in one of the accompanying engravings and another illustration shows a plan and elevation which apply to both sub-stations, in which the equipment is identical. The high tension wires are taken from the line to three insulators mounted on an iron bracket near the roof of the sub-station. From these insulators the wires bend upward passing into the building through the bottom of a box-like projection built above the insulators. This arrangement, as can be seen in one of the accompanying illustrations, is very effective in preventing rain or moisture from dripping along the wires inside of the building. Inside of the sub-station the high pressure wires are carried on porcelain insulators attached to the rear wall and the lightning arresters are located high upon this wall and are reached by means of an iron gallery and ladder. There are two step-down transformers located in each of the sub-stations and space is provided for a third one should it be found necessary. The locations of the rotary converters and switchboard are shown in the plan view of the sub-station and it will be noticed that conduits are provided underneath the floor of the building for carrying the wires and cables, so that only the high tension wires are in sight.

The car barn and freight house, which are not yet entirely completed, are shown in an accompanying illustration. The car barn, which is the further building shown, is 180 ft. long and 42 ft. wide. It contains 3 tracks which run the whole length of the building and the tracks are laid on a 1-per cent grade, so that in case of fire cars could be quickly run out of the building, even if no current was available. Both of these buildings are of brick laid on stone foundations and have slate roofs. All of the doors and shutters are of the Kinnear steel rolling type. The track on the righthand side of the car house is provided with a pit 16 ft. wide, which extends about 11 ft. outside of cars standing on this track. This pit really constitutes a kind of basement and was designed so that men need not work under the cars to any extent. After the motors, armatures or wheels are removed from the car, it will be necessary only to move them a few feet to one side where a man can work on them as comfortably as upon the upper floor. At one side of the car barn is the stock room, 30 x 20 ft. in area, which has a basement on the level of the pit floor, so that supplies and repair parts are readily accessible to the workmen. The small room in the annex of the car barn is 14 x 20 ft. in size and will be used as the dispatcher's office and motormen's and conductors' room, and is fitted with a lavatory and shower bath.

The building in the foreground of this illustration is the freight house. This is 32 x 60 ft. in size and is of the same construction as the car barns. A track will run through the center of this house, so that the freight cars can be loaded or unloaded from either side.

A telephone system has been installed along the line, which will be used for dispatching the cars. The telephones were made by the Hipwell Manufacturing Co. of Allegheny, Pa.

The rolling stock at present comprises four 50-ft. combination passenger and baggage cars and one express car. One of the passenger cars is shown in the accompanying illustration. These cars were built by the John Stephenson Co., of Elizabeth, N. J., and contain passenger, smoker, baggage and toilet compartments. They are finished in cherry rubbed down to a dead finish. The bottom framing is especially strong and substantial, the outside sills being double with a steel plate sandwiched between them, and the center and intermediate sills are similarly constructed. It will be seen from the illustration that the sides and windows are built on lines similar to the latest Pullman type of coaches. The seats of the passenger compartment are of the Hale & Kilburn "walk-over" type, upholstered in Pantasote in imitation of leather. The vestibules are arranged so that the space on one side of the center door is utilized as a motorman's cab and covers are provided for the platform steps. Both platforms are equipped with controllers and the doors which form the motorman's cab can be folded back so as to enclose the controller and brake valve in a very small space and leave an ample passage for the passengers through this side of the platform. The cars are mounted on M. C. B. type of high speed trucks and are equipped with four G. E. No. 57 motors with type M. control. Westinghouse straight air brakes are used and the cars are equipped with "Eclipse" fenders at each end, G. E. arc headlights and hot water heaters. A rack is provided in the center of each vestibule which contains several tables, which are attached between the seats, similar to the tables used on Pullman sleepers, and which may be used for card-playing, etc., when the cars are chartered by private parties. The main compartment of the car seats 38 passengers and the smoking compartment 16 passengers. The express car has the same motor equipment as the passenger cars.

STANDARD PASSENGER CAR, SPRINGFIELD, TROY & PIQUA RY.

There are two parks along the line of the Springfield, Troy & Piqua Railway which will undoubtedly give rise to considerable pleasure traffic during the summer season. One of these is Snyder Park, which is situated one mile from Springfield and which is controlled by the city. The other park is a base ball park, which is controlled by the railway company, and this is located six miles out from Springfield. As there is no other railway connection to this park, the company will enjoy a monopoly of the traffic to the base ball park.

The same interests which own the Springfield, Troy & Piqua Railway control the Springfield & Xenia line and it is expected that traffic arrangements will be made with the Dayton & Xenia road so that through passenger, freight and express business can be operated between Dayton, Xenia, Springfield, Troy and Piqua, where connections are made with the Western Ohio Railway running to Lima. Its extensive connections with other trolley roads leading to all of the populous centers of Western Ohio will undoubtedly enable this company to build up a lucrative freight and express business within a short time, especially as this line runs through a number of small towns hitherto entirely without railroad connections and all of which are fully alive to the advantages which the new line will offer to them.

The road has been conservatively financed and is owned by a small number of local stockholders. It was built entirely by stockholders and no bonds whatever have been issued. The officers of the company are: John L. Bushnell, president; Fred J. Green, vice-president and general manager, and H. C. Dimond, secretary and treasurer.

Cross-Tie Forms and Rail Fastenings, with Special Reference to Treated Timbers.

An interesting treatise on this subject by Herman Von Schrenk, of the Bureau of Forestry, has recently been issued as Bulletin No. 50 by the United States Department of Agriculture, and the following abstract of this bulletin contains a number of suggestions which are worthy of the attention of street railway men. The wasteful methods employed in cutting ties in the past have called forth many protests and suggestions as to how this work might be checked, but in spite of the general urging to economy and the general acceptance of the fact that timber has become scarcer and more expensive from year to year very little progress seems to have been made towards solving even partially the question as to what is to be done to secure ties in the future. The rapid introduction of treated timbers is the first step in this direction. The advisability of using treated woods is no longer an open question; their use is a matter of necessity. The author, however, firmly believes that unless the problems of tie forms and rail fastenings are considered many if not all users of chemically treated ties will be disappointed. Ties made of red oak and the soft pines will not last, using that term in its broadest sense, unless they are cared for in other ways beside chemical treatment. The chemical treatment of timber is no longer an experiment; timber can be prevented from decaying, and there should be no hesitation in adopting the use of treated timbers on most railroads.

Tie Forms.

With the introduction of treated ties new developments in tie making have taken place. Treated ties allow the use of sap wood, sawed dead timber and of sawed ties. Consequently, tie forms which were impracticable under old methods are now possible. The ties in use in this country are practically all rectangular in cross section, but they vary considerably in dimensions. Each road has its own standards, and hardly two agree. The classification of ties into first, second third class has little significance, because a first-class tie on one road may be a second-class tie on another. The author suggests that they be classified by letters A, B. C, etc., each letter standing for a particular size. Such a classification was, in fact, adopted by the American Engineering & Maintenance of Way Association at its Chicago meeting, Mar. 16, 1904.

Most tie specifications now exclude dead timber, but there is absolutely no reason why dead timber which is sound should not

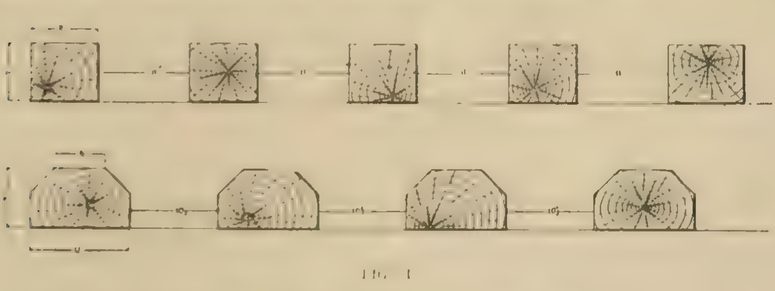


Fig. 1

be used for ties, especially when they are to be treated. Test ties of dead timber which were treated with zinc chloride and placed in the track in 1902 show absolutely no sign of decay, while untreated ties of live hemlock, beech, tamarack, etc., in the same region partially, and in some cases wholly, decayed in 12 months. It can, therefore, safely be asserted that a tie made out of sound dead wood is a good tie, especially when treated.

In regard to decreasing the number of ties per mile of track, it is agreed that the number of ties per rail length could possibly be reduced, so far as the safety of the bearing of the rail on the tie is concerned, by using a stiffer rail, but such a reduction would mean less bearing surface on the ballast, and this is evidently undesirable. The author then devotes considerable space to the discussion of the number of ties possible to cut from logs of certain dimensions, and suggests as a desirable form of tie the section shown in the lower part of Fig. 1. It is possible to cut more ties of this form from logs of a certain size, and a fewer number of such ties would give the same bearing surface on the ballast, although the bearing centers on top of the ties would be decreased. By utilizing this form of tie it will be possible to make a good many more ties than are made out of the same amount of timber under the present specifications. This form of tie has been in use on European railways for many years. A summary of the conclusions of the author is given in the following generalizations:

1. It is not desirable to continue the present method of classifying ties as first-class, second-class, etc., and culls. Instead, an alternative classification is proposed which substitutes a division into grades A, B, C, etc., each standing for a definite size. Such a classification will throw out the cull ties entirely.

2. It is not desirable to decrease the number of ties of the present breadth now laid per rail, for the reason that even with an increased stiffness of rail a reduction in the bearing surface on the ballast is not warranted in view of the fact that a larger wearing surface on the ballast is continually being sought for. In this connection it must be remembered that close spacing of ties will not be possible, since a certain minimum space must be maintained to permit proper track work. Increasing the breadth of the tie will necessarily mean a reduction in number per rail length.

3. Triangular ties are not desirable and ought not to be used because they give less bearing surface on the ballast rather than more.

4. Assuming that tie plates are to be used on treated timbers of inferior grade, it is a waste of timber to require an 8-in. top bearing surface. It is, therefore, proposed that the present requirement be modified so as to admit timber having a minimum of 6-in. top bearing surface. At the same time it is proposed that the bearing surface on the ballast be increased above 9 in. to such an extent as may prove advantageous, depending upon the class of timber from which the ties are made. This would make a half-round tie of the following dimensions: Top bearing surface, minimum breadth, 6 in.; bearing surface on the ballast, 10 to 12 in.; thickness, 7 in.; length, 8 ft. or more.

5. The half-round tie is advantageous from a mechanical standpoint because it gives a greater bearing surface per mile and a correspondingly more stable track when spaced at approximately the same distance now used with 7 x 9-in. ties.

6. The half round tie is good for the lumbermen because in numerous instances it will make two ties where it would have been possible to make only one of the rectangular form.

7. The half-round tie is good for the forest because it will encourage the cutting of large trees and the saving of small ones, and further, will prevent the waste due to leaving many tops in the woods.

8. Taking all these matters into consideration, it would appear that the half-round tie is worthy of trial. Experiments are now under way to test the practicability of sawing a large number of these ties. These experiments are being made in co-operation with the New York Central & Hudson River in the Adirondacks with beech and birch, with the Santa Fe in Texas and Arizona with various pines, and with the St. Louis & San Francisco in Missouri and Arkansas and the Northern Pacific Ry. in Montana and Washington with red fir and lodgepole pine.

Rail Fastenings.

Treated ties require protection against wear, and the rapid introduction of chemically treated soft timbers for ties has raised certain new questions of track construction and maintenance. The deterioration of ties is due to two causes—wear because of mechanical abrasion, and decay. By treatment decay only is arrested. Wear due

to abrasion is a very serious defect, but in view of the fact that railroads nowadays must take what timber they can get, not what they want, it is strongly urged that possible changes be made in those mechanical arrangements which cause wear. The subject of track fastenings is, therefore, discussed at considerable length because it is believed by the author that only with very much modified systems of fastening can ties of most of the softer woods be made

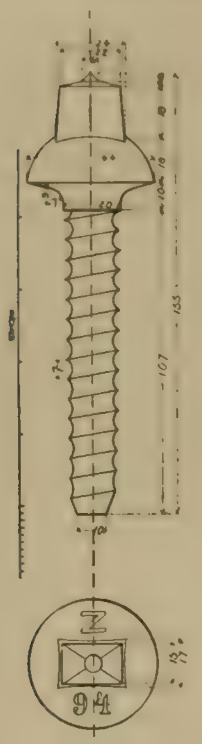


FIG. 2—IMPERIAL FERDINAND NORTHERN RY. OF AUSTRIA.

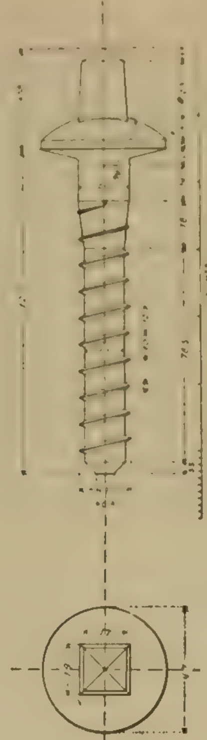


FIG. 3—PRUSSIAN RAILWAY.

to last sufficiently long to pay for the chemical treatment. The forms of fastenings considered are spikes, screw spikes, tie plates and dowels.

Spikes.

The functions of the ordinary nail spike are to hold the rail to the tie and to prevent the rail from spreading laterally. Its principal duty is to hold against lateral displacement in the case of hard wood ties, but this statement will not hold for soft wood ties. The more important objections to the spike and the reason why it contributes to wearing out the tie prematurely are: First, that in a soft wood tie the spike does not hold with sufficient firmness to prevent creeping of the rail, which results in more or less rapid wearing out of the tie. Second, that in driving the spike into the softer woods the fibers are broken to an unusual extent and water collects around the spike and decay sets in. Third, that whenever a spike becomes so loose that it no longer holds it is pulled out and driven in at another point. This constant respiking rapidly ruins the tie.

It appears that while the ordinary spike may have served its purpose with the harder woods like oak, chestnut and long leaf pine, it has certainly been found a great source of trouble when used in softer woods in which it tends to wear out the tie rapidly.

Screw Spikes.

The most promising substitute for the nail spike is the screw spike, its chief advantage being that it is put in under circumstances which prevent the mechanical injury to the tie at the time, and when it is once put in it holds the rail to the tie so firmly that a large part of the wear is done away with. It firmly clamps the base of the rail against the wood and thereby causes the rail and the tie to act as one body when a load is passing. While it is not possible to absolutely prevent the sawing action of the rail even when held with a screw spike, nevertheless this action is reduced to a minimum by the use of other devices such as the tie plate. The first use of the screw in its simplest form was probably in Germany, where an extremely simple nail modified so as to approach a screw form was used. The greatest progress, however, in the use of screw spikes has been made on the French and Belgian railways. A large number of forms of screw spikes have been tried in various places and abandoned, but the types of screw spikes now used in various countries are shown in Figs. 2 to 6. After a mathematical discussion of the size of the screw spike, character of the thread, etc., to secure the maximum resistance to being pulled out the author states that it is a reasonable conclusion that the proper device for fastening the flange of the rail upon wooden ties "is a steel screw spike threaded hot with a pitch of at least .472 in. for a shank with a diameter of .787 in., and with the length, diameter of core and projection of thread calculated, respectively, to offer a resistance to a vertical pull, the nature of the ties being considered, about equal to the resistance to rupture under tension of the core of the screw." This screw spike must be driven into a hole previously bored with an augur having a diameter not appreciably greater than that of the core. The hole may be conveniently widened from .08 to .012 in. at the top to facilitate the entrance of the shank of the screw spike in the wood into which it penetrates about .394 in. The type of spike shown in Fig. 4 practically fulfills these conditions and is the one now being tested in this country.

Comparative Pulling Strength of Nail and of Screw Spikes.

The Bureau of Forestry has lately tested the pulling strength of spikes at its timber testing station at Purdue University. The load at which the spikes pulled out from the ties was measured in pounds and the tests were made on chestnut and oak as well as softer woods. In addition to direct pull on the spikes the rail was turned sidewise so as to receive on the inside the blow of a falling weight

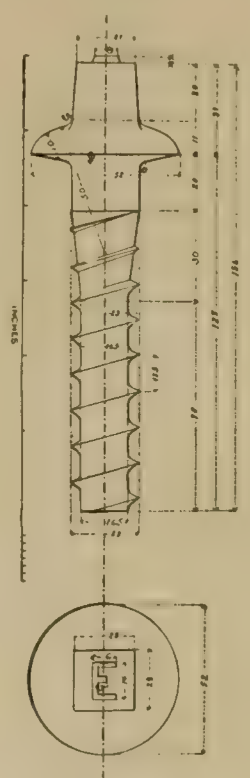


FIG. 4—FRENCH EASTERN RY.

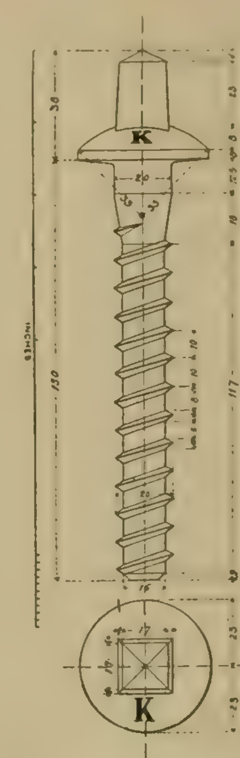


FIG. 5—BAVARIA STATE RAILWAYS.

similar to the side blow of the rail in service. On the direct pull the screw spike required from about three to five times heavier pull to draw out than the nail spike. In the tests under side blow the rails secured by nail spikes required but two to three blows before the inside spike pulled out enough so that the rail could be slipped out while on the rails fastened by screw spikes seven similar blows did not start the screw spike perceptibly, but gradually bent the head of the inside spike until the rail came out. These results show that under the action of a side blow such as comes on a rail a com-

mon spike is pulled out from 1/4 to 1/2 in., while the screw spike is not perceptibly started. The screw spikes manufactured in France and Belgium now cost about $4.45 per 100 kg. (220.46 lb.) Each spike weighs about 18 oz. It is expected that these screw spikes will cost about 4 to 4½ cents in the United States.

Conclusions as to Screw Spikes.

1. The type of screw spike which it is believed in the light of European experience will give the best service is that shown in Fig. 4. This screw combines the advantages of ease of making, cheapness and longer service than the other types of screws and, moreover, wears out the thread of the wood less than closer wound screws. Tests with this screw are now under way on several roads in the United States.

2. It is suggested that these screw spikes be placed in two ways —four screws per tie and six screws per tie—according to the European model.

3. As the screw spike forms one of the supposed modifications of the present method of fastening it is desirable that the screws be tested on a broad base rail without any plate, also with steel and with wooden plates.

4. In buying screw spikes only such as show a sufficient strength of head should be accepted. Most screws hitherto used have not had strength enough to stand the vertical blow upon the head.

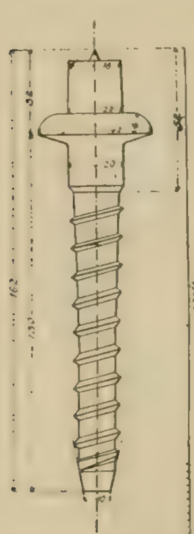


FIG. 6—ITALIAN RAILWAYS.

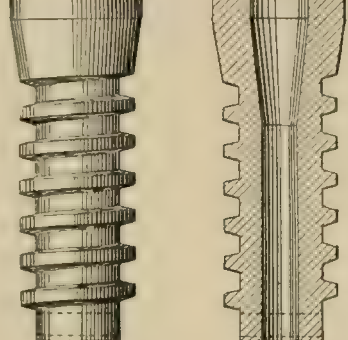


FIG. 7.

5. Recent tests show that the ratio of the holding power of the screw spike compared with the common spike ranges from 1.87 to 1 for white oak to 4.63 to 1 for long leaf pine.

The result of lateral impacts shows that under the action of a side blow such as comes on a rail a common spike is pulled out from ¼ to ½ in., while the screw spike is not perceptibly started.

Tie Plates.

The reasons for using tie plates are to distribute the load from the rails to the tie and prevent the mechanical abrasion of the tie so far as possible. The experience of the last 30 years has shown that by using a rail with a broad flat base the cutting into the tie could be largely stopped in the case of hard wood timbers except where there is a severe strain as on curves. On the softer woods, however, it is still necessary to use tie plates to prevent wear. The experience on several railroads goes to show that a broad, flat tie plate of sufficient thickness to prevent buckling is the most satisfactory. It should also be free from any projection so that it will damage the tie as little as possible. The general tendency has recently been towards the adoption of rigidly flat plates with firm fastening.

Wooden Plates.

Some of the European roads are using a novel form of tie plate with great success. This tie plate consists of creosoted wood about ⅛ in. thick, 8 in. long and of the exact width of the base of the rail under which they are to be used. The ties are adzed in the treating plant so that a place is left for this flat wooden shim. When the track is laid the shim is placed in position and screw spikes are screwed into the tie. Their pressure holds the plate firmly between the base of the rail and the tie. When the shim is worn out a new one is substituted by giving the screw spike one or two upward turns. A new plate is then shoved in endwise and the screw is fastened. The length of life of the wooden shim is from 1½ to 2 years and they cost approximately $2 per 1,000. They are made of any hard wood and creosoted.

The theory upon which the wooden tie plate is used is that there is a possibility of movement between the rail and the plate, also between the plate and the tie. Where a wooden plate is used it adheres so closely to the tie that when the rail moves across the tie the wooden plate and wooden tie act together even though the tie plate is not anchored to the tie. This means that any wear would probably be at the expense of the plate instead of the tie. Arrangements are now being made for testing these wooden tie plates in a number of stretches of track in this country.

Dowels.

One of the greatest difficulties with soft timbers lies in the fact that the wood around the spikes wears out with considerable rapidity after the new tie has been put in service. A dowel has recently been invented by a French engineer which has already shown remarkable results in the way of preventing wear around the spikes. This dowel is illustrated in Fig. 7 and consists of a cylindrical piece of wood formed into a screw with a very wide thread. At the upper end the dowel is somewhat larger than the lower so that when it is screwed into place the water cannot enter between the dowel and the tie. A hole is bored in the center to admit either a screw spike or an ordinary spike. The dowels are made out of well seasoned beech or birch heavily creosoted, and are put in either by hand or

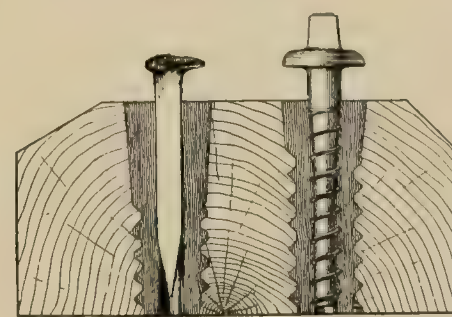


FIG. 8.

by special tools when large numbers of them are used. Fig. 8 shows a tie fitted with dowels for both common and screw spikes. The best proof of the high estimation in which European engineers hold the dowel is the great extent to which they are being adopted. The Prussian State Ry. this year provided 350,000 old ties with dowels, and the Paris-Lyons-Mediterranean Ry. of France has for several years been putting dowels in its ties. Some of the Spanish roads have been putting in from 250,000 to 300,000 dowels annually, and on the part of the Marienfelde-Zossen line where the high speed experiments were carried on all the ties were provided with dowels. The increased strength of the track given thereby is testified to by the authorities in charge of the track construction.

There can be no question but that the introduction of the dowel is one to be welcomed by all engineers, as it greatly increases the holding power of both ordinary and screw spikes. It is believed that the great problem of how to make a spike hold in soft wood ties as well as it would in an oak tie may at least be partially solved by the use of this device. If it turns out that it is possible to make a soft wood serve the same purpose as white oak or long leaf pine an important step in the utilization of our forest resources will have been made.

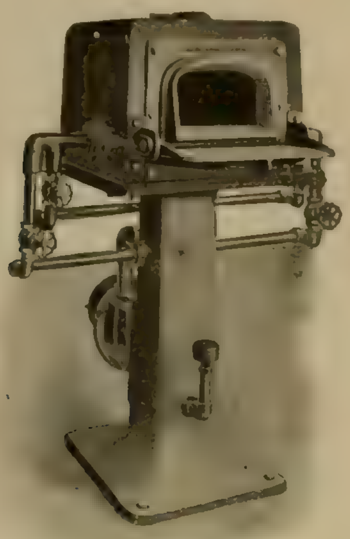
The York (Pa.) Street Railway Co. has introduced an eight minute schedule on its busiest lines by running through cars and doing away with transferring passengers in the center of the city. Heretofore it required 20 to 25 minutes to make a complete transit over these lines, whereas it can now be done in 8 minutes

Modern Machine Tools.

One of the most essential requirements of street railway practice is an up-to-date machine shop equipped with modern tools, in which convenience, efficiency and durability combine to turn out the best work in the shortest time. Realizing that a large number of railway shops are not so equipped, but that managers are constantly reaching out for something better in the line of shop accoutrement, the "Review" recently sent a request to the leading manufacturers of machine tools for descriptions and illustrations of the latest pattern machine tools on the market, with the idea in view of furnishing helpful suggestions to electric railway managers and master mechanics who seek to obtain the most desirable features of the best modern practice. A few of these tools are described here and others will be shown in succeeding numbers of the "Review."

A USEFUL MUFFLE OR OVEN FURNACE

A convenient heating furnace for use in the electric railway machine shop is shown herewith, it being designated as the No. 1 muffle or oven furnace which is made by the Chicago Flexible Shaft



MUFFLE OR OVEN FURNACE

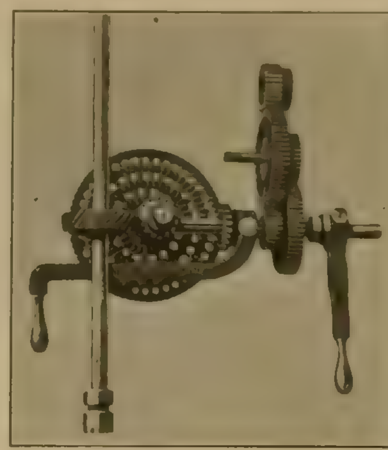
Co., of Chicago, Ill. Tools of all kinds—taps, dies, reamers, milling cutters, springs, etc.,—can be heated to excellent advantage with this furnace and the cost of operating on ordinary city gas is stated not to exceed 8 or 9 cents per hour when used continuously.

This furnace is mounted on a hollow base which encloses an air reservoir and has a blower directly attached. It is fitted with a muffle, 4¼ x 8 x 13¼ in., and the burners are so arranged that the flame is projected from either side along the bottom. The flame of one burner passes the flame from the other in an opposite direction and rising to the top on the sides it reverberates from the top lining down, completely enveloping the muffle. This arrangement also allows the substitution of a fire clay slab for the muffle, when required, transforming the furnace to an oven furnace, the size of the oven being 6 x 9 x 14 in.

The mixture of gas and air can be so regulated that a perfectly non-oxidizing atmosphere can be maintained, and by reason of direct heating a quicker heat can be accomplished. For case hardening small work in iron boxes it is also well adapted. The shelf at the front can be tilted up and made to serve as a door. The linings are extra heavy and the controlling valves are placed to secure the greatest convenience to the operator. The size of floor space occupied by this furnace is 13 x 13 in.

THE BARNES UPRIGHT DRILL

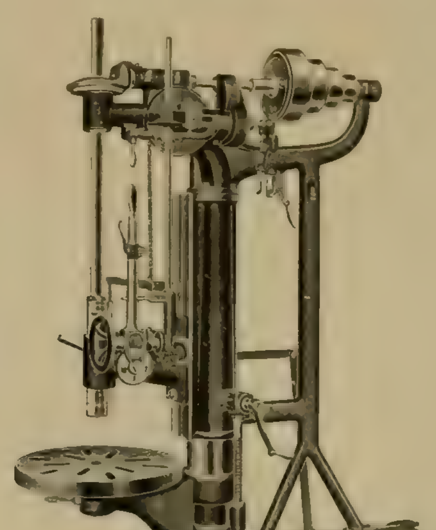
The 26-in. swing drill which is illustrated herewith is manufactured by the W. F. & John Barnes Co., of Rockford, Ill. This drill is adapted for a wide range of work and is well fitted for street



BARNES POSITIVE SELF-FEEDER

railway repair service. It is equipped with sliding head, is back geared and has a positive self feed and automatic stop, with a quick return lever for the spindle. It also has the plain lever and combined lever and wheel feed.

The positive self feed gives eight changes of feed which adapt the drill for reamer work, drilling in steel or boring in casting iron.



BARNES 26-IN. SWING DRILL

It is claimed that this positive feed will increase the capacity of the drill from 15 to 25 per cent. There are no belts to slip, or to throw off or on, all changes being made by the simple movement of a lever. A feed index plate is provided so that the operator may tell at a

glance the feed being used. The feeds per revolution of spindle range from .006 to .064 in. The feature of a hand lever feed on a sliding drill head is new.

The height of this drill is 7 ft. and the greatest distance from spindle to base, 53 in., the minimum being 21 in. The greatest distance from spindle to table is 39 in. Other dimensions are as follows: Diameter of column, 7 in.; diameter of spindle, 1 11-16 in.; width of column face, 6 in.; travel of sliding head, 21 in.; travel of spindle, 11 in.; diameter of table, 22 in.; diameter of large pulley on cone, 10 in.; diameter of small pulley on cone, 4 in.; face of pulleys, 3 in.; tight and loose pulleys, 10 x 3 in.; diameter of crown gear, 7¾ in.; diameter of bevel pinion, 3¾ in.; face of tooth, 1¾ in.; ratio of back gearing, 5½ to 1; required floor space, 61 x 21 in.; weight, 1,400 lb.

THE "AMERICAN" ENGINE LATHE.

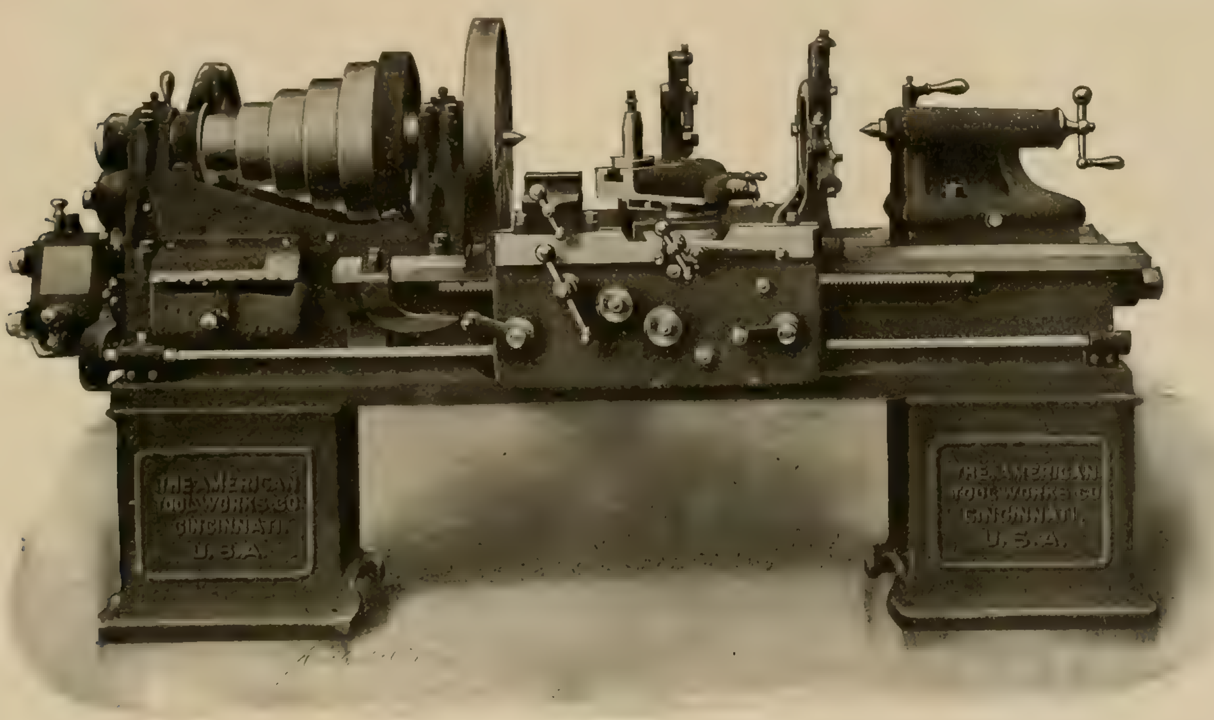
The accompanying illustration shows the 20-in. "American" engine lathe made by the American Tool Works Co., of Cincinnati, O., a tool that is especially recommended for use in street railway shops for turning up axles, and, being rapid and easy to operate, it is of particular fitness for work of this character.

The carriage is very heavy, especially in the bridge, due to the drop-V bed, and has long continuous bearing on the ways. The carriage is gibbed to the bed its entire length. The leadscrew is on the inside of the bed and imparts motion to the carriage directly under the cutting tool. This construction obviates all tendency to twist. The half-nuts are operated by a lever at the front of the carriage. The apron is tongued and grooved to the carriage. All gears are coarse pitch and wide face. Both longitudinal and cross feeds are reversed from the front of the apron, and not at the headstock, as on most lathes.

The compound rest is fitted with the taper gibs in such manner that no amount of strain will disturb them. The swivel is graduated, and the top slide and cross feed screws have micrometer dials. An automatic stop, engaging at the proper time with the drop plate, throws the rack pinion out of mesh, stopping the motion of the carriage.

Tire Heater.

A tire heater recently made for use in the shops of the Southern Railway Co. at Manchester, Va., is described as follows in the Railroad Gazette, from which the accompanying illustrations are reproduced:



20-IN. "AMERICAN" ENGINE LATHE.

A feature of the "American" lathe to which especial attention is called is a rapid change gear mechanism which provides a range of 44 changes for feeding and screw cutting, each instantly and easily available while the machine is in full operation without the removal of a single gear. Simple but complete index plates show clearly how to obtain any desired thread or feed, and the operation is so simple and positive that any unskilled apprentice can be trusted to handle the lathe. The range of threads is from 2 to 32 per inch, including 11½ pipe thread, and of feeds 8.8 to 140. Steel gears are used wherever necessary, the cone of the gears being all steel.

The bed is of deep section, of the company's patented drop-V pattern, which gives 2 in. additional swing, and has cross box girders at short intervals its entire length, this construction insuring exceptional rigidity. The headstock is firmly bolted to the bed and is very heavy. The spindle is of high carbon special steel, accurately ground, and has a large hole its entire length. Bearings are of the best quality phosphor bronze, with improved oiling facilities, and with means for any necessary adjustment. The tailstock is of the offset type, strongly proportioned, and is provided with setover for turning taper. The tailstock spindle is graduated.

The heater consists of a wheel of gasoline burners at the end of pipes, each of which is furnished with a slip joint. The tire is suspended from a crane and the burners adjusted so that they stand about an inch from it. A gasoline tank with a compressed air pipe leading thereto completes the equipment. The heater is shown in Fig. 1 and the tank in Fig. 4. The former is attached to a bracket supported on a small platform carried by three wheels. The weight at the back marked A is to counterbalance the overhang of the burner. The burner is shown in Fig. 3. A piece of brass pipe B is screwed into the center casting, shown in detail in Fig. 2, and this pipe is provided with a packing box and collar for a thumb screw to hold the telescope pipe, which is also brass. Beyond the telescope pipe the connection is ½-in gas pipe ending in a gooseneck and a piece of 1¼-in. iron pipe, with six holes 3-32 in. in diameter drilled in it to form a Bunsen burner. The gasoline tank is ¼-in. steel, 24 in. inside diameter and 36 in. long over all. It is filled through a funnel opening at the top. When in operation, compressed air is admitted through the pipe A and regulated by the

pressure gage. The air passes down through the pipe B in the interior of the tank to a point near the bottom and then bubbles up. In doing so it becomes charged with gasoline and issues as an inflammable gas.

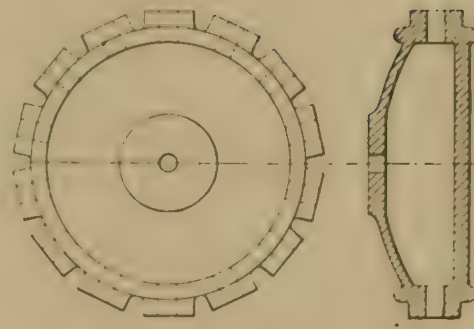


FIG. 2.—DETAIL OF CENTER CASTING.

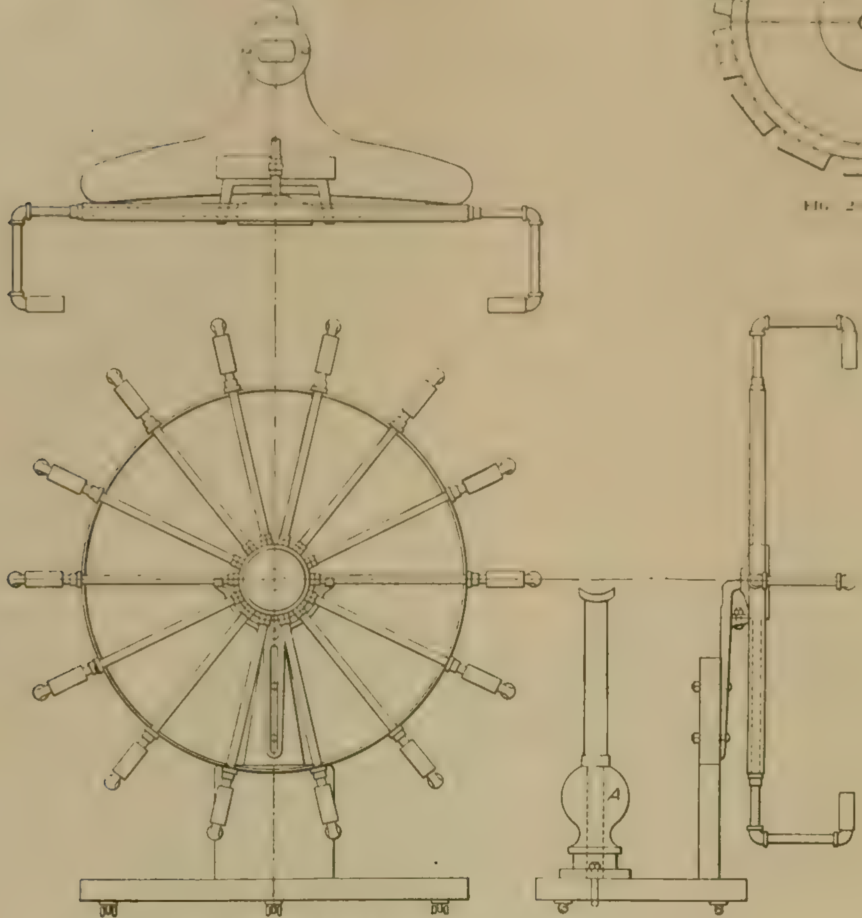


FIG. 1.—GASOLINE TIRE HEATER.

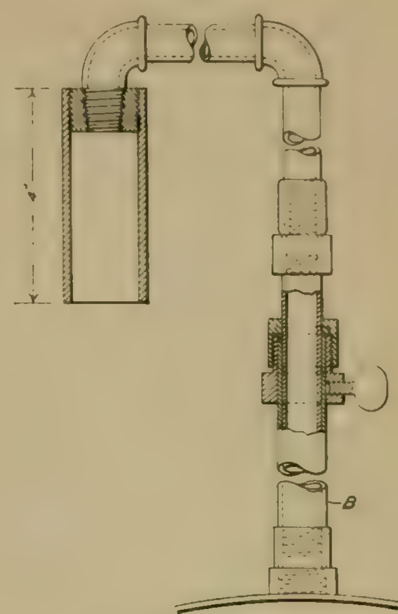


FIG. 3.—DETAIL OF BURNER.

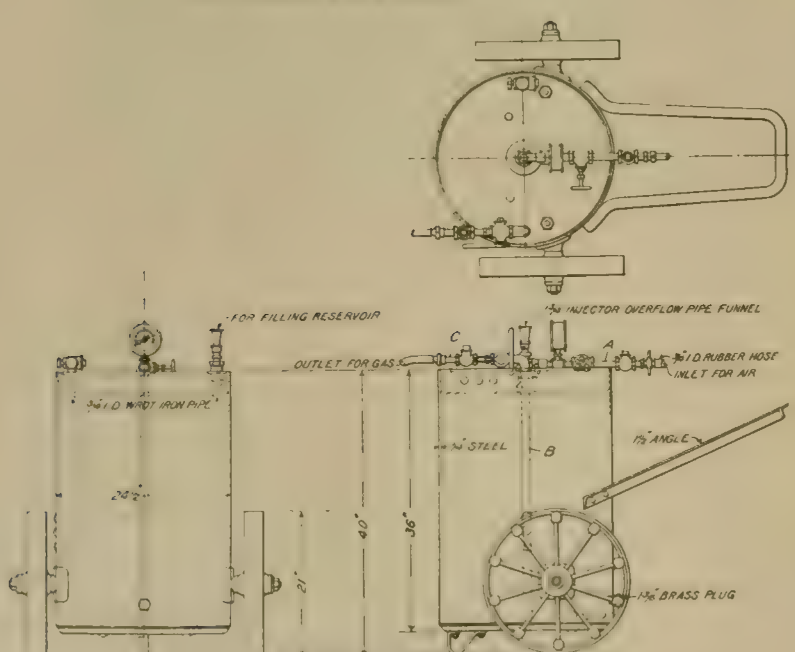


FIG. 4.—GASOLINE TANK FOR TIRE HEATER.

Gen. F. F. Myles, of New Orleans, La., has purchased for the Bayou Teche Electric Co. the rights of way for an electric road extending from New Iberia, La., to Berwick, 55¼ miles. There is a population of over 60,000 contiguous to the line.

New Departure in Handling Excursion Business.

The Boston & Northern Street Railway Co. and the Old Colony Street Railway Co., of Boston, Mass., have adopted a new plan for handling excursion parties this summer. These companies have arranged to conduct a series of special car excursions to the principal seashore resorts and places of historic interest around Boston, the trips to be run only in pleasant weather. Guides will meet the excursionists and conduct them to the objective points when desired and meals and other accommodations will be provided upon request. It is expected that this plan will obviate changing cars on long-distance trips and will insure to every passenger a seat.

As the companies are only experimenting, in order to ascertain whether the increased facilities will be appreciated, it is decided to run weekly trips only, for the present, the first run by the specials being made August 2nd. While some of the trips are within a radius of 25 miles of Boston, others are planned to run around Cape Ann, and through to Newport, R. I., the latter city being 80 miles from Boston. In all cases the special will be run through without change. These trips are under the personal supervision of Mr. R. H. Derrah, the trolley expert, who has for many years made a study of pleasure riding on electric cars, and who has so far conducted all the long special car trips in the country. The tickets used for these excursions are similar to those used by the steam roads, not only taking care of transportation, but meals, hotel accommodations, carriage rides and guides.

Costs and Profits of Electric Railways in Germany.*

The enforced publication of corporate finances and the exhaustive methods by which municipal accounts are kept and made public in Germany have enabled the Association of Electrical Engineers to collect and formulate some highly interesting statistics on the financial results which have followed the change from horse to electrical traction in street railways in this country. Although this transformation began later here than in Belgium and the United States, it was made with such promptness and energy that within a period of four or five years the horse car practically disappeared from Germany and was replaced by electrical tramway systems, which traverse all the cities and larger towns and connect each of them with practically every village and hamlet in a large and constantly extending radius. These systems have now been in operation long enough to supply some definite data as to the profits of such enterprises under existing conditions in Germany, which, measured by average street railway dividends and the market values of their shares, have been in general somewhat disappointing. The net fact, which has been known to investors for some time, and which these newly formulated statistics confirm and explain, is that electric street car lines, while serving the public infinitely better than any other method of city and suburban transportation yet devised, have proved in many if not most cases less lucrative to shareholders than the horse-car lines which they replaced. There are several tangible reasons for this, some of which are more or less peculiar to Germany. Among these may be cited the fact that most German municipalities refused at the outset to permit overhead conductors to be used in important or centrally located streets, and the companies were therefore forced to use a costly type of car which would take its current in the suburban streets from an overhead wire carrying a voltage sufficient to charge at the same time storage batteries of sufficient capacity to run the car through the central districts where the trolley wire was forbidden. These storage batteries were heavy and expensive, they deteriorated steadily and were difficult to keep in order, and when the snow and ice of winter encumbered the tracks they failed so utterly in Berlin, Hanover, and other cities that thousands of cars equipped with them had to be thrown out and their storage batteries removed. It was only at this heavy cost that the overhead trolley wire secured admission to the central districts of several German cities, and there are even yet in Berlin and elsewhere long stretches on important avenues where it is tabooed and underground conductors are insisted upon as indispensable.

A second important fact in this connection is that German municipalities are very exacting with tramway companies in respect to rates of fare, paving, and all the other specifications of their franchises. Every step in the process of construction is subject to the inspection and control of the city engineers. Most franchises involve the responsibility of the company of laying and keeping in repair the pavement on all space between the two outer rails, a breadth, in case of double tracks, of 12 to 15 ft. or more, and where, as in Berlin, the pavement is asphalt laid on deep foundations of rubble and cement, this becomes a heavy item in the cost of construction and maintenance, for no skill and experience seem able to avert the necessity of frequent upheavals for purposes of repair, in which asphalt and cement have to be cut out with cold chisels driven by sledges, a slow and toilsome operation.

Moreover, there are very few municipalities in Germany where electric current can be generated by any other or cheaper power than that of steam or gas engines, and no form of steam fuel is really cheap in this country. Although a very few of the largest central stations produce electric power as low as 1¼ cents per kilowatt-hour, in most others the cost averages from 2¼ to 3¾ cents, and in certain small stations as high as 10 cents per kilowatt-hour. Estimated by the ordinary German standard, the power consumption per car varies with grade, curves, and other conditions from 450 to 700 watt-hours per car-kilometer, equal (in case of the latter figure) to 1,170 watt-hours per car-mile.

Finally, the outlay for track renewal and repair turns out here, as elsewhere, to be unexpectedly heavy. In the days of horse cars a well-laid track in a city of from 150,000 to 200,000 inhabitants would last from a dozen to fifteen years. Now, with the far heavier and more frequent cars, the rails, especially at curves, wear in much less than half that period until the wheel flanges are found running on the bottom of the groove, so that the track has to be taken up and renewed. Another cause of frequent and expensive repairs lay in the fact that the surface resistance of the copper bonds with which the rail ends were united increased rapidly under certain conditions, until their use was largely superseded by the better system of welding the rail joints by means of electrical heat or thermite.

Still another increased item of expense has been that of labor. The motormen are naturally employes of a higher grade than horse-car drivers, and being well organized, they have been able to compel increased wages and to shorten working hours until the net labor cost per car-kilometer is more than 50 per cent greater than in former years.

To all this is to be added the fact that the rates of fare in most if not all German cities are rigidly restricted by the authority granting the concession. In Berlin, for instance, street railway fares anywhere within city limits are restricted to 10 pfennige (2.38 cents), and for the same sum the passenger may ride on some of the suburban lines any distance up to 7 kilometers (4.34 miles). From the latest published statistics it appears that the average street railway fares paid in 11 principal German cities during the year 1903 varied from 2.2 cents each at Frankfort to 2.72 cents at Hamburg, the mean average for Berlin and its suburbs being 2.35 cents, or less than half the usual 5-cent fare that prevails generally in the United States. To complete the restrictions under which street railways operate in this country, most of their charters contain clauses providing that from a prescribed date the company shall pay to the municipality a portion of its surplus after disbursing a stipulated percentage as dividends. A typical contract of this kind stipulates that beginning with 1903 the company shall pay to the city 35 per cent of its surplus remaining after a 6½ per cent dividend has been paid to stockholders, and 50 per cent of the surplus after an 8 per cent dividend. Many charters further provide that after being operated by the companies for a specified term of years the whole installation, tracks, power plant, and equipment, shall revert in fee simple to the municipality which has granted to the corporation for a term of years the use of its streets.

The total length of German street railways at the close of 1902 was 1,906 miles, of which 346 miles, or about 18 per cent, were under municipal ownership. Of the latter, 65 miles were leased to individuals, leaving 281 miles of lines operated directly by the municipalities. The four longest municipal lines are at Frankfort, 26½ miles; Düsseldorf, 25 miles; Munich, 29 miles, and Cologne, 40 miles. It does not appear that fares over these lines are lower, but, on the contrary, that they are rather higher than those charged on similar lines worked by individuals or corporations. In Nuremberg, for example, the principal street railway charged, under private management, a uniform 10-pfennig (2.38-cent) rate, until the city, in order to complete a zone system, took over the private line and thereupon increased the rate of fare. On the whole, it can not be said that experience has increased public sentiment in Germany in favor of municipal management of street railways, and several cities—among which is Barmen—which built their own lines, are now considering the plan of leasing them to private companies.

By far the largest and most important corporation of this kind in Germany is the Great Berlin Street Railway Co., which, with its various branches, operates 200 miles of track, of which 144 miles are owned and the remainder are controlled by the company. On its own lines the "Grosse Berliner" ran last year 40,400,000 car-miles and carried 295,000,000 passengers, whose fares aggregated $7,025,000. The total capital of the company is 100,082,400 marks ($23,819,611); its shares are today worth 184, and its 3½ per cent bonds are quoted at 99.40. This, however, is the status of an exceptionally powerful and ably managed company in a large, level city, and is quite above the average financial condition of street railway companies elsewhere in Germany, most of which have to be satisfied with 4 and 5 per cent net earnings on their stock.

The Berlin company is at present in litigation with the city over a question which, as it involves the important point whether

*Report of United States Consul General Mason, Berlin, Germany, to U. S. Department of Commerce and Labor.

[illegible] may grant franchises to new companies on streets already occupied by another lessee, has a certain pertinent interest in this connection. About two years ago there was opened to traffic the so-called Elevated and Underground Railway, a double-track electric line of the most perfect construction and appointment, with two arms or branches running from a central station to points in the eastern and western parts of the city. Trains of three cars run over these branches at intervals of three to five minutes and at such speed as to traverse a distance of 2½ miles in about ten minutes. The line is very popular and carries an immense and steadily growing traffic, which naturally trenches more or less upon the business of the surface lines which belong to the "Grosse Berliner." In order to reach a still more central and crowded portion of the city the new company asks authority to extend its subterranean main stem from the present terminus at the Potsdam Railway station northeastward to a point beyond the river. To this the Great Berlin company objects, and the municipality has applied to the courts to confirm its authority to disregard the protest and grant the franchise for what would be an important public improvement.

The one all-controlling fact which has enabled street railways in Berlin and other German cities to make head against the exacting requirements of municipalities and the enormous cost of conversion from horse to electric traction, with the increased outlay for labor, workmen's insurance, paving, and other expenditures, has been the phenomenal increase in business, particularly in the suburban traffic in all the larger towns, which has come with the increased speed, the greater frequency of service, the better ventilation, space, and comfort of electric cars. Whole suburbs have been built up within a few years by the influence of a single well-managed tramway line, which carries a legion of men and women to and from their daily toil in the city more quickly and cheaply than the horse car could transport them half the same distance. And although the electric street railways of Germany under the conditions above described are but moderately remunerative to shareholders, they hold a high place among the potent influences of modern civilization.

Wrinkles.*

A SCHEME TO PREVENT THE OIL FROM BEING THROWN FROM A DYNAMO BEARING

BY C. G. KNODE, LONG BRANCH, N. J.

We have had some trouble with one of our machines throwing oil up on the commutator. We maintained the oil level in the bearings as low as we dared, but some of the oil would come out. As

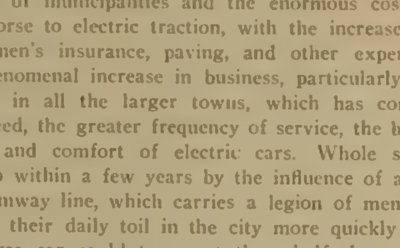


Fig. 1

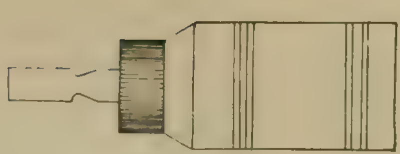


Fig. 2

you are aware, there is a groove cut into the shaft, which is supposed to keep the oil from running out along the shaft. These grooves are cut into the shaft in the manner shown in Fig. 1. I beveled off the side next to the commutator as per Fig. 2, and have had no more trouble with oil.

The reason of this is that the oil tends to climb the high side; it will, therefore, stay in the bearing, where it will do some good.

RUNNING ALTERNATORS IN PARALLEL

BY A. GARLEY, HONOLULU, H. I.

We are operating two 300-kw., two-phase, 2,000-volt alternators, direct connected to vertical cross-compound marine engines, running 189 r. p. m. The alternators are on the ends of an extended shaft, and each engine is fitted with a 13,000-lb. flywheel between the alternator and the engine. The cranks are not at right angles nor opposite, but the high-pressure crank leads the low-pressure crank 150°. This crank angle was adopted to give uniformity of rotation during each revolution. We found that notwithstanding this precaution, the heavy flywheel and high speed, there would, under certain conditions, be some variations in speed during each revolution. The machines would run in parallel sometimes without any

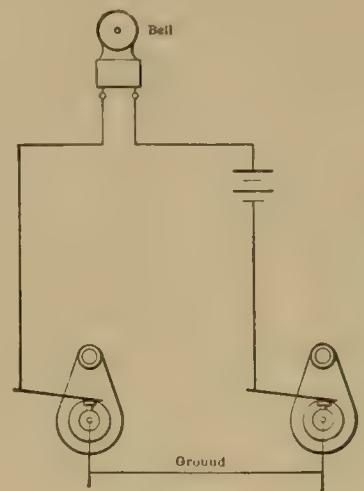


Diagram Showing Connections

surging; at other times the surging would be quite pronounced. The engines are exact duplicates, and we found that when the alternators were thrown in parallel with the cranks of the two engines at the same point of the stroke we would have no difficulty. Since demonstrating this fact we have constantly run our engines under these conditions. To accomplish this we placed on each engine shaft a small wooden disk. A small contact, grounded through the shaft, was placed on this disk in a certain position relative to the crank pin. A small brush, insulated from the ground, was placed in contact with this disk and two brushes placed in series with a battery and bell. As the contacts on the two engines passed into these brushes the circuit was established and the bell was rung. If the alternators are in synchronism at the same time the switch is closed the engines will then run together for a week at a time, each taking its proportion of the load without surging or disturbance on the electrical end.

A HOME-MADE TRAVELING CRANE.

BY B. C. ADAMS, MADISON, WIS.

A great many of the smaller and older stations are not fortunate enough to have a traveling crane in the plant and have to resort to all kinds of make-shifts in order to do heavy lifting, which is bound to occur along with repair work. A cheap and quite satisfactory arrangement can be made use of as follows:

Out of 8 x 10-in. pine timbers make two A-frames which fit snugly into an extra heavy 12-in. I-beam, as shown in the accompanying sketch.

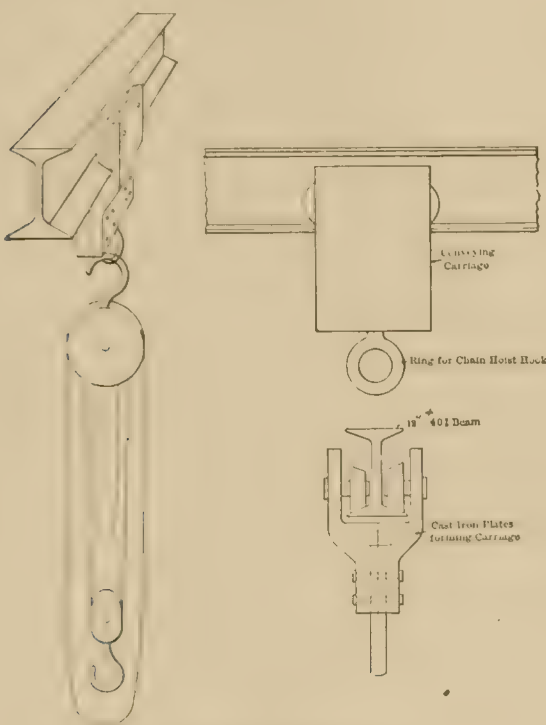
The strain at the beam is mostly one of compression along the length of the beam. Bolts are passed through both timbers above and below the I-beam, and substantial cross pieces are fastened diagonally across the two legs to add stiffness. A heavy timber is

*Edited by Charles H. Williams and read before the Boston Convention of the National Electric Light Association, May 24-27, 1904.

notched out near each end, to keep the legs from spreading, and bolts are run through the ends of the bottom beam to prevent any tendency of shearing of the end pieces.

A carriage made of four wheels with faces beveled off to fit the flange of the I-beam distributes the weight to be carried over the face of the flanges.

The hook block, which is below the I-beam, has two stiff cast-iron plates running up to carry the pins on which the wheels revolve.



Details of Traveling Crane

A heavy chain block, fastened into the hook, completes the arrangement, which is of sufficient capacity to pick up any weight that the average station is called upon to handle.

The crane can be set up easily by four men in half a day, and when not in use can be readily taken apart and stored away.

A 20-ft., 12-in. I-beam weighing 40 lb. per foot costs $24, and the carriage can be built at any machine shop for $30, while a five-ton hoist of 12 ft. lift will cost $85.

With this arrangement a piece of apparatus can be picked up and moved along the length of the I-beam 15 to 18 ft. in a very short time.

SWITCHBOARD LOCATED TO FACILITATE CAREFUL WATCHING WHERE ONE MAN OPERATES THE PLANT.

BY W. A. THOMAS, ABINGDON, ILL.

Our plant being small, one man fires the boilers and looks after machinery, too, for the most of the time. Not owning a voltage regulator, and our switchboard not being as conveniently located as we could wish, we moved our voltmeter and rheostat into the boiler room where the engineer can have them right at his elbow all of the time, and we find that it enables him to keep the voltage almost exactly uniform.

A FEED-WATER HEATER ON A GAS ENGINE EXHAUST.

BY E. M. RICHARDS, MADISON, WIS.

[illegible] 30 per cent of all the heat of the gas that goes into a gas engine is lost in the sensible heat of the exhaust gases. If any use can be found for hot water around the plant, the heat can be recovered to a very large extent.

The cooling water passes around the cylinders in the water jacket, and then generally goes to waste. At the gas engine plant at Madison, Wis., this water is led through a Wainwright feed-water heater after it leaves the jackets, and there takes up additional heat from the exhaust gases that pass on the inside of brass tubes, while the jacket water passes on the outside. By this scheme, the feed water, which enters the jackets at 40° F. and leaves them at 100° F. enters the feed-water heater at 100° and leaves it at 210° F. The pump that supplies the cooling water to the engine jackets forces this water on through the feed-water heater over to the boilers at the gas works, where it reduces the steam fuel expense 12 per cent on a plant with a make of about 100,000,000 cu. ft. of mixed gas per year.

AN ELECTRIC SIREN USED IN PLACE OF A TELEPHONE GONG.

BY F. G. TROUT, MEMPHIS, TENN.

I take pleasure in inclosing herewith a wrinkle that we have had in use in our station for several years; it has been quite a curiosity to people from other places who have visited us from time to time. You, no doubt, have experienced trouble in having telephone calls answered promptly by the operators in your central station. To overcome this trouble we made and put in several years ago what we call an electric siren. This piece of apparatus is nothing more

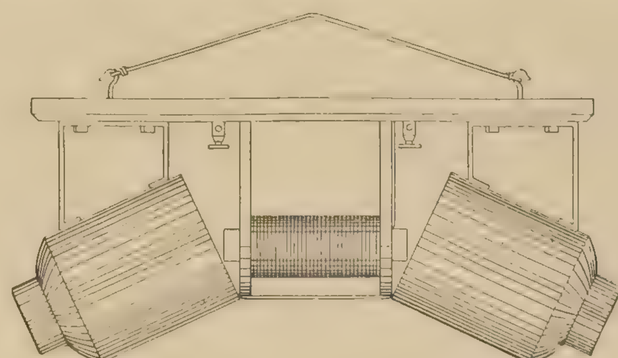


Fig. 1

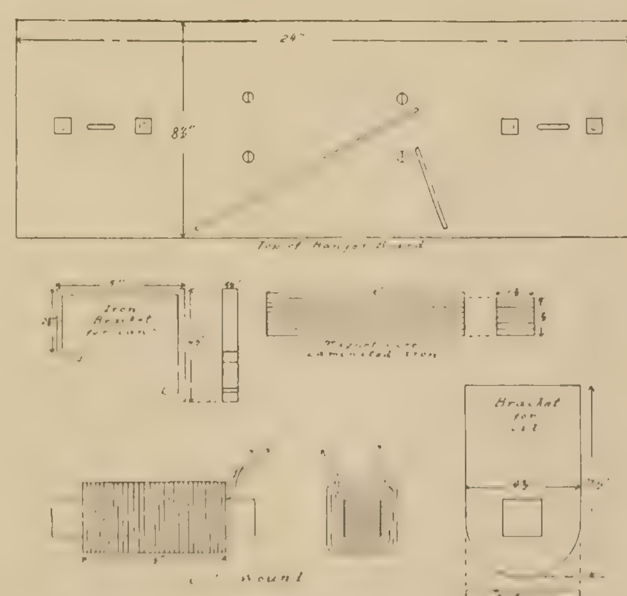


Fig. 2

Details of Magnetic Siren

nor less than a horn, operated on an alternating current of electricity. We have made out the working drawings so that should any one be disposed to manufacture one it can be very easily done at an expense of five or six dollars, and the result will be that from the time it is installed there will be no further excuse for

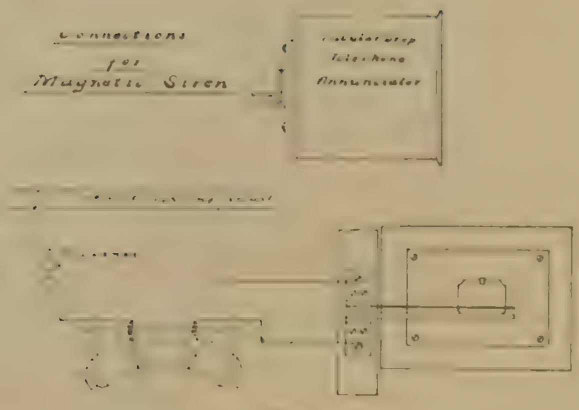


FIG. 5

not hearing the telephone ring, as a machine of this kind can be heard several blocks from the station.

REPAIRING A DEFECTIVE BOILER CROWN SHEET

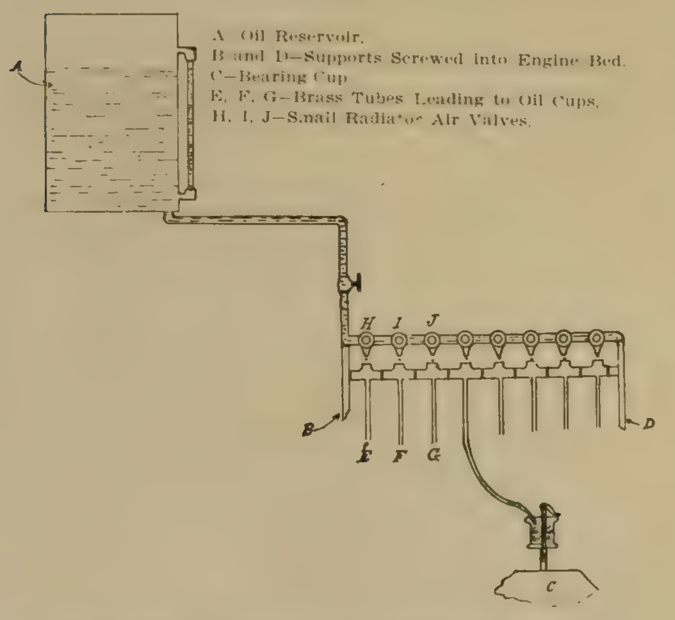
BY D. L. DAVIS, SALEM, O.

We once had a cracked crown sheet in one of our boilers, due to a brace-rivet hole. It was cut out and patched repeatedly, until the hole grew to be 8 in. in diameter. The rivet holes would crack out, due to unequal and violent expansion. We remedied the trouble entirely by placing a soft-copper gasket between sheet and the patch, cut from sheet copper, about three-sixty-fourths inch thick, or less.

ARRANGEMENT OF OIL-TANK VALVES, ETC., FOR OILING HIGH-SPEED ENGINES.

BY E. C. WARD, WASHINGTON, N. J.

The accompanying cuts illustrate two schemes which our engineer, Mr. Samuel Beatty, has put in use in our plant here. The first is an arrangement of oil-tank valves, etc., for oiling high-speed engine. A ten-gallon tank is placed above the top

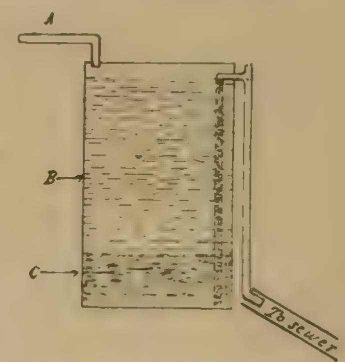


ARRANGEMENT OF TANKS, VALVES, ETC., FOR OILING ENGINE.

of the engine bed. This leads to a framework in which is fastened horizontally a section of ⅜-in. pipe. This pipe is drilled and tapped to receive a number of small air valves, corresponding to the number of oil cups that it is desired to feed. From these valves the oil drops into openings in the sides of a corresponding number of tees that are joined with short nipples and have the nipples soldered shut. From these tees the oil is carried in ⅛-in. bore brass tubes to the several oil cups. The small valves are set to allow the proper flow of oil, and in shutting down the engine all that is necessary is to close the globe valves in the supply pipe, leaving the small valves set at the proper opening. We have found this arrangement a great saver of oil and time, and, in addition, it keeps the oil cleaner and gives an additional sight feed. The framework was made of ¼-in. pipe.

The second is an arrangement of a tank or can for catching the drip from the stuffing boxes of the engine. The oil and water fall

A—Drip from stuffing boxes of engine.
B—Oil
C—Water



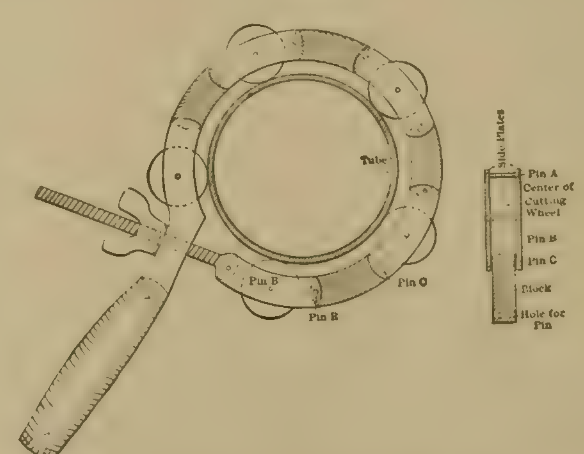
RECEPTACLE FOR SEPARATING OIL FROM WATER.

into the can and are then separated, the water going to the bottom of the can. A pipe extends from the bottom of the can almost to the top, and from there down into the waste pipe. There is an opening in the highest part of the pipe, which acts as a vent and prevents any action as a syphon. As the oil reaches the level of the highest part of the pipe the water flows out, and continues to do so until the can is full of oil. We are thus able to save three or four gallons of oil per week, which would otherwise be wasted.

A TOOL FOR CUTTING OUT A TUBE FROM A WATER-TUBE BOILER.

BY A. J. GODDARD, FREEPORT, ILL.

Perhaps the accompanying diagram will give a suggestion that some of the members of the association have not had in regard to cutting out a tube from a water-tube boiler. The principle is that of a bicycle chain made of alternate steel blocks and plates, the cutter wheels being set between the plates. With five cutters the



TOOL FOR CUTTING OUT BOILER TUBE.

tube can be cut out by moving the handle one-fifth of the distance around the tube and then back again, etc. We have made these in our shop for about $3, buying the wheels. We find that we can cut out ten times as many tubes from a water-tube boiler in a day as we can with the old method.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

[The decisions which have been reported in the Legal Department of the "Street Railway Review" since 1893 have been published separately by the Windsor & Kenfield Publishing Co. under the title "Street Railway Law," four volumes of which have been printed. Vol. I covers the period from January, 1894, to January, 1897; Vol. II from January, 1897, to July, 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901, to April, 1903. Vol. V is now in press. Price: Bound in sheep: four volumes, $10.00; single volume, $3.00. Bound in buckram: four volumes, $6.50; single volume, $2.00.]

CONDUCTOR ON ONE CAR AND MOTORMAN ON ANOTHER ARE FELLOW-SERVANTS.

Stocks vs. St. Louis Transit Co. (Mo. App.), 79 S. W. Rep. 1176. Mar. 15, 1904.

A conductor on one trolley car and a motorman operating another, the St. Louis court of appeals holds, are fellow-servants, so that the company employing them is not responsible for an injury to the conductor due to the negligence of the motorman.

RIGHT OF EMPLOYE TO ASSUME SAFETY OF CONSTRUCTION OF ROAD.

Hoffmeier vs. Kansas City, Leavenworth Railroad Co. (Kan.), 75 Pac. Rep. 1117. Mar. 12, 1904.

The plaintiff, a conductor on an electric street car which was without an aisle or other passageway lengthwise through it, and who was obliged to perform his duties from a footboard running the length of the car on its outside, was struck by a pole on a trestle and knocked from the car. The supreme court of Kansas says that, upon entering the defendant's service, he accepted no risk from its negligence. He had a right to assume that the company had not set him to toil in the midst of danger. He had a right to assume the road was built with ordinary care and consideration for the safety of the men who were to operate it, and he was not obliged to make any independent investigation for hazards resulting from the disregard of such care. Without actual knowledge of his peril, or a patency so ample as to preclude ignorance, he assumed no risk in continuing to work under the conditions surrounding him.

INJURY TO PASSENGER ON OPEN CAR BY SLAB PROJECTING FROM WAGON—PRESUMPTION AND EVIDENCE OF NEGLIGENCE—CARE REQUIRED OF PASSENGER IN CAR.

Jones vs. United Railways & Electric Co. of Baltimore (Md.), 57 Atl. Rep. 620. Mar. 22, 1904.

A passenger sitting on one of the rear seats of an open car, with his elbow on a brass railing between the posts, but entirely within the car, had the upper part of his arm, near the shoulder, struck and injured by a marble slab which projected from a passing wagon that collided with the car. Under these circumstances, the court of appeals of Maryland holds, the occurrence of the accident by which the passenger was injured raised the presumption of negligence on the part of the company, and the burden was cast upon the latter to show that the injury did not result from its negligence, or that the passenger was himself guilty of negligence directly contributing to its occurrence. A passenger traveling in a street car is not bound, as is a person approaching a dangerous crossing, to keep all of his senses alert, and be constantly on the lookout for danger. He has, while exercising ordinary care and prudence on his own part, a right to presume that the railway company in whose care he is traveling will discharge its duty towards him as its passenger and exercise that high degree of care for his protection which the law requires of it. It might be that, with all of the facts of the case before them, a jury would come to the conclusion that this passenger was guilty of such contributory negligence as to deprive him of the right of recovery, but, in the court's opinion, that fact did not appear from the uncontradicted evidence then in the case. The mere belief expressed by one witness that any one in the car could have heard the noise of the collision before the stone projecting from the colliding wagon reached the seat in which this passenger sat might not, in the opinion of the jury, be sufficient to destroy the latter's testimony that he neither saw nor heard it before he was struck.

CONDUCTOR ON ONE TRAIN AND GRIPMAN ON NEXT ARE FELLOW-SERVANTS.

Chicago City Railway Co. vs. Leach (Ill.), 70 N. E. Rep. 222. Feb. 17, 1904. Rehearing denied Apr. 6, 1904.

In this case a conductor engaged in taking up the slack between his car and the grip car to which it was attached, while they were standing still, was injured by the alleged negligence of the gripman of the next train running same into the one stopped. The supreme court of Illinois says that the undisputed evidence was that the conductor and said gripman were in the same general service and the same general line of employment, and that it was the duty of the employes on one train to run it in such a manner as not to injure those on the train next preceding, and that the duties of employes on such trains were such as to bring them into habitual association, with power and opportunity to influence each other by advice and caution. They were, in the strictest sense, engaged in the same character of service, in which they were brought into such relations to each other as to depend upon each other for their safety, and with power to observe the manner in which each discharged his duty, and to influence each other by caution, advice, and example. There was no undisputed fact to be submitted to the jury, and the facts proved by the conductor or admitted brought him and the gripman of the other train within the legal definition of fellow-servants.

STARTING CAR WHILE PASSENGER IS STILL ON RUNNING BOARD—CONDUCTOR BOUND TO TAKE NOTICE OF DISTANCE BETWEEN PILLAR IN STREET AND CAR AND SIZE OF PASSENGER—NOT REQUIRED TO ANTICIPATE UNUSUAL MOVEMENTS.

Canavan vs. Interurban Street Railway Co. (N. Y. Sup.), 87 N. Y. Supp. 491. Mar. 24, 1904.

The plaintiff, who had just got upon the running board of a street car that remained stationary long enough to enable him to safely do that, was injured by colliding with an upright pillar of an elevated railway. It did not appear how far the elevated railway pillars were from the side of the car, but it did appear that the plaintiff was a very large and stout man. The appellate term of the supreme court of New York thinks that the conductor was bound to take notice of the distance between the pillars and the car, and of the plaintiff's size, and to exercise reasonable judgment in determining whether, taking these two factors into consideration, it was safe to start the car past a pillar before the plaintiff had entered the car; but it is not prepared to hold that it was necessarily negligent to start a car before every passenger had passed from the running board into the car. It says that it was referred to no case in which it has been held that the mere fact that a passenger was on the running board of an open car when the car was started constituted negligence. Doubtless, under certain circumstances, it might be negligence, and one of those cases probably would be presented if the passenger was so large that there was not room enough for his body between the car and an elevated railway pillar. That, however, was not this case, as what caused the accident, as the plaintiff himself testified, was that he swung back just as he reached the pillar. It may be that he found this

movement convenient in order to swing himself more easily up into the car, but the court does not think that the defendant was bound to anticipate and guard against such a contingency as this. It says that it is not the result of common experience that people in stepping upwards swing their bodies backwards. The defendant had given the plaintiff time to get safely upon the car, in a position where he could ride safely unless he did some act (as he did do) not to be expected or foreseen. It was not negligent not to foresee it or guard against it.

DUTY OF MOTORMAN TO HAVE REGARD FOR SAFETY OF PASSENGERS ON PLATFORM AND TO BREAK FORCE OF BRAKE HANDLE REVOLUTIONS—DUTY OF PASSENGER TO KEEP OUT OF WAY OF BRAKE HANDLE.

Brewer vs. St. Louis Transit Co. (Mo. App.), 79 S. W. Rep. 1021. Mar. 15, 1904. Rehearing denied Mar. 29, 1904.

The St. Louis court of appeals thinks that an instruction given a jury was open to criticism, which ignored the duty of a motorman to pay attention and have some regard for the safety of passengers on his platform. It says that if, as the evidence tended to show, the platform was in a crowded condition, then the motorman should have anticipated the probability of some one being within the radius of the brake handle, and should have broken the force of its revolutions, as the evidence tended to show he could have done. But the plaintiff's own evidence showed that he was in the right-hand corner of the platform. The measurements of the platform showed that he had ample room to keep out of the way of the brake handle. He knew the handle was there, knew a signal had been given for the car to start, and knew the brake handle would immediately begin to revolve, yet he placed his arm within its radius. It was his duty under the circumstances to have kept out of the way of the brake handle, which the evidence clearly showed he could have done had he exercised any care whatever for his own safety. He was in the situation of having negligently placed his arm in a place of known danger, and for this reason was not entitled to recover for his injury.

INCREDIBLE EVIDENCE AS TO ACTIONS OF ELECTRICITY FOR JURY RATHER THAN COURT—SO QUESTION OF REALITY OF ALLEGED INJURY FROM SHOCK FROM GUY WIRE BROKEN OFF FROM TROLLEY WIRE FOR JURY.

Walters vs. Syracuse Rapid Transit Railway Co. (N. Y.), 70 N. E. Rep. 98. Mar. 15, 1904.

A guy or stay wire broke near the point where it was connected with the main trolley wire. The plaintiff testified that he was at that moment riding on a bicycle through the street, underneath the wire, and that it fell upon him, coiled around his body, and communicated what he called a shock of electricity to him, which affected his heart and nervous system. His testimony was in many respects corroborated by other witnesses, and the proof tended to show that he was subjected to considerable physical suffering in consequence of the accident. But he was nonsuited, and the judgment of nonsuit was affirmed at the appellate division of the supreme court of New York, on the sole ground that the facts to which he and his witnesses testified at the trial were utterly incredible, and in fact scientifically and physically impossible. The court of appeals of New York holds that this was error; that the credibility and the weight to be given to his testimony should have been determined by the jury.

The court of appeals says that it has frequently had occasion, in cases of accidents upon electric railways, to try and fathom some of the unaccountable freaks of electricity. It knows that there are many things concerning its action that are imperfectly understood. What it does or may do under a given state of circumstances is perhaps not yet accurately known. It may be that the plaintiff's claim that he felt a shock of electricity when the wire coiled around his body was purely imaginary; but, if he told the truth as to what followed, and the effect that the accident had upon him, there could be no doubt that in some way and from some cause he sustained bodily injuries. What the extent of these injuries was, and whether they were real, or in some degree feigned, was a question for the jury. If his testimony as to the circumstances attending the injury was incredible and impossible, it was as easy to expose the falsity and to demonstrate the truth before the jury as it was before the court.

If this court is to be consistent with the position taken in the case of Williams vs. Del., L. & W. R. Co., 155 N. Y. 158, 49 N. E. 672, and in many other cases of like character, it cannot hold, as matter of law, that there was no proof in this case to sustain the plaintiff's cause of action. It often happens that science and common knowledge may be invoked for the purposes of demonstrating that a particular statement in regard to some particular accident must be absolutely false. In such cases the question is for the court. But in cases of doubt the court thinks it is wiser and better to remit such controversies to the proper tribunal for settling facts and ascertaining where the truth lies, rather than that it assume the power to determine the facts. This is an old rule, and, while like all other rules, it may work hardship or injustice in a particular case, it is wiser to adhere to it.

INJURY TO INFANTILE TRESSPASSER GETTING ON REAR STEP OUTSIDE OF CLOSED GATE—LIMIT TO DUTY OF COMPANY—DUTY OF CONDUCTOR—INADMISSIBLE EVIDENCE AS TO NEIGHBORHOOD.

Monehan vs. South Covington & Cincinnati Street Railway Co. (Ky.), 78 S. W. Rep. 1106. Mar. 3, 1904.

At an intersection of streets, where an electric car had stopped for the purpose of receiving and discharging passengers, the plaintiff, between six and seven years old, and a companion of about the same age, got upon the lower step of the side of the rear platform which was not being used for the purpose of taking on or letting off passengers, where there was a small, movable, iron wicket gate which was closed, and, taking hold of the iron gate with their hands, stood on the step until the car started. The car soon attained a rapid rate of speed, and the plaintiff was jolted off and injured. The court of appeals of Kentucky affirms a judgment on a peremptory instruction to the jury, after the close of the plaintiff's testimony, to find for the company.

The court says that the question involved was whether or not, under the plaintiff's own testimony, the company owed him any duty other than to avoid injuring him, if that could have been done, by the exercise of ordinary care, after his danger was discovered. It also says that the crucial question of this case was whether or not the company owed the plaintiff any active duty in order to discover his peril. It says that it was not pretended that he was a passenger upon the car, nor could it be denied that he was a trespasser. Neither did the evidence show that the conductor saw him. The question of the plaintiff's infancy, the court says, was immaterial, until it had been established that the company owed him an active duty, as opposed to the passive duty of not injuring him after his peril was discovered. He was a mere trespasser upon the rear steps of the car, and those in charge of it did not owe him any duty of discovering his peril. Nor does the court think that there was any error in excluding proffered testimony that the intersection of streets referred to was in a thickly settled portion of the city; that many children congregated thereabouts, and therefore they had often trespassed upon the company's cars, with the knowledge of the employes in charge thereof.

Finally, the court says that the company, although it was a common carrier of passengers, owed the infant plaintiff no different duty than was owed him by the owner of any other vehicle plying the streets of the city. As he had a right, in common with the general public, to use the public highways, the company, in common with all other owners of vehicles, owed him the active duty of exercising ordinary diligence not to run over him; but neither it nor they were under any duty of anticipating his trespassing on the rear end of the vehicles while they were being driven or propelled along the streets. Suppose a private carriage is being driven along the street; must the driver maintain a lookout to see that small boys are not stealing a ride by climbing up in the rear of the vehicle, and thereby placing themselves in positions of danger? Surely not, and yet it will be difficult to draw a distinction between the case at bar and that supposed. The fact that there was a conductor on the car would not alter the case. The conductor's duty is primarily to attend to his passengers, not to look out for trespassers; and, while the presence of the conductor would neces-

sarily increase the chances of the actual discovery of the infantile trespasser, it would not add the duty of an active vigilance to make the discovery of his presence and danger.

INJURY TO PASSENGER ATTEMPTING TO ALIGHT FROM CAR STOPPED TOO SOON WHERE IT IS A LONG STEP TO SURFACE OF STREET—DUTY OF PASSENGER TO OBSERVE CONDITIONS—GETTING OFF ON CHAINED SIDE OF OPEN CAR SUGGESTED—CONDUCTOR NOT REQUIRED TO BE SUPERLATIVELY COURTEOUS OR TO SUPERVISE EVERY MOTION OF PASSENGER.

Scanlon vs. Philadelphia Rapid Transit Co. (Pa.), 57 Atl. Rep. 521. Feb. 29, 1904.

A passenger upon an open car wishing to get off at a certain street told the conductor so while yet some distance from the street. Whether or not he heard was not shown. But he evidently saw her signal, and shortly afterwards the car was brought to a standstill, though at a considerable distance from the street. When the car stopped the passenger stood up and looked at the conductor, and he looked at her. Neither of them spoke, but the passenger testified that she thought she ought to get off, because the conductor seemed to be waiting for her to do so, although she knew the car had not yet reached her street. She then stepped down on the running board, and attempted to step off backwards from there to the ground. The track was laid at that point near the side of the road, which sloped considerable towards the gutter. She found the distance too great for her to touch the ground comfortably with her foot immediately under the running board, and, whether from confusion or inability to control herself, the result was that she fell. The supreme court of Pennsylvania holds that a verdict should have been directed for the company.

The car, the court says, was running upon the public highway, over which it must be remembered the company has no control. In laying its tracks it must conform to the established grade. It can neither construct nor alter any of the places at which passengers are to step on or off its cars. It is obliged to place its tracks and run its cars where the public authorities direct. The contour of the surface of the street and the sides and gutters are all fixed by the municipal authorities. Passengers leaving the cars must step upon the surface of the street in the condition in which it is placed by the city, which fixes and maintains the grades. Obviously, the rules which might well and reasonably apply to steam railroads owning their own right of way, and having complete control of the approaches thereto, cannot reasonably be applied to street railways, which have not the right of eminent domain, and are only allowed the use of the public highways in common with other vehicles.

It may be that in this case the conductor misunderstood the signal of the passenger, and stopped the car sooner than she wished; but, if so, she had only to signify that fact, and retain her seat, and be carried to the desired spot. She was under no compulsion, nor did she receive even a suggestion from the conductor, as to where she should get off. That was a matter solely for herself. But the stopping of the car had nothing whatever to do with the cause of the accident. That resulted entirely from the manner in which she left the car. The fact that the street sloped off at the side upon a descending grade to the gutter necessitated a very long step for any passenger attempting to get off in that vicinity. But this fact was perfectly obvious to her, if she used her eyes, which she was certainly bound to do. The situation was entirely open to her view, and, if she had apprehended any danger whatever from the attempt to step down upon that side, and felt the necessity of leaving the car at that point, it would have been an easy matter for her to step to the other side of the car, and request the conductor to remove the chain, or pass out underneath it. Presumably she saw exactly where she was to step.

It is true that the highest courtesy upon the part of the conductor would have impelled him to step off the car and assist a lady to alight who desired to leave the car at a point which involved the taking of an unusually long step, but the court cannot say that he was under any legal obligation to do so. It knows of no rule which requires the conductor of a street car to supervise every motion of a passenger stepping from a stationary car to the ground. It thinks he may assume that under such circumstances, in broad daylight, with everything open to view, the passenger, even though a woman, may be allowed to judge for herself the distance she can safely step.

ELECTRIC RAILWAY IN STREET AN ADDED BURDEN—CONSENTS CANNOT BE WITHDRAWN AFTER CONSTRUCTION OF ROAD—RECEIVER CANNOT ABANDON RIGHTS ACQUIRED UNDER CONSENTS—CONSENT OF COUNCIL TO ABANDONMENT OF STREET—CONSENTS CONFER A PROPERTY RIGHT—PUBLIC ONLY CAN TAKE ADVANTAGE OF FORFEITURES—INEFFECTIVELY ATTEMPTING TO OBTAIN CONSENTS TO RECONSTRUCTION — SECURING APPROVAL OF COURT.

Paige vs. Schenectady Railway Co. (N. Y.), 70 N. E. Rep. 213. Mar. 15, 1904.

The court of appeals of New York says that although its decision in the case of Peck vs. Schenectady Ry. Co., 170 N. Y. 298, 63 N. E. 357, IV Street Railway Law, 203, where it held that the use of a city street for the purposes of a street surface railroad operated by electric power imposes an added burden upon the property rights of the owners of the fee of the street, is in conflict with the rule adopted in most other jurisdictions, yet, as that case was most carefully and thoroughly examined and considered, and the conclusion reached that this court should adhere to its former decision upon the subject, that decision must now be regarded as final and conclusive—not to be overruled or avoided, even by indirection.

The consents in this case were in writing, under seal, acknowledged by the parties, and, the court says, were valid grants of the right to build and operate the Schenectady Street Railway over the street in question. Having been once given, and the railway having been constructed, they could not be withdrawn. But the abutting landowners contended that the rights acquired under their consents were abandoned by the act of the receiver in a mortgage foreclosure suit, and by the action of the common council of the city in consenting to the abandonment of the railway upon a portion of the street, including that in front of their premises. The receiver, however, was appointed to manage and operate the railway and property belonging to the Schenectady Street Railway Company, to preserve and protect it in proper condition and repair, and to protect the title and possession thereof, and the business of the same. Under this limited authority the court can discover no principle upon which the receiver had a right to abandon any of the property belonging to such railway company without the consent of the company, of its stockholders, and the consent of the legislature of the state.

Nor was the common council clothed with any authority to compel or to authorize an abandonment of any portion of such street railway. While its consent might possibly waive any right the city possessed to enforce, or compel the enforcement of, a continued operation of the road, still it certainly could not, by any action upon its part, deprive the railway company of its rights, or affect the rights of the stockholders or the rights of the state and general public to require the company to continue the maintenance and operation of its road as originally constructed. These consents vested in the original railway company the right to maintain its road on the street in front of the plaintiff's premises, and, having been once given, and the road constructed, they could not be withdrawn at the will of the owner, where, as in this case, there was no contract with the company to that effect, no consent by the state or general public, or by the stockholders of the company, and no consideration therefor. Under the original consents, the railway company obtained a property right to construct and operate its road, which could not be destroyed by the action of the receiver or of the common council, or by the consent of a portion of the owners of the land abutting on the street, or by all. Nor did the removal of the tracks by the receiver determine or forfeit the franchise of the original company over the street, so as to prevent the defendant, who had succeeded to its rights, from relaying its tracks thereon. Such abandonment only operated as a cause of forfeiture, of which the public alone could take advantage.

The plaintiffs also sought to have their consents held ineffective upon the ground that the defendant subsequently attempted to obtain the consent of the property owners to a reconstruction of its road on this street, and, having failed, had secured the approval

of that route by the appellate division of the supreme court. But the court of appeals holds that the fact that the defendant, from abundant caution, acquired the approval of the court to run its road over that portion of the street, in no way forfeited or impaired its rights acquired under the original consents of the plaintiffs. That proceeding, it says, was, perhaps, unnecessary, but it was at most by way of further assurance, and not destructive of the rights already acquired. These consents being in the nature of conveyances of easements in the street, the right thereby acquired was not destroyed by reason of the proceeding which was taken to obtain the approval of the appellate division.

INJURY TO PERSON ATTEMPTING TO BOARD CAR AT SWITCH BY PULLING LOOSE OF HANDRAIL—TOLERATING BOARDING OF CARS ANYWHERE NOT AN INVITATION—DUTY TO ONE ATTEMPTING TO BOARD CAR AT UNUSUAL PLACE—WHEN ONE BECOMES A PASSENGER—PRESUMPTION FROM PULLING LOOSE OF HANDRAIL—DUTY TO HAVE HANDRAIL SOUND AND SECURE.

McCarty vs. St. Louis & Suburban Railway Co. (Mo. App.), 80 S. W. Rep. 7. Mar. 29, 1904.

The plaintiff was injured in attempting to board a car where it was stopped just before reaching a crossing for the throwing of a switch. He said that he had got one foot on the first step of the rear platform, and had his other foot raised above the second step, when the car started, and destroyed his balance, and he grabbed a handrail, which gave way in his struggles to maintain his position on the step, throwing him on the street. There was no testimony that either the motorman or the conductor saw him before or at the time he attempted to get aboard, or knew he desired or was trying to become a passenger, the conductor at the time being at the center of the car, inside. The only testimony as to its being usual to receive passengers there was the plaintiff's own, and it went no further than the statement that he had previously seen men and women board cars where he did.

The St. Louis court of appeals says that people occasionally get on street cars anywhere along a street, when they happen to stop, or even while they are running; but proof of that fact would not establish a custom to receive passengers everywhere, and bind carmen to be always alert. If there was a usage to take passengers at the switch, the carmen would have been bound to watch and be as careful about starting there as at far crossings—the common and appropriate localities for taking passage—for then persons would have a right to board cars, and the operatives good reason to expect them to do so. But that people had theretofore got on cars at the switch did not make out a custom, in the absence of evidence as to how many had done so, and for how long. The court is willing to notice, as a well-known fact, that companies tolerate persons getting on street cars wherever they stop, or, as said, when they are in motion, but it is unwilling to notice, as of common knowledge, that the public is invited to do so. The fact, it thinks, is quite the other way.

A person becomes a passenger on a street car by contract, express or implied. He may become one in attempting to get on a car at a place provided for that purpose, and where people are expected to take passage, though his attempt fails. But a man does not become a passenger by making such an attempt at a place where he is not expected, and when the carmen are ignorant of his presence. The case differed from that of a man who, by license of a defendant, was in a place so usually occupied by persons that the defendant was under the duty of looking out for his welfare. As the proof stood, this company was no more bound to be on the lookout for passengers where the accident occurred, than at any point the car might stop because of some impediment. So the court concludes that the carmen were not remiss in failing to notice the position of the plaintiff before they started, and that it was right to confine the jury's attention to the issue of whether they knew he was attempting to get aboard at that time.

The handrail pulled away from the car when the plaintiff clutched it to keep him from falling from the step, and the inference was fair that otherwise he would have maintained his position; and, if he would, the loosening of the handrail was the proximate cause of the injury. That it gave away while thus used was sufficient evidence of negligence on the part of the company to shift the burden of proof to it, as the party in possession of whatever evidence there was to exonerate it from blame. In the ordinary course of operating street cars, and traveling on them, such attachments do not break loose. They are grabbed as aids to boarding cars by many persons every day, with perfect and merited confidence in their security. The handrail, as well as the rest of the car, was in the control and under the management and care of the company. That an accident so contrary to common experience occurred bespeaks carelessness in the party using the appliance, and makes a prima facie case for the injured individual.

The plaintiff was not a passenger; but, as regards the use of the handrail at an unusual place, his status was intermediate between that of a bare licensee and a passenger—a status that has no distinctive legal appellation, so far as the court knows. He was not exactly an invited licensee, but perhaps might be called appropriately a probable licensee, for he, like every one else, was expected to use the handrail as an aid to mounting to the platform and maintaining a position on it. The duty owed by the defendant to him was like that owed by railway companies to persons who walk on depot platforms or get on cars, not with the intention of becoming passengers, nor as mere idlers or intruders, but to assist friends who are taking passage, or on some other privileged mission. The defendant was under an obligation to the plaintiff, as to the public generally, to have the handrail sound and secure, if that could be done by ordinary care. In providing the handrail the company tacitly agreed with any one who had occasion to use it, in a lawful attempt to take passage on the car, to be careful that it was safe. The tearing loose of the attachment was evidence going to prove non-performance of the duty growing out of that implied promise.

Illinois Tunnell Co.'s Power Plant.

The Illinois Tunnel Co. has purchased from the Chicago Dock Co. about 265,000 sq. ft. of land, fronting on Taylor St., Stewart Ave. and the south branch of the Chicago River. The price paid was $2,500,000. The tunnel company will immediately begin the construction of a power plant, warehouses and other improvements for the carrying out of its plan for storing and delivering freight by means of the 20-odd miles of tunnels which it has under the streets of Chicago and which were described, together with the purpose of the company, in the "Review" for April, 1904. The building plans are not yet complete.

Allis-Chalmers Co. Gets Large Contract.

The Allis-Chalmers Co. recently secured the contract for nearly 100,000 h. p. of equipment to cost upwards of $2,000,000. It is one of the largest contracts of the kind ever placed in this country, and calls for six turbines of 5,500 kw. (8,250 h. p.) capacity, each to be direct connected to 25 cycle, 750 r. p. m., three-phase alternating generators of similar size. The generators will be wound to give either 6,600 or 11,000 volts. One of the turbo-generator sets will be installed in the large power station which the Brooklyn Rapid Transit Co. is to build at Kent and Division Aves., Brooklyn, N. Y. This plant will have an ultimate capacity of almost 100,000 h. p., and eventually 12 turbo-generators will be installed there.

Rhode Island Co. Benefit Association.

The Mutual Aid Association of the employes of the Rhode Island Co., organized in November, 1901, at the same time that the pension fund was established, shows expenditures for the year 1903 of $30,961.52, the balance in bank Dec. 31st, 1903, being $366.48, about $170 less than at the beginning of the year. Of the expenditures $12,833.33 was for death claims and $18,128.19 for disability benefits, the latter being disbursed in no less than 1,653 checks. The receipts for the year 1903 were about equally divided between the dues received from members and contributions from the company, each of these items being in excess of $15,000. Since the organization of the association the death claims paid have aggregated $19,333.33 and disability benefits $31,112.

Financial.

The Long Island Electric Railway Co., of Jamaica, L. I., reported for the quarter ending June 30, 1904, as follows: Gross earnings, $35,201, an increase of $4,881; net earnings, $12,350, increase $2,038; other income, $313, an increase of $25; surplus after charges, $3,475, an increase of $1,881.

The Lancaster County Railway & Light Co. reported net earnings of its various holdings and leased lines for the year ending July 1, 1904, as $124,316; receipts from loans and other sources, $23,926; total income, $148,242. The general expenses for salaries of officers and clerks, office rents, etc., were $10,768; interest on funded and floating debt, $54,229; taxes, $1,987; total expenses, $66,583; net income, $81,259. The Lancaster County Railway & Light Co. does not operate, but owns the stock of the Conestoga Traction Co., Edison Electric Illuminating Co., Lancaster Gas Light & Fuel Co., and the Columbia Electric Light & Power Co.

The Lehigh Valley Traction Co. reported for June as follows: Cash on hand June 1, 1904, $50,092; passenger receipts, $46,749; sale of junk, power, etc., $1,488; other income, $381; total, $98,712. Disbursements—Maintenance and operation, $45,204; Bethlehem & Nazareth Passenger Railway Co. rental, $3,750; Macunzie extension rental, $1,500; real estate used in operation, $1,860; Philadelphia & Lehigh Valley Traction Co., $849; Whitehall Street Railway Co., $267; interest and discount, $305; Eastern Delaware Bridge Co., rental, $403; taxes, $76; total, $54,216; cash balance June 30th, $44,496.

St. Louis Transit Co. gross earnings for July broke all records in the history of that company, being $984,644.20, as against $639,705 in July, 1903, an increase of $344,939.50, or nearly 50 per cent.

Passenger receipts of the Cleveland & Southeastern Traction Co. for July were in the neighborhood of $50,000, against $43,000 for last year, a gain of $7,000 for the period.

The Lake Shore Electric Railway Co. gross passenger receipts for the month of July were $71,130, against $64,608 for July, 1903, an increase of $6,521.

The Georgia Railway & Electric Co., of Atlanta, Ga., report gross earnings for the year ended June 30, 1904, of $1,971,981; net earnings of $383,970.

Earnings of the Detroit United Ry. for the last 10 days of July were $141,431.49, an increase of $7,946.12 over same period last year. For the entire month the earnings were $483,108.38, a decrease of $906.10.

The Terre Haute Electric Co. report for the month of June gross earnings $47,654, an increase of $9,169 over same month of previous year, and for the fiscal year ended June 30, gross earnings $526,292, an increase of $115,947 over previous year.

The Seattle Electric Co. gross earnings for the month of June, 1904, are $191,495, an increase over June, 1903, of $15,892. For the fiscal year ended June 30th, $2,229,880, an increase of $210,973 over the previous year.

THE NEW YORK & QUEENS COUNTY RAILWAY CO.

The following earnings are reported by the New York & Queens County Railway Co. for the quarter ending June 30, 1904, as compared with the same period in 1903:

	1904	1903
Gross	$105,233	$100,764
Net	90,575	70,264
Other income	2,506	3,210
Surplus after charges	53,126	35,911

STATEN ISLAND RAPID TRANSIT.

Reports show the earnings of the Staten Island Midland Railroad Co. to be as follows:

	1904.	1903.
Gross	$167,070	$176,628
Net	83,128	54,670
Other income	10,428	11,728
Surplus after charges	46,024	14,327

CENTRAL PENNSYLVANIA TRACTION CO.

The first annual report of the president of the Central Pennsylvania Traction Co., of Harrisburg, Pa., rendered at the annual meeting held July 26, showed the gross receipts for the year to have been $522,022; operating expenses, $277,998; net earnings, $244,024. The total number of passengers carried was 12,606,037, a gain of 909,782. The total number of miles run was 1,921,961, a decrease of 423 miles from last year. This decrease was due to paving and repairs, and consequent cessation of travel while the work was in progress. The company plans to construct a line from its terminal at Paxtang to Hummelstown, six miles.

NORTHERN OHIO TRACTION & LIGHT.

The comparative statement for June of the Northern Ohio Traction & Light Co. follows:

	1903.	1904.	Increase.
Gross receipts	$77,971	$80,504	$2,533
Operating expenses	43,736	43,274	*462
Net earnings	34,234	37,230	2,996
Bond interest, etc.	23,259	23,167	*92
Net income	10,975	14,064	3,089

*Decrease.

TOLEDO RAILWAYS & LIGHT CO.

Following is the comparative statement of the Toledo Railways & Light Co. for June:

	1903.	1904.	Increase.
Gross receipts	$141,545	$148,636	$7,091
Operating expenses	71,806	76,942	5,136
Net earnings	69,739	71,694	1,955
Deductions	41,135	41,643	508
Net income	28,603	30,051	1,448
Operating ratio	.5073	.5177	.0104

CINCINNATI, DAYTON & TOLEDO.

Following is the comparative statement of earnings of the Cincinnati, Dayton & Toledo Traction Co. for the 12 months ending May 31st:

	1903.	1904.	Increase.
Gross earnings	$489,493	$502,990	$13,497
Operating expenses	271,812	301,788	29,976
Net earnings	217,681	201,203	*16,478
Deductions from income	193,673	195,181	1,508
Net income	24,008	6,022	*17,986

*Decrease. Operating expenses include an accident appropriation equal to 2 per cent of gross receipts.

PHILADELPHIA CO.

Following is the statement of the Philadelphia Co. and affiliated corporations for the six months ending June 30, 1904:

Gross earnings from operations	$7,928,594
Expenses and taxes	4,566,228
Net earnings from operations	3,362,366
Miscellaneous income	224,894
Total earnings and income	3,587,260
Total fixed charges	2,048,359
Total income	1,538,902
Accrued div. Phila. pref.	143,614
Net income—surplus	1,395,288
Available for Phila. Co.	1,392,842

All items representing transactions between the companies have been eliminated in this report.

TWIN CITY RAPID TRANSIT CO.

The Twin City Rapid Transit Co. reported for June as follows:

	1903.	1904.	Increase.
Gross earnings	$347,745	$370,140	$22,395
Expenses and taxes	168,745	173,638	4,893

Net earnings	[illegible]	[illegible]	[illegible]
Charges	78,391	[illegible]	[illegible]
Surplus	[illegible]	[illegible]	[illegible]
Twelve months ending...			
Gross earnings	$1,918,653	$2,030,262	$111,609
Expenses and taxes	922,372	956,875	34,503
Net earnings	996,281	1,073,387	77,106
Charges	470,318	540,441	70,123
Surplus	525,963	532,946	6,983

BROOKLYN HEIGHTS R. R. AND CONSTITUENT COMPANIES

The general balance sheet of the Brooklyn Heights Railroad Co., as of June 30, 1904, shows total assets of $29,341,591, an increase of $7,134,014 over 1903. The assets include: Cost of road and equipment, $470,740, an increase of $5,651; stocks and bonds, $2,062,000, an increase of $2,042,000; additions, betterments and leased lines, $10,255,022, a decrease of $305,827; open accounts, $2,371,184, an increase of $1,402,766; prepaid taxes, $168,127; cash on hand, $304,868, an increase of $112,068; bills receivable, $3,660,763. The liabilities include: Capital stock, common, $200,000; taxes accrued, $1,217,267, an increase of $270,057; funded debt, $250,000; loans and bills payable, $2,985,000, an increase of $2,240,000; interest due and accrued, $193,406, an increase of $190,281; rentals due, $572,481, a decrease of $522,314; accounts to adjust Brooklyn Rapid Transit equity in construction, $8,225,480; open accounts, $810,534, a decrease of $262,755; certificates of indebtedness, $2,850,438; Brooklyn Rapid Transit loans, $2,042,000; profit and loss, surplus, $806,905, an increase of $338,160.

The Coney Island & Gravesend Railway Co. reports for the quarter ended June 30th as follows:

	1903.	1904.	Increase.
Gross earnings	$8,054	$9,779	$1,725
Operating expenses	7,249	8,803	1,554
Net earnings	805	976	171
Other income	101	.....	*101
Total income	906	976	70
Fixed charges	98	246	148
Surplus	808	730	*78
Surplus for year	3,556	4,162	606

The general balance sheet shows: Cash on hand, $7,979; profit and loss surplus, $11,699.

The Brooklyn, Queens County & Suburban Railroad Co. reports for the quarter ended June 30th:

	1903	1904	Increase.
Gross earnings	$229,840	$284,073	$54,233
Operating expenses	114,477	151,999	37,522
Net earnings	115,363	132,074	16,711
Other income	6,298	831	*5,467
Total income	121,661	132,905	11,244
Fixed charges	99,525	102,121	2,596
Surplus	22,136	30,784	8,648
Surplus for year	48,422	43,830	*4,952

*Decrease.

The general balance sheet shows: Cash on hand, $20,392; profit and loss surplus, $118,654.

CHICAGO & MILWAUKEE ELECTRIC RAILROAD CO.

The July and fiscal year earnings of the Chicago & Milwaukee Electric Railroad Co. are reported as follows:

	Gross earnings.	Operating. expenses	Net earnings.
July, 1904	$52,227.94	$18,508.04	$33,719.90
July, 1903	29,529.43	8,522.87	21,006.56
Increase	22,698.51	9,985.17	12,713.34
Jan. to July, inclusive, 1904	215,478.12	91,095.17	124,382.95
Jan. to July, inclusive, 1903	123,249.93	48,369.64	74,880.29
Increase	92,228.19	42,725.53	49,502.66

ELGIN, AURORA & SOUTHERN TRACTION CO.

The Elgin, Aurora & Southern Traction Co. reports for June and for twelve months as follows:

For the month ending June 30:

	1904	1903
Gross	$39,943.00	$42,545.17
Operating	22,036.00	22,817.82
Net	17,907.00	19,727.35
Deductions	9,451.04	9,452.33
Surplus	8,455.96	10,275.02

Twelve months ending June 30:

	1904	1903
Gross	$456,069.80	$434,966.71
Operating	274,766.68	250,706.18
Net	181,303.12	184,260.53
Deductions	110,676.32	110,068.14
Surplus	70,626.80	74,192.39

NORTHERN TEXAS TRACTION CO.

The Northern Texas Traction Co. report of earnings for the month of July is as follows:

	1903.	1904.	Increase.
Gross earnings	$42,548.41	$52,281.05	$9,732.64
Operating expenses	20,543.20	27,551.03	7,007.83
Net earnings	22,005.21	24,730.02	2,724.81
Fixed charges	9,018.33	10,209.43	1,191.10
Net profit	12,986.88	14,520.59	1,533.71

For the seven months ending July 31st:

	1903.	1904.	Increase.
Gross earnings	$249,487.61	$311,216.78	$61,729.17
Operating expenses	132,972.75	175,525.41	42,552.66
Net earnings	116,514.86	135,691.37	19,176.51
Fixed charges	63,143.33	70,756.85	7,613.52
Net profit	53,371.53	64,934.52	11,562.99

AURORA, ELGIN & CHICAGO RAILWAY CO.

The Aurora, Elgin & Chicago Railway Co. reports for June and for the first twelve months in which the line has been in complete operation, as follows:

	June, 1904.	12 mos. ending June 30, 1904.
Gross earnings	$44,117.93	$427,530.26
Operating expenses	26,338.36	240,271.24
Net earnings	17,779.57	187,259.02

HOUGHTON COUNTY STREET RAILWAY CO.

Reports from the Houghton County Street Railway Co. for the month of June are as follows:

	1904.	1903.
Gross earnings	$16,936	$16,417
Net earnings	6,694	6,850
Surplus	3,313	3,921

For the fiscal year ended June 30th:

	1904.	1903
Gross earnings	189,037	182,577
Net earnings	57,688	61,373
Surplus	20,378	28,173

CHICAGO UNION TRACTION CO.

The receivers of the Chicago Union Traction Co. recently filed with the court the report of earnings of the company for the year ending June 30, 1904, compared with 1902 and 1903, as follows:

	Earnings, etc. Year Ending June 30, 1904	Increases Year Ending June 30, 1904. Over 1903.	Over 1902.
Passenger	$8,556,533	$230,684	$755,458
Other	33,934	2,480	9,890
Gross	8,590,467	233,164	765,348
Expenses:			
Maint. way	609,600	240,765	335,024
Maint. equip.	741,252	216,741	242,204
Transportation	3,718,746	402,515	924,747
General	1,039,618	b92,985	36,521
Total	6,109,216	767,036	1,538,496
Net earnings	2,481,251	b533,872	b773,148
Other income	137,018	b6,154	19,668
Total income	2,618,270	b540,026	b753,480

Charges:			
Rental	a1,843,078	b1,038,473	b1,041,001
Other	509,802	b131,137	b224,706
Total	2,352,881	b1,169,610	1,266,307
Surplus	205,380	620,584	512,017
Statistics:			
Car miles	33,275,288	1,890,744	2,543,237
Passengers—			
Revenue	171,832,673	4,804,244	15,695,775
Free	944,923	84,936	133,475
Transfer	108,204,739	24,525,864	43,889,018
Total	280,082,335	29,415,034	59,718,268
Per cent transfer	62.63	12.79	21.65
Per car mile—			
Car earnings	25.82c	b.81c	.36c
Operating expenses	18.36c	1.34c	3.49c
Net	7.46c	b2.15c	b3.13c
Per Rev. Passenger—			
Car earnings	5.00c	0.00c	b.01c
Operating expenses	3.56c	.36c	.63c
Net	1.44c	b.36c	b.64c

[a] Contains no charge for dividends accrued on outstanding West and North Chicago stock for the period subsequent to September 1, 1903, when the modified leases were adopted, except that part of the payments of October 15 and November 15 that applies to the period after September 1.

[b] Decrease.

The receiver states that during the past two years all earnings have gone back into the system; that over $500,000 more was spent in 1904 on way and equipment than in 1902; that service has been increased by 2,500,000 miles; that 1½ times the number of transfers were issued in 1904 than in 1902; that $500,000 more was paid to labor, and that power was added at a cost of $300,000. The net earnings in 1904 were stated to be equal to the net in 1902.

Canadian Notes.

Arrangements have been made with the Grand Trunk Ry. by which the Toronto & Hamilton Railway Co. will give the Toronto & Hamilton running rights over its tracks from Burlington to Stoney Creek, where the company's tracks will begin again. The company has yet to secure an entrance into Hamilton.

City Engineer Rust, of Toronto, suggests that two main avenues 100 feet in width, be laid out, providing for a double line of street car tracks, one commencing at Queen street and University avenue and running northwesterly to the intersection of Royce avenue and Dundas street, which would be about 3½ miles in length; the other commencing at the intersection of Church and Queen streets and running in a northeasterly direction to Danforth avenue and Broadview avenue, which would be about 1¾ miles in length. Mr. Rust reports that there are over 32,000 miles of electric wires in the city, which, especially in the business sections, should be placed underground.

The application of the Toronto & Mimico Railway Co. for permission to cross the Grand Trunk Ry. tracks at Sunnyside at the western limit of Toronto is meeting with much opposition. City Engineer Rust suggests an overhead bridge. The government engineer reports the place too dangerous to allow of a diamond crossing. The Grand Trunk Ry. states that it is willing to construct a subway from the Humber, a mile west of the disputed crossing, to Duffer street, a mile east of it, which would do away with crossing on the level, but nothing definite has been agreed upon, meanwhile the street railway have extended their tracks to within a few yards of the Grand Trunk Ry. tracks.

The proposal to connect Arcola, B. C., with the Canadian Pacific line on the north and the Estevan and Soo lines to the south by an electric line is being discussed by prominent business men of Moosamin, Arcola and Alameda. The intention is to construct a line to carrry freight as well as passengers. Provision would also be made for the lighting and supplying of power in the towns adjacent to the line as well as the installing of telephone systems.

The Hamilton, Grimsby and Burlington Ry., who wishes to extend its line to St. Catharines, has offered the City Council there $25,000 towards the construction of a high level bridge.

The Niagara, Queenston & St. Catharines Electric Ry., with capital of $250,000, and power to issue bonds to the extent of $30,000 a mile, hopes to start work this year on the construction of a belt line railway from St. Catharines, Ont., through Niagara-on-the-Lake and Queenston, back to St. Catharines. J. N. McKendry, F. Denton, H. L. Dunn, A. D. Crooks, Toronto; E. J. McIntyre, Niagara, Ont.; R. G. Code, E. F. Burritt, Ottawa, the provisional directors, are at present carrying on all negotiations. W. H. Middlemist, A. M. I. C. E., is chief engineer. It is understood that Pittsburg capitalists are back of the enterprise. The road is to be 21 miles in length.

In the action recently taken by the city of Hamilton against the street railway company to recover $3,300 and interest on a percentage of fares collected from passengers on the Jockey Club section of the line outside the city boundary, a verdict was given in favor of the city.

The Toronto & Hamilton Electric Ry. intends constructing a loop line, that will carry freight and passengers, from Burlington Beach to Hamilton.

A by-law has been passed by the London City Council providing for a number of small extensions during the current year, provided the necessary rails can be obtained, in all two miles of track.

The cable has been laid across the suspension bridge at St. Johns, N. B., and work completed on the construction of the St. Johns Street Railway Co's. line to Bay Shore Park and cars are now running. Seven double-truck combination cars have been added to the rolling stock and a new car house is being built.

The Toronto Railway Co. is building 15 double truck motor cars, 30 single truck motor cars and 35 single truck trailers, all of the convertible type, in its shops. The company will probably build 30 more motor cars this year.

J. H. Armstrong, St. Catharines, Ont., is chief engineer of the St. Catharines, Pelham & Welland Electric Ry., seeking power for an extension of its line from the present terminus of the Toronto, Hamilton & Burlington Ry. in Pelham township to Dunville. Address J. W. Holmes, of Dunnville, for information.

Messrs. McPherson and Sandison, of Winnipeg, are solicitors for a company seeking a charter for the construction of an electric road from Lac du Bonnett to Winnipeg, in connection with the development of water power on the Winnipeg river.

Work on the Winnipeg, Selkirk & Lake Winnipeg Ry. is completed and ready for the rolling stock. The line will be operated by steam until electric connections can be made.

At the request of the City Council, the Winnipeg Electric Street Railway Co. has decided to extend its line along Logan avenue to McPhillips avenue. The city will repave the street to McPhillips avenue to allow the company to lay tracks.

The Peterboro Radial Railway Co. has been granted permission to cross the Grand Trunk and Canadian Pacific Railway tracks at Peterboro, the railway company to contribute 25 per cent of the cost.

Advertisements are out for tenders on eight sections of 10 miles each, between Guelph and Goderich on the Guelph and Goderich Railway Co's. line. Information furnished at the engineer's offices of the company in Guelph and Goderich.

The Amherstburg Town Council have granted the Sandwich, Windsor & Amherstburg Ry. a bonus of $6,000.

The London, Aylmer & North Shore Electric Railway Co. has raised the capital to finish the road which will be 45 miles long, with power station and repair shop at Aylmer, Ont. R. M. Luton, Widdinton Building, Grand Rapids, Mich., is president.

The provisional directors of the Brantford & Hamilton Electric Railway Co., which has been granted power to build a line from Brantford to Hamilton, is connected with the Von Echa Co., which controls the Brantford Street Ry., the Woodstock, Thames Valley and Ingersoll Ry. and the Grand Valley Ry. C. P. Raikes, Canadian representative of Harper Brothers & Co., of London, Eng., recently went over the proposed route, and it is understood will report favorably to his firm.

Superintendent Leonard and Secretary Chas. Drinkwater, of the Canadian Pacific Ry., are negotiating for the purchase of the Berlin, Waterloo, Welland and Lake Huron Ry.

The contract for building a new car barn at Binghampton, N. Y., for the Binghampton Railway Co. has been awarded to Mason I. Ford. It will be constructed of brick and the offices of the company will also be located therein.

Personal.

MR. CHARLES REMELIUS has been appointed master mechanic of the Brooklyn Heights Rapid Transit Co.

MR. L. S. SAGE, for the past two years auditor of the Union Traction Co., of Indiana, has tendered his resignation.

MR. J. B. ROGERS has been appointed superintendent of the railway department of the Winona (Minn.) Railway & Light Co.

MR. ISAAC A. SMITH, formerly chief engineer of the Southern Illinois Electric Railway Co., has been appointed general manager of that company.

MR. R. W. GRAY has been appointed general manager of the St. Louis, St. Charles & Western Railroad Co., succeeding Mr. J. D. Houseman, resigned.

MR. I. H. SHERWOOD has been appointed manager of the People's Light & Railway Co., of Streator, Ill., to succeed Mr. George J. A. Paul, resigned.

MR. W. K. RANKIN has been appointed assistant superintendent of the Chester Traction Co., of Chester, Pa. He will be in charge of the car barn, succeeding Mr. Thomas Gibson, resigned.

MR. T. H. BOYD, for several years superintendent of the car shop and paint shop of the Knoxville Traction Co., has been promoted to the position of master mechanic of that company.

MR. ARTHUR J. WILSON has resigned his position as master mechanic of the Brooklyn Heights Railroad Co. Mr. Wilson has been connected with the operating department of the Brooklyn roads for over fourteen years and for several years past has been in charge of the three large repair shops of the surface and elevated divisions and the 15 division shops. Mr. Wilson's resignation was caused by ill health and it became necessary for him to take a much needed rest. He was very popular with all of the men on the road and at the time of his resignation he was presented by the employes with a set of engrossed resolutions telling of the good work he did in the operating department. They also presented him with a handsome cut glass service.

A. J. WILSON.

MR. E. B. GUNN has resigned his position as general superintendent of the Dayton, Springfield & Urbana Electric Railway Co. and has been succeeded in that position by Mr. A. H. Hayward.

MR. J. A. BARRY, who recently resigned as general manager of the New Jersey & Pennsylvania Traction Co., was presented by the employes of his road with a handsome Masonic emblem in the form of a watch charm.

MR. GEORGE H. BINKLEY on August 6th resigned as manager of the Railway Department of Kohler Bros., Chicago, and will form a partnership with A. N. Hadley, of the Hadley-Derrick Co., Talbot Bldg., Indianapolis. Ind.

MR. ELLIS BARTHOLOMEW has resigned as president of the Toledo, Columbus, Springfield & Cincinnati Railway Co. and is succeeded by Mr. E. C. Shiness, a member of the board of directors. The vacancy on the board of directors has been filled by Mr. A. Beesch, of Toledo.

MR. JOSEPH FORSTOVE has been appointed superintendent of the Galesburg (Ill.) Electric Motor & Power Co., vice Mr. H. E. Davisson, resigned. Mr. Forstove has for 10 years been connected with the Quincy (Ill.) Horse Railway & Carrying Co., as cashier, assistant superintendent and manager.

MR. ROSCOE CORNELL has been appointed manager of the branch office which the Allis-Chalmers Co. has just opened in El Paso, Texas. Mr. Cornell goes to the Allis-Chalmers Co. from the Mine & Smelter Supply Co. of Denver. He is a graduate of the Michigan College of Mines, and is well known as a mining and mechanical engineer.

MR. JOHN MELLOR has been appointed superintendent of the mechanical department of the Worcester & Connecticut Eastern Railway Co. and the Worcester & Southbridge division of the Consolidated Railways Co., both of which are owned by the New York, New Haven & Hartford Railroad Co. Mr. Mellor's headquarters will be at Dayville, Conn.

MR. WILLIAM WAMPLER has been appointed general sales agent of the Peckham Manufacturing Co., with headquarters at 26 Cortlandt St., New York City. Mr. Wampler enjoys a wide acquaintance in the electric railway industry, and his many friends will be glad to know of his advancement to the position of general sales agent for the Peckham company.

MR. J. D. HOUSEMAN has resigned as general manager of the St. Louis, St. Charles & Western Railroad Co., to become general manager of the Suburban Telephone Co., with headquarters at Clayton, Mo. Mr. Houseman has been with the St. Louis, St. Charles & Western since it was opened in 1899, and during that time he has not had occasion to discharge a single employe, and only four of the regular men have resigned. The wages of the men have been increased 20 per cent without solicitation, and it is a noteworthy fact that during this period the company has not been called upon to pay out but $250 for damages, and there are at present no damage suits against the company.

Accidents.

July 19th a Rapid Ry. car of the Interurban Railway & Terminal Co., of Cincinnati, O., ran away on a steep grade, jumped the track at a switch at the bottom of the hill and overturned. The motorman was seriously, if not fatally, injured.

July 25th two persons were killed and several injured in a collision between a Big Four passenger train and an Indianapolis Street Railway Co. car at Indianapolis, Ind.

July 24th a Verango Power & Traction Co. car at Oil City, Pa., ran away on a steep grade and one passenger was killed and several hurt by jumping from the car.

July 28th a Milwaukee Electric Railway & Light Co. car collided with a chemical engine of the fire department and seven passengers were injured, some seriously.

July 30th four passengers were fatally hurt and nine others injured in a collision on the Rochester, Charlotte & Manitou Railway Co's. line near Rochester, N. Y.

July 31st nearly 50 passengers were injured, 12 seriously, in a head-on collision between two cars of the Union Railway Co., near 234th St., New York.

July 31st 23 persons were injured in a trolley car collision on the Cleveland, Painesville & Eastern Railroad Co's. line near Nottingham, O.

July 31st, in a collision between a Chicago City Railway Co's. Ashland Ave. car and a Chicago Junction Ry. freight train, eight persons were hurt, one probably fatally.

July 30th a Macon (Ga.) Railway & Light Co. car jumped the track at a curve and collided with a telegraph pole 40 ft. away. The conductor and motorman were seriously hurt.

August 1st two Boston & Worcester Street Railway Co. cars collided on a single track at White's Corner, near Worcester, Mass., and 14 persons were badly injured. The motorman of one of the cars died from his injuries.

August 1st a car of the Philadelphia Rapid Transit Co. caught fire from a live wire falling across the roof and in the panic that followed seven persons were injured. The car was almost totally destroyed.

August 2d two trolley cars on the Boston & Worcester railway collided at a point three miles from Westboro, Mass. One person was killed and fourteen injured. Both cars were badly damaged by the impact.

August 6th an Atchison, Topeka & Santa Fe passenger train crashed into a trolley car at the Belt line crossing, Kansas City, Mo., killing one and injuring nine persons.

August 7th a Wallace street and a Halsted street car of the Chicago City Railway Co. collided in the Clark street subway, the Halsted street car crashing into the rear of the other just as it was starting out of the subway. Fourteen persons were injured.

The Manchester Traction Co. dam at Garvin's Falls, N. H., has been completed and the company's power plant at that point put in operation. Now that the new plant is in operation, the generators at the Brook street station, which have been operated by steam, will be put out of commission.

Question Box of the New York State Street Railway Association.

At the 22d convention of the Street Railway Association of the State of New York, to be held at Utica, Sept. 12-13, 1904, a question box is to be introduced, which, it is hoped, will prove an important element in the success of the meeting. The following preliminary questions have been submitted to the membership of the association by Mr. W. M. Probasco, editor of the question box, who requests that they be not answered merely by "yes" or "no", but that reasons for the answers be given and illustrations furnished wherever possible from actual practice. It is proposed to print the questions and answers received up to within a short time before the meeting.

CONSTRUCTION AND EQUIPMENT.

Power Station Construction.

1. What is the life of a good storage battery when well taken care of? Is a floating battery preferable to a booster installed in station? How much attention does a battery require?

2. Is the specific heat of superheated steam constant, and if not, what law will give the specific heat of superheated steam at various temperatures and pressures?

3. One company has in its power house one 800-kw., 550-volt, direct current generator with compound fields. In the armature there are 800 coils and 800 commutator bars, 12 poles and 12 brush holders. Would like to know the proper connections to make to balance the magnetic circuits of this machine and size of wire necessary.

Track Construction.

4. What type of rail has given the best satisfaction for city service in unimproved streets, and what troubles, if any, have been met with in the 9-in. girder rail?

5. Cannot a limited number of standard rail heads be adopted for paved streets?

6. What rights has a railroad company in arranging drainage for its tracks? Where the company pays for paving between tracks and for a certain distance on each side, can it claim any jurisdiction in arranging grades for drainage?

7. Which is the better material for paving—Medina sandstone or granite block?

8. What type of rail joint has proven best in paved streets?

9. What is the best method for detecting broken bonds? Is the electrical drilling machine practicable?

10. What is the best type of bond—the compressed head or the pin head?

Overhead Line Construction.

11. What wood is best adapted to stand the elements; and what paint; how many coats, and how often should same be painted?

12. Which is the best hanger—the mechanical or soldered clip?

13. What is the best method of spacing d. c. lightning arresters along the line?

14. How many lightning arresters to the mile in the best practice? Should more arresters be used in suburban than city lines?

15. Has it been observed that the presence of a high voltage transmission line, running along the same right of way with the trolley, has a tendency to relieve the d. c. line from some of the lightning disturbances to which it would normally be subject?

16. Information is requested with regard to the use of aluminum for a. c. high tension lines and for d. c. trolley feeders; also for use bare in underground conduit as an auxiliary to the rail return.

17. What are the most efficient methods of jointing the main conductors and of attaching trolley taps to the main feeders?

18. What are the principal advantages and the disadvantages in the general use of aluminum for such purposes?

19. What is the maximum distance direct current can be advantageously transmitted for the operation of interurban cars?

Selection of Rolling Stock.

20. Have the semi-convertible cars given as good satisfaction for summer service as the open cars, and to what extent have double truck cars replaced single truck for strictly city service?

21. Has any practical type of power brake been developed to take the place of air brakes?

22. What is the difference in current consumption of two- and four-motor equipments?

23. What is the best method of determining the life of motor [illegible]

24. What type of snow plow has given the best satisfaction for city streets?

25. Are electric heaters economical? What other system is more efficient and convenient?

26. Have any experiments been made, or has any one had experience with hot water heaters, and if so, what has been the difference in expense between them and electric heaters?

27. Viewed from the standpoint of maintenance, which is preferable, the split or solid gears?

Block Signal System.

28. Which is the more reliable, automatic signals or those manipulated by hand?

29. Is there a satisfactory automatic block signal system used that will take care of any number of cars passing through the same block?

30. Are telephonic train orders satisfactory?

OPERATION.

Accident Department.

31. Where and when should derailing switches be used, excluding steam railroad crossings?

32. Give experience with accidents with derailing switches.

33. Have you used the premium system with your employes for avoiding accidents; if so, what percentage have the accidents been reduced?

34. Has not the practice of giving premiums to conductors and motormen for avoiding accidents made them careless in reporting slight accidents?

35. What is the best method of training employes to avoid accidents?

Car Houses.

36. What is the best design for a car house?

Employes.

37. What has been the benefit, if any, of forming an association among employes?

38. Can associations of employes be made sufficiently attractive to take the place of union organizations? Can a successful benefit fund be established by contributions from employes alone without assistance from the company? If so, would not such a fund be more appreciated by the men than one on which they had received assistance? Would not a written examination at the end of each year of all conductors and motormen employed during the year, somewhat in the nature of the competitive civil service examination, be the best method of determining seniority?

39. What is the best method of disciplining employes?

40. Give experience of the merit system in connection with discipline of employes.

41. Does the merit system entail extra office expense, and to what extent has it helped discipline?

42. Do all roads subject their intending employes to a physical examination?

43. What benefit or check has resulted in the securing of bonds from employes?

44. Should conductors furnish bonds, and if so, who should pay the premium?

Fares on Interurban Railways.

45. What is the best method of collecting and accounting interurban fares?

46. Are there any data available to show the percentage of tickets used to tickets sold, and what is a fair per cent of shrinkage?

Parks and Pleasure Resorts.

47. Is it better to operate all attractions at parks or to induce outsiders to put them in on a percentage basis? Are any pleasure parks self-sustaining, or can they be made so?

48. What is the most effective method of advertising, for the least expense?

Repair Shops.

49. What is the proper test to give equipment before leaving the shop for service?

50. What is the best method of keeping shop record of cost of maintenance; bodies, trucks and motors?

51. Considerable trouble has been experienced with broken car axles from crystallization, especially during cold weather. The axles break either at the end of the key way or at the shoulder next to the journal bearing. We would like to know the cause; also, if

salt water getting into a small check will cause it to spread or deepen. From the appearances of some of the breaks, those are the indications. Also would like to know which grade of steel is considered best for car axles.

52. Which is productive of the best results—pit work, or overhauling from above?

53. Is it best to overhaul equipment by mileage?

Snow Removal.

54. What amount of snow can the city authorities demand removed?

55. What is the best form of organization of snow fighting forces?

Traffic Development.

56. Has it proven beneficial, in moderate sized cities, to largely increase the number of cars during rush hours, over the ordinary times of day?

57. What has been found to be the best method of advertising to develop traffic?

58. What has been the experience with the use of trailers as regards accidents, and have they proved more satisfactory than the use of larger cars with no trailers?

59. Does not the use of trailers increase the number of derailments?

60. Should the extra list be a revolving one? (i. e., after an extra has had work, should he go to the bottom of the list and work up again?)

Wheels—Chilled Iron, Steel Tired, Fused Wheels and Solid Steel.

61. Would not the trouble, which was experienced by many roads during the past winter, of motors dragging on the ice, be eliminated by the use of 36-in. wheels?

62. What are the relative merits of steel and cast iron wheels?

63. How does the life of cast iron wheels compare with steel-tired, fused and solid steel wheels? Is not the cost of maintenance per mile in favor of the cast iron wheel?

64. Is not a 550-lb. double plate cast iron wheel as safe to run under our modern interurban cars as the steel-tired wheels now being used?

65. What is the principal cause of wheels being flatted on air-brake interurban cars?

66. What are the causes, all of them, of flat wheels?

67. What weight and model of chilled car wheels, 33 in. in diameter, are proper and safe for an 8-ton single truck electric car for city service, and the probable life of the same?

Illinois Electric Railway Map.

We publish herewith the fifth of our series of state maps showing the present development of electric railways in the state of Illinois. These maps have been compiled by the Arnold Electric Power Station Co. and the present map has been corrected to August 12th, and is undoubtedly the most complete electric railway map of Illinois ever published.

The following list contains 96 electric railroads under construction and in operation in the state of Illinois.

1. Alton, Granite & St. Louis Traction Co.
2. American Central Traction Co.
3. Aurora, De Kalb & Rockford Electric Traction Co.
4. Aurora, Elgin & Chicago Railway Co.
5. Bloomington & Normal Railway, Electric & Heating Co.
6. Bloomington, Joliet & Pontiac Electric Railway Co.
7. Blue Island, Riverdale & Hammond Railway Co.
8. Cairo Electric & Traction Co.
9. Calumet Electric Street Railway Co.
10. Carbondale & Carterville Electric Railroad Co.
11. Central Railway Co.
12. Central Illinois Traction Co.
13. Central Traction Co.
14. Centralia & Central City Street Railway Co.
15. Charleston, Champaign & Northern Interurban Railway Co.
16. Chicago & Joliet Electric Railway Co.
17. Chicago & Milwaukee Electric R. R.
18. Chicago & Oak Park Elevated Railroad Co.
19. Chicago City Railway Co.
20. Chicago Consolidated Traction Co.
21. Chicago Electric Traction Co.
22. Chicago General Railway Co.
23. Chicago, Harvard & Geneva Lake Railway Co.
24. Chicago Union Traction Co.
25. Coal Belt Traction Co.
26. Danville, Urbana & Champaign Railway Co.
27. Decatur Railway & Light Co.
28. Decatur, Springfield & St. Louis Railway Co. (Part of Illinois Central Traction Co.)
29. Decatur, Tuscola & Champaign Interurban Railway Co.
30. De Kalb & Sycamore Electric Co.
31. Dixon, Rock Falls & Southwestern Electric Railway Co.
32. Eastern Illinois Traction Co.
33. East St. Louis & Suburban Railway Co.
34. Elgin, Aurora & Southern Traction Co.
35. Freeport-Dixon Electric Railway Co.
36. Fulton County Electric Railroad Co.
37. Galesburg & Kewanee Electric Ry.
38. Galesburg Electric Motor & Power Co.
39. Galesburg, Monmouth & Rock Island Railway Co.
40. Hillsboro Electric Railroad Co.
41. Illinois & Kentucky Railroad Co.
42. Illinois & Rock River Railway Co.
43. Illinois Central Traction Co.
44. Illinois Valley Traction Co.
45. Interstate Electric Railway Co.
46. Interstate Railway, Light & Power Co.
47. Jacksonville Railway Co.
48. Jacksonville & Springfield Traction Co.
49. Jacksonville Traction Co.
50. Joliet & Northwestern Railway Co.
51. Joliet, Plainfield & Aurora Railroad Co.
52. Kankakee Electric Railway Co.
53. Kankakee Interurban Riverview Railway Co.
54. Keokuk & Western Illinois Railway Co.
55. Kewanee, Cambridge & Geneseo Railway Co.
56. Kewanee Short Line Electric Railway Co.
57. Lincoln Electric Railroad Co.
58. Macomb & Western Illinois Railway Co.
59. Mechanicsburg & Buffalo Railway Co. (Horse.)
60. Metropolitan West Side Elevated Railway Co.
61. Mississippi Valley Traction Co.
62. Morrison & Denrock Electric Railway Co.
63. Murphysboro Street Railway Co.
64. Northern Electric Railway Co.
65. Northern Illinois Electric Railway Co.
66. Northern Illinois Light & Traction Co.
67. North Kankakee Electric Light & Railway Co.
68. Northwestern Elevated Railroad Co.
69. Peoples Light & Railway Co.
70. Peoples Traction Co.
71. Peoria & Pekin Terminal Ry.
72. Peoria & Prospect Heights Railway Co.
73. Quincy & Western Illinois Railway Co.
74. Quincy Horse Railway & Carrying Co. (Horse.)
75. Rockford & Freeport Electric Railway Co.
76. Rockford & Interurban Railway Co.
77. Rockford, Beloit & Janesville Railroad Co.
78. Rock River Traction Co.
79. St. Louis & Springfield Railway Co. (Part of Illinois Central Traction Co.)
80. St. Louis, Vandalia & Eastern Electric Railway Co.
81. South Chicago City Railway Co.
82. Southern Illinois Electric Railway Co.
83. South Side Elevated Railroad Co.
84. South Side Suburban Railroad Co.
85. Springfield & Northern Railway Co.
86. Springfield & Southwestern Railway Co.
87. Springfield Consolidated Railway Co.
88. Springfield, Lincoln, Bloomington, Pekin & Peoria Electric Railway Co.
89. Springfield, Moweaqua, Sullivan & Mattoon Railroad Co.
90. Springfield, Petersburg & Beardstown Interurban Railway Co.
91. Springfield Railway & Light Co.
92. Sterling, Dixon & Eastern Electric Ry.
93. Suburban Railroad Co.
94. Tri City Railway Co.
95. Waukegan, Fox Lake & Western Railway Co.
96. Western Illinois Traction Co.

ELECTRIC RAILWAY MAP OF ILLINOIS.

West Baden, Ind., for the 1905 Convention.

The American Street Railway Association has already received an invitation from the West Baden Springs Hotel, of West Baden Ind., to hold the 1905 convention at West Baden, and accordingly our readers will be interested in knowing about the accommodations which the hotel can offer as a meeting place.

The three principal things which have to be considered in choosing a meeting place for the electric railway associations are the hotel accommodations, a hall that will be suitable for exhibits, and the transportation facilities. In all these particulars it would be difficult to find a place which surpasses the West Baden Springs Hotel.

The Springs are situated in a beautiful valley in Orange County, Ind., and are readily accessible from the principal railroad centers of the country, being reached by the Monon from Chicago and Louisville; by the Baltimore & Ohio Southwestern and the Monon from Cincinnati and St. Louis, and by the C., H. & D., Big Four and Pennsylvania, in connection with the Monon, from Indianapolis.

The first mention of the Springs is made in the memoirs of Gen. George Rogers Clark concerning the Kaskaskia and Vincennes expedition in the latter part of the eighteenth century, and since 1840 they have been a celebrated health resort. While through the efforts of the present proprietor, Hon. Lee W. Sinclair, who has had control of this property since 1888, West Baden Springs have become one of the best-known spas in the country, this feature of the Springs is of minor importance in connection with the railway conventions. It should be mentioned, however, that the Springs are not only a delightful summer resort, but are kept open the entire year.

EXTERIOR OF WEST BADEN SPRINGS HOTEL.

HOTEL ACCOMMODATIONS.

The new West Baden Springs Hotel was built in 1901 and 1902, replacing a frame building which was destroyed by fire June 4, 1901. In planning the new structure, Colonel Sinclair determined to build a hotel that should be absolutely fire-proof. The structure is of brick and concrete on a foundation of solid rock, and no wood, excepting the doors and window casings, enters into the construction.

The hotel building proper covers nearly five acres, and is octagonal in shape, surrounding a circular court 200 ft. in diameter. The building is six stories high and contains 708 guest rooms, all of which have telephone connections and basins with hot and cold water. All of the rooms excepting 30 are provided with toilets, and 150 of them have bath tubs in addition. The central court, which is known as the "Grand Atrium", is covered by a dome which is 135 ft. high at the center. Some idea of the magnitude of this dome may be had when it is said that it is larger than that of the Capitol at Washington. In addition to the guest rooms, which easily provide accommodations for fourteen hundred people, there are in the building 31 suites of parlors varying in dimensions from 15 by 50 ft. to half that area; a ball room 80 x 90 ft., and six private dining rooms for the use of guests, besides the main dining room, which is 80 x 90 ft. The office rotunda is 100 ft. in diameter and has opening from it commodious reading and writing rooms.

GRAND ATRIUM, 200 FT. IN DIAMETER—THE EXHIBIT HALL.

Connected with the hotel by arcades are a number of annexes, in which are comprised one of the largest bath houses in the world, a gymnasium, an opera house, and a Casino with bowling alleys, billiard and pool tables and opportunities for indulging in games of chance not to be equaled outside of Monte Carlo. Near the Casino is a covered oval, two story, bicycle track, the inner field being available for base ball, foot ball or tennis. The bath house comprises 40 suites of rooms, a dressing room and bath room in each suite; in the lower part of this building is a swimming pool 120 by 32 ft. in area, with a depth of water ranging from 4 to 10 ft. An idea of the completeness of this hotel is given by the statement that, located on the ground floor and opening into the Grand Atrium, are the West Baden National Bank, a drug store, a furnishing goods store, a barber shop and a depot for oriental goods of the associations, and these, as well as the Atrium, are offered to the Association free of cost.

TRANSPORTATION.

West Baden is reached by the Monon Route, which has, by means of the Baltimore & Ohio Southwestern, Cincinnati, Hamilton & Dayton, Big Four, and Pennsylvania lines, direct connections with Chicago, Louisville, Cincinnati, St. Louis and Indianapolis. A spur from the Monon runs direct to the entrance of the hotel on one side, and on the other is the track of the French Lick & West Baden R. R., the electric railway connecting West Baden with French Lick, one mile distant. These railroads offer the best of facilities for reaching the exhibit hall with a minimum amount of trucking, and also afford desirable space for the display of cars, snow plows and sweepers, and other track exhibits that it may not be deemed desirable to take into the building.

BATH ROOMS AND NATATORIUM.

No comparison can be made with the exhibit halls and accommodations that have been available at former conventions, as the West Baden Springs Hotel has so many points of superiority as to be in a class by itself.

The rates vary from $3 to $5 per day, American plan. The $5 rate is for the most desirable rooms, those having bath tubs. When $5 rooms are occupied by two persons the rate is $4 each per day.

It should be mentioned that every room in the house fronts upon the exterior of the building or upon the interior court. The latter rooms are in every respect as desirable as the others, perfect ventilation making choice a matter of indifference.

Besides the West Baden Springs Hotel there are a number of other hotels in West Baden, which in the aggregate can accommodate 1,000 persons.

HALL FOR EXHIBITS.

At no former convention of the Associations has there been available a hall for exhibits that can be favorably compared, in point of available area of floor space or in architectural appearance, with the "Grand Atrium." The base of the glass dome covering this is 80 ft. above the floor, resting upon 24 columns spaced at equal intervals about the circular inner wall of the building. From face to face of the bases of these columns the diameter of the Atrium is 200 ft. The bases of these are about 6 ft. wide and project 4 ft. from the wall, so that the floor area is further increased by 20 spaces each 4 x 20 ft. Absolutely all of this floor space, excepting a circle at the center 20 ft. in diameter, which is occupied by a fountain, is entirely free from obstructions of any kind, and available for exhibits. Excluding the fountain, the floor space available is 32,938 sq. ft. The floor of the Atrium is cement concrete laid on solid rock, so that the question of sufficiently strong foundation for heavy exhibits does not enter. Two entrances into the Atrium from the exterior may be used. The only limitation imposed upon the size of exhibits shown in the Atrium is that they must pass through the entrances, which are rectangular and 17 ft. 4 in. wide by 10 ft. 5 in. high in the clear.

The West Baden Springs Hotel has offered to place the "Grand Atrium" at the disposal of the American Street Railway Association for its exhibit hall, and to furnish 125-volt electric current for operating exhibits which it is desirable to show in motion.

The ball room and the 31 parlors, mentioned before, offer every accommodation that could be desired for meeting places for all three

Waste of Power Because of Truck Equipments.

BY W. G. PRICE.

It is probable that there are many electric railway companies in this country that waste from 15 to 25 per cent of the power received at the trolley wheels by using a defective car-truck equipment. This is a very broad statement and it will doubtless surprise many to learn that there is any reason for making it. But it is probable that all electric railways are wasting a large amount of power by using defective car-truck equipment.

Most of the motor trucks in general use are in the design of the pedestals, bearings and brakes practically the same as the horse-car trucks which preceded them. In fact, most of the motor trucks today are an evolution from the horse-car truck with no improvement upon the horse-car journal box and pedestal. The steam railroad passenger equalizer bar truck and the diamond freight truck arrived at much greater perfection before most of us were born,, as their journal boxes were rigidly connected. While some designers attempted to build motor-trucks in the early days of electric traction with the journal boxes rigidly connected, they were not adopted.

When the motors are placed on the car trucks, the forces acting were reversed and instead of the truck wheels being hauled by the car, they were caused to push the car. The truck became a locomotive and the design of the truck should have been changed, so as to be similar in some respects to the frame and running gear of the locomotive. In the locomotive there is practically no lost motion in the journal bearings and pedestals; the axles, and the wheels they carry, are a fixed distance apart. That type of single and

double motor trucks in use today, which have developed from the horse-car truck, have journal boxes which do not fit closely in the pedestals, and usually have as much as from ⅛ in. to ½ in. side play, and, owing to the wear of parts, this play or lost motion is becoming greater every month. The journal boxes are castings which are not machined either inside or outside. Their width on the inside and outside varies, owing to the degree of skill of different molders, as much as ¼ in. Journal bearings are usually designed to be ⅛ in. narrower than the inside width of the rough boxes, but there is frequently as much as ⅜ in. side play between the journal bearing and the inside of the journal box, and this added to the side play between the journal box and the pedestals makes a total of from ¼ to ⅞ in. The journal bearing is usually well greased on the top and it slides sidewise in one direction when the brakes are applied and slides back to the other side of the box when the motor pushes it in the other direction and the journal boxes move back and forth between the pedestals from the same cause. The application of the brakes, if inside brake-shoes are used, forces the wheels away from each other to the furthest limit of movement of the journal bearings in the boxes, and of journal boxes in the pedestals and when the car comes to a stop the wheels are apt to be found in this spread apart position. The car is then in the car house, when the wheels are thus spread apart, that the brakeman adjusts the shoes, and if he listens to the motorman he will adjust them to come at least within 1-16 in. of the wheels.

When the car goes out on the road one motor in each truck is pushing the rear pair of wheels towards the front pair, and we have seen that there is usually a chance for as much as ¼ in. to ⅞ in. movement in that direction. But the shoes have been set to within 1-16 in. of the wheels when the wheels were spread apart by a previous application of the brakes, so that the total play of the shoes is 1-16 in. plus 1-16 in., or ⅛ in. When the wheels have moved this ⅛ in. they are then in contact with the shoes and cannot go any further and we then know that the car is being propelled by the motors pushing the wheels against the brake shoes, which is about the most efficient arrangement for wasting power in propelling the car one can imagine. There is also a loss in the wear of shoes and wheels and a large motor loss owing to motors becoming overheated, so as to ruin the insulation, causing short circuits and making necessary the frequent rewinding of armatures and field coils. Motors which were designed to have ample power to propel heavy cars up long grades have for this reason had to be replaced by heavier motors.

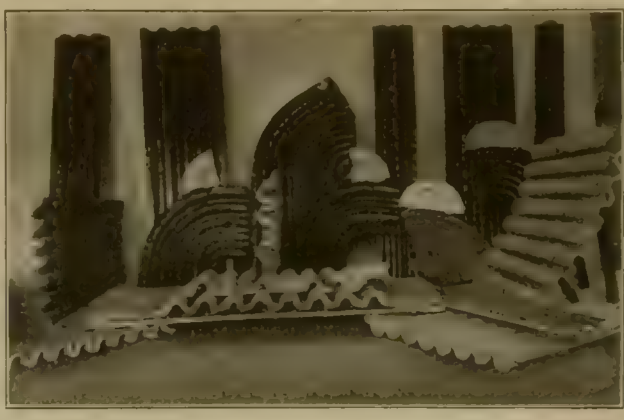
Many of the trucks used under single truck cars, which were constructed a few years ago, are particularly good examples of trucks designed to waste power. It was thought, when these trucks were designed, that the truck would go around a curve easier if the journal box had a large amount of play in the pedestals, and for this reason the side play between the box and the pedestals was made as much as ¾ in. in some instances. The only possible advantage the writer can see in this form of construction would be to allow for the truck frame being constructed out of square, or for the axles being out of parallel, or the wheels out of line, from the journal boxes being thicker on one side than on the other, which is almost invariably the case when the boxes are not machined inside. It has been the practice to assemble truck frames directly upon the wheels and axles and to square them by bringing the wheels in line to a straight edge, but, owing to the variation in chilled iron wheels, trucks assembled in this way are seldom perfectly square. Truck frames should be assembled separately and made perfectly square before placing on the axles.

To eliminate this loss of power with the single and double trucks now in use, which have the journal boxes loose in the pedestals and which are not rigidly connected by equalizer bars, is very difficult. When constructing new trucks of these types the journal boxes could be machined inside and outside to exact widths and the pedestal jaws and journal bearings could also be machined to one exact width, so as to reduce the lost motion to small amounts. The lost motion could be reduced in this way to 1-32 in. between the journal bearing and the box and to probably 1-16 in. between the box and pedestals. If we were then to adjust the brake shoes to within 1-16 in. of the wheel, we would have 1-64 in. clearance between the wheels and the shoes when the car was climbing a grade, which is too close an adjustment. The shoes with this construction would have to be adjusted not nearer than ⅛ in. from the wheel. Owing to the rapid wear which takes place in such trucks on the journal boxes and pedestals, due to the friction between these parts when they are forced together by the application of the brakes, this condition becomes rapidly worse and the shoes must be adjusted farther and farther away from the wheels.

The only remedy which the writer can think of, is the adoption of the M. C. B. type of equalizer bar truck. Where single car trucks are used, the journal boxes should be rigidly connected by a bar, and, if this were done, the saving of power in each truck would probably be equal to the cost of a new truck every year or two. By connecting the journal boxes rigidly by a bar, the application of the brake shoes cannot force the boxes against the pedestals, and so most of the wear of the boxes and pedestals is avoided. The journal boxes can be machine-finished inside to one exact width and the journal bearings can be machine-finished to an exact width not over 1-32 in. less than the boxes. As there is no sliding of these surfaces of contact on the side of the journal bearing against the box, only pressure, they do not wear. We can then adjust our shoes to 1-16 in. from the wheels and have a clearance of 3-64 in. when the truck is climbing a grade, and this condition will be permanent, as there is no wear of parts to make it grow worse.

Fireproof Protection for Cars.

The new underwriters' rules for car wiring and equipment of cars formulated by a joint committee from the American Street Railway Association and the Underwriters' National Electric Association require that in order to meet the approval of the fire underwriters and receive the benefit of lowest insurance rates, the underside of car bodies must be protected by approved fire resisting insulating material not less than ⅛ in. in thickness. Foreseeing that the rapid developments in heavy electric railway service would soon make necessary a more thorough fireproof type of car construction, the H. W. Johns-Manville Co., of New York, about a year ago brought out a new composition of fireproofiing material which is known as Transite. Transite is an asbestos lumber, designed to be used as a sheathing board under the car body for the purpose of protecting



FORMS OF ELECTROBESTOS.

the car body from any flame or fire that might possibly be caused under the car through electrical or any other means. Transite is furnished in thicknesses ranging from ⅛ to ½ in., and is furnished in sheets 40 x 40 in. standard sizes, and in special sizes 40 in. wide up to 5 ft. long. Transite is unique in that it can be worked like lumber, that is, it can be sawed, chiseled or nailed and can be painted or decorated as may be required.

The H. W. Johns-Manville Co. has also brought out a material, known as "Electrobestos," which is made in the form of conduits to receive all forms of electrical wires and cables used in the wiring of cars, including the motor leeds and connections, air brake compressor connections and for interior and headlight wiring. This material is similar to Transite in that it can be worked with ordinary tools just the same as lumber. Both these materials possess considerable tensile strength, and combine a high degree of electrical insulating quality as well as fire resisting properties.

Electrobestos is furnished in straight section, "T's" and elbows to suit the wiring conditions of all types of cars.

The H. W. Johns-Manville Co. has furnished these fireproofing

materials for cars used on the Manhattan Elevated, the Rapid Transit Subway, the Brooklyn Rapid Transit, the Schenectady Railway and numerous interurban electric railway systems throughout the country. The materials conform in every way to the requirements of the national board of fire underwriters, and furnishes an absolute and reasonably inexpensive means of affording full protection to electric railway cars against injury or destruction by any fire that may start beneath the car flooring or at any point along the wiring circuits.

As will be seen from the illustration, Electrobestos is not made up of separate conduits necessarily, but consists of a number of corrugations, thus enclosing each wire or cable in a separate channel. The parts forming the two sides of these channels are united by an insulating compound known as Electrobestos sealing cement. Great care is now being exercised in the electrical insulation of car circuits and even electric lighting rosettes are being constructed of Electrobestos.

Novel Type of Car for Montreal.

The Montreal Street Railway Co. has lately placed on its lines a novel type of car, designed and built by the J. G. Brill Co. The car is a combination of the patented convertible and semi-convertible system of the builders. As will be seen in the illustration, the entrances are all on one side, because the Montreal system is provided with loops at the terminals, so that the cars run in but one direction. The chief advantage of this arrangement is the prevention of passengers entering or leaving at the wrong side of the car, doing away with the necessity of a running board on that side, and increasing the transverse seating space. Having one side solidly paneled also keeps passengers from entering or leaving the car on the wrong side. By staggering the posts, the seats on the semi-convertible side abut against the side lining between the posts, thereby adding about 3½ inches to the transverse seating space. By operating this type of car, the expense of keeping a set of summer cars, which in many cities can only be used a few months of the year, is avoided, and at the same time provision is made for the comfort of passengers because of the ability to change the car in a few minutes from closed to open or vice versa. Rapid changes of temperature during spring and fall and cool rainy weather in summer are therefore met.

BRILL CAR FOR MONTREAL—OPEN SIDE.

The window system of both sides of the car is identical. The lower sashes have trunnions at the corners, which move in all-metal runways, one to each post, and on being raised this sash carries the upper sash with it into pockets in the side roofs. On the right side of the car, in addition to the sashes sliding into the roof pockets, flexible metal panels are arranged to slide into the same pockets, so that in a few minutes this side of the car may be made entirely open. A running board of the usual type is furnished, which with the platform steps gives entrance at any point along the side.

The window sills for the semi-convertible side are provided with arm rests of the builders' type as the top of the sills are 24⅝ in. from the floor—too low to be reached by the elbows of adult passengers. The seats are 34 in. long, and the aisle 20½ in. wide, the width of car over posts being 7 ft. 10 in. Single seats are used at the corners of the convertible side and longitudinal double seats at the opposite side. The total seating capacity of the car is 38. Instead of using grab-handles on the posts of the convertible side, the brackets which close the space between the seat back and the posts are formed to serve that purpose.

BRILL CAR FOR MONTREAL—INTERIOR.

The sides of the vestibule opposite the entrance are furnished with extra large windows, both sashes of which drop into pockets in the wainscoting. The three sashes in the end of the vestibule are composed of single lights, and also have pockets into which they may be dropped. Curtains at the convertible side may be drawn completely to the floor, so that in case of a light shower which promises to be of short duration, ample protection is furnished without drawing down the panels and sashes. The interior is handsomely finished in cherry with ceilings of decorated birch. "Dumpit" sand boxes, angle-iron bumpers, "Dedenda" gongs, radial draw bars, ratchet brake handles, round corner seat end panels and other of the builder's specialties are included in the furnishing of the car, which is mounted on Brill No. 27-G trucks.

The construction of the car is very substantial, including double corner posts at each side, 3¾ in. thick. The side posts of the convertible side are 3⅛ in. thick, and on the semi-convertible side 3¾ in. The sweep of the posts is 1¾ in. Sill plates 8 x ⅝ in. are used on the outside of the side sills. The size of the side sills is 4¾ x 7 in., and of the end sills, 5¼ x 7 in. The length over the end panels is 28 ft. 4 in. and over the vestibules, 38 ft. 4 in. The width over the sills and the panels is 7 ft. 7½ in., and over the posts at belt, 7 ft. 10 in.

BRILL CAR FOR MONTREAL—CLOSED SIDE.

The J. G. Brill Company is building a car for Cleveland similar to the one described, but with a center vestibule. It is believed that the type formed by the combination of these systems will be accepted as one most suitable for cities where the cars may be run in one direction.

New Type of Elevated Car.

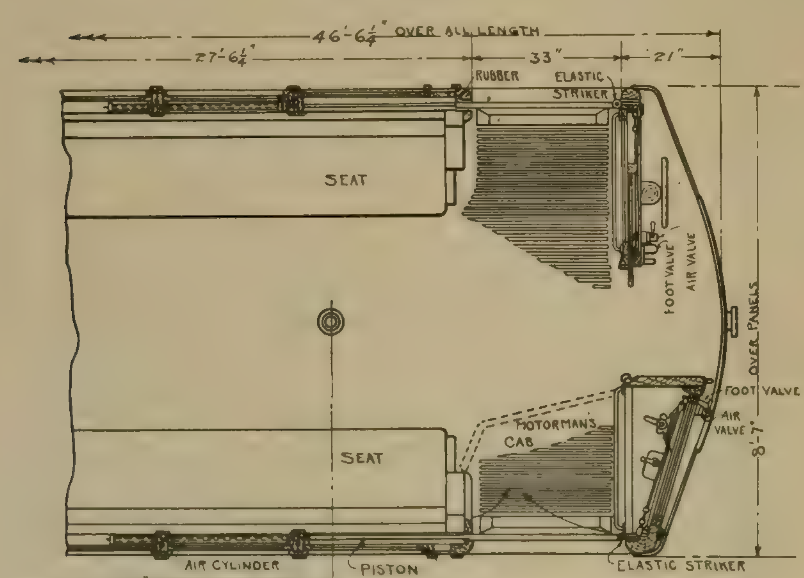
The Boston Elevated Railway Co. is about receiving 24 additional elevated cars which have been designed with certain changes intended to overcome some of the difficulties which are experienced with the present type of car. The present cars, except as to a door midway of the side, are of the so-called Manhattan type, with open end platforms enclosed by gates of the "swing back" type, controlled by levers operated by the brakeman standing on the ends of both platforms.

During the hours of heaviest traffic the opening and closing of these gates is accomplished only after much pushing and discomfort on the part of passengers and delay to the train at the station. Such delays seriously impair the capacity of the road, as they reduce the number of trains which it is possible to operate in a given period. Still further, the end doors of the cars constitute a restricted point which impedes the easy ingress and egress of passengers.

The new cars have therefore been constructed without any platforms, the space occupied by the end platform being taken into the car and the access provided by sliding doors instead of gates. In order to remove all risks of passing from one car to another an end door has been provided solely for the use of the brakeman.

The method of operating the new end side door consists of an air cylinder, the piston of which is attached to the door, and a spring latch that holds the door in place. To open the door the brakeman steps on the foot lever which unlocks the spring latch. Then by operating the air valve he releases the air from the back of the cylinder and admits it at the front, forcing the door open. The valve is held in this position for a moment, where it is placed in mid position which lets the air exhaust from the cylinder into the atmosphere.

In closing the door the shock is taken up by a rubber cushion at the back of the door. A weatherproof fit is made between the door and the frame by means of an elastic striker composed of a pneumatic cushion 1 11-16 in. in diameter which is interposed between the door and the post. The striker being flexible prevents injury to passengers from getting their hands or limbs caught in the door when it is being closed, and also permits the easy removal of any clothing that should happen to be caught in this manner.



PLAN OF VESTIBULE.

An increase in speed in handling the passengers will be accomplished by removing the present end door, thereby making enough space for two rows of passengers to enter the body of the car without any danger of crushing.

A number of other advantages are gained by the doing away with

BOSTON ELEVATED RAILWAY CAR WITHOUT PLATFORM.

the present platform, among them being an increase in the interior carrying capacity of the car, greater comfort for the motorman by being less exposed to the weather, and the brakeman can make his station announcements without leaving his place instead of being obliged to cross both platforms.

Conductivity of Third Rails.

The World's Fair Street Railway Commission, which is making exhaustive electrical tests at the Bullock Electric Mfg. Co's. exhibit at Section No. 15, Palace of Electricity, under the direction of Profs. Norris of Cornell, Swenson of Wisconsin, and Plum of Perdue, obtained some interesting results last week while testing the temperature co-efficients of steel rails.

These tests are made by taking the resistance of the rail at a normal temperature, then passing a large enough current through the rail to raise its temperature through a range of 30° C. and at various stages of heat making other tests. The results so far have been rather surprising. There seems to be but little difference in the resistances at the various temperatures. It has been suggested that this may be due to the presence at the same time of iron and carbon in the steel, the one losing in conductivity while the other gains with the rise of temperature. So far the drop in voltage has been found to be much smaller with direct than with alternating current and that it varies much with the variations of current density and saturation. The relationship has not been established. Tests for this purpose will now be made with constant wave forms, those heretofore used having varied some in this respect.

Handsome Car for Advertising Purposes.

The St. Louis Car Co. has built a handsome private car, called the "Mabel", for the Lewis Publishing Co. Its principal dimensions are as follows: Length over all, 45 ft.; length over vestibule, 43 ft. 8 in.; width over sills, 8 ft. 3 in.; width over sheathing, 8 ft. 4 in.;

PRIVATE CAR "MABEL".

height from under sill to top of roof, 9 ft. 3 in.; height from rail to top of roof, 12 ft. 4 in. The car is divided into two compartments, a parlor and a buffet and smoker. The compartments are separated by a vestibule, which is also the entrance, in the center of the car. The parlor compartment is very handsome; in the center is a carved settee tastefully upholstered in light yellow fabrics, to match the ceiling, curtains, portieres and carpet, and a handsome desk is placed near the vestibule entrance.

The buffet compartment contains a sink, a combination table and

INTERIOR, PRIVATE CAR "MABEL".

refrigerator, and a china, glass and linen locker. The toilet room has a washstand and locker. Entrance to the toilet room is from the center vestibule only. The ceiling in the buffet is pea green, with the portieres and carpet to match. The chairs are cane. In the center of each compartment is an arc light, and there is also an arc light in the vestibule. In both compartments, along each side of the deck sill, is a string of electric bulbs.

The interior finish of the car is of the finest African mahogany, inlaid with marquetry. The roof is of Empire type, with opalescent glass ventilator lights of colonial pattern. The upper sash are also of colonial pattern, bevel plate, with a center piece designed in art glass. They are stationary. The lower sash have plate glass and drop into pockets covered by flaps. Both compartments are the same size—10 ft. 8½ in. long by 7 ft. 7 in. wide. The vestibule is 2 ft. 8 in.

The car is mounted on St. Louis Car Co. short wheel base trucks No. 47, and is equipped with air and emergency hand brakes. The arc lights are also of the St. Louis Car Co. make.

In response to an inquiry as to the reason for investing in the private car "Mabel", the Lewis Publishing Co. writes us as follows:

"This year we are entertaining the advertisers of the world and the advertising agents of the world. Over a thousand of them are coming to St. Louis as our guests, and as our plant, which is the finest publishing plant in the world, is outside of the city limits, it would be necessary to divide them up into small parties and drag them out there in hacks. As it is, with this private car, one end of which is a beautiful ladies' parlor, and the other end a gentlemen's smoking room, we can get on board 30 or 40 people and divide our party up in the right way so that everybody is congenial and can get at them heart to heart under the most favorable conditions while en route to the plant and through the country on a beautiful trolley ride.

"The impression obtained by this beautiful car traveling over the streets of St. Louis is one of the best advertisements that we could possibly have, and we are in the advertising business and have space for sale. Anything that tends to turn the lime light on us adds to the value of this space. This car has probably created more talk and is more indelibly impressed in the minds of thousands of people than twenty times the amount of money spent in any other kind of advertising, under the present conditions, could secure. People are in St. Louis from all over the world, and the effect of this car running on the streets and of the search-light thrown upon the city from the top of our building at night enables us to divide the honors with the World's Fair itself."

Coal Testing and Timber Preserving Plants at the World's Fair.

Two interesting exhibits have recently been completed at the World's Fair in St. Louis. These are the coal testing plant of the United States Geological Survey and the timber preserving plant of the Bureau of Forestry.

The work of the coal testing plant will be the determination of the respective fuel values of every grade of coal which may be submitted. A 250 h. p. horizontal Allis-Chalmers engine in this plant supplies power for the various mechanical operations to which the coal will be subjected and will also serve to measure the values of the various coals. The samples of coal will be analyzed, burnt under boilers under various conditions, coked and used for gas producing. Their value for gas production will be tested by a gas engine.

The timber preserving plant is under the direction of Dr. H. Van Schrenk and its work will be to test all the methods offered for preserving railroad ties. For this purpose the Allis-Chalmers Co. has lent a tie-treating retort and two tanks for the preservative solution. The tie preserving system consists in placing the ties in the retort where all of the water and sap were dried out by heat, after which the greater part of the air in the retort is exhausted. Then while the pores of the wood are all open and practically free from vapor or air the preservative mixture is led into the retort from the tanks and under the influence of the vacuum is carried into the pores of the timber. Each batch of ties thus treated is to be put into regular service in some railroad track and a record kept of each tie until it is worn out.

There has been organized recently the Evansville, Princeton & Indianapolis Traction Co., which expects to build from Princeton, Ind., to New Harmony, and from Princeton to Martinsville. Those interested in the Evansville, Princeton & Indianapolis company are practically the same as those controlling the Evansville & Princeton Traction Co. The headquarters of the two companies will be at Princeton. Mr. W. P. Larcey is general manager.

Weston Employes' Club.

"Social Economics of the Weston Electrical Instrument Co." is the title of a very interesting pamhplet prepared for the Louisiana Purchase Exposition at the request of the Bureau of Statistics of Labor and Industries of the State of New Jersey. Convinced of the fact that the great struggle between capital and labor is approaching a crisis and that more harmonious relations and community of interest must be established to avert the same, the Weston Electrical Instrument Co. is working towards a peaceful and satisfactory solution of the problem. With this end in view, the company reserved the most desirable portion of the premises and several commodious halls of its present plant for the Weston Employes' Club of Newark, N. J., and on May 22, 1903, the entire club outfit, consisting of recreation room, library, dining room, kitchen, gymnasium, etc., was transferred to the employes.

The plant is very pleasantly located in the southwestern part of the city. The buildings are of plain, unornamented brick, spacious, airy and neat. The lavatories and toilets are well lighted and ventilated and the plumbing of the best quality. In the main factory nothing has been left undone to perfect sanitation, ventilation and arrangement of safety appliances, making the surroundings both healthful and cheerful. The club rooms comprise a dining hall for the employes, one for the heads of the departments, and another for the directors of the company, library, cosy corner, kitchen, recreation hall, natatorium, bicycle depot and hospital. Lunch is either table d'hote or a la carte and the prices are exceedingly low, the service comparing favorably with that of first-class hotels and restaurants. The library is just east of the main retaurant, and the company has provided many standard reference works, together with periodicals of a scientific nature. In addition to this, the library has been made a branch of the Newark Public Library and books are distributed therefrom under the same conditions as at the public library. The recreation hall is 182 x 26 ft. and is furnished with piano, pool and billiard tables and various games.

The club is conducted along the same lines as all well-ordered social clubs, and has been successful both socially and financially. The company exercises no control over the club, but after creating the club plant and fully equipping it, it turned the same over to the employes, on whom the responsibility of organization and administration has rested and to whom is due the credit of the success and welfare that the organization is now enjoying.

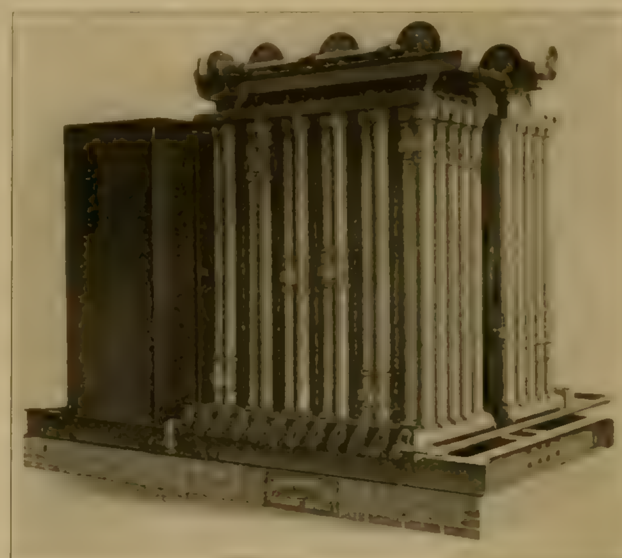
Sturtevant Standard and Pony Economizers.

Herewith are illustrated two economizers, manufactured by the B. F. Sturtevant Co., Hyde Park, Mass. These devices have an

STURTEVANT ECONOMIZER.

establshed reputation for efficiency in every respect. The company makes two sizes of economizer, similar in design, to meet all conditions—the standard and the pony types. The Sturtevant standard economizer is installed in conjunction with boilers of almost any capacity, but is more practical for boiler capacities of 350 h. p. and over. The pony economizer was designed to give the smaller power plants the same proportional saving effected with the larger type. It is substantially the same as the standard, excepting that the whole apparatus is built on a smaller scale. The pony type is more commonly used with plants of from 50 to 500 h. p. capacity.

The Sturtevant economizers are flue feed-water heaters, although they are often not used for that purpose, but for supplying hot water for other uses. The advantages claimed for these economizers are, briefly: A large quantity of hot water is always available; a saving of from 10 to 20 per cent is effected in the fuel; boiler capac-



STURTEVANT PONY ECONOMIZER.

ity increased from 20 to 40 per cent; life of the boilers is prolonged by the prevention of unequal expansion and contraction; the feed water is purified, thus permitting boilers to steam to better advantage; utilization of otherwise wasted heat; efficiency of boilers increased; expense of repairs on boilers reduced; large amounts of soot are deposited in the economizer chamber that otherwise would be thrown out into the air.

To agitate the gases and allow them to come into contact with the maximum area of the economizer pipes, thus utilizing a maximum amount of waste heat from the boiler, a patented system of staggered pipes was adopted. The several sections are so arranged that the pipes of any one section stand longitudinally opposite the spaces between the pipes of adjoining sections. At the same time the economizer is constructed with as few joints as is consistent with good design. In order to make the deteriorating effect resulting from the many joints as little as possible, each section is fitted into its wall box or branch pipe with tapered iron to iron joints, no packing being used. All caps are also fitted with taper iron to iron joints. In this design the number of joints is lessened materially by the elimination of the branch pipes on top of the economizers.

All pipes are cast on end and made of the best tough gray iron. Both ends are tapered and the pipes forced into the headers by hydraulic pressure, insuring perfectly tight joints. Any pipe can be easily removed and another put in its place without disturbing the other pipes, sections or enclosing walls. All caps can be easily removed at any time for cleaning. The caps directly over the pipes in the top headers are tapered, so that the greater the pressure in the economizer the more firmly the caps will set themselves. All the other caps are held in place by through bolts, but the bolts do not come into contact with the water.

The headers are made of the best cast iron and designed with due regard to strength and durability. The bearing parts are properly machined and finished to gages, in order that the taper joints may be perfectly tight and the headers exact duplicates. Instead of the manifold header with its branch pipes and numerous pipe joints a wall box is placed in the front side wall of the economizer, forming a part of the wall. The economizers are all provided with re-

lief valves which may be set at the desired steam pressure and with blow-off valves.

The ease and simplicity of removing a damaged pipe and replacing it by a new one is a marked advantage of the Sturtevant economizer. The whole operation requires only an hour's time. All joints being taper metal to metal, excepting one gasket joint, repairing may be readily accomplished without the use of packing, cement or rusting. The top and bottom headers can be readily removed and duplicates replaced without disturbing the other headers, sections or side walls. There are no branch pipes to take off or replace if a cap, pipe or section is to be repaired. All water surfaces are readily accessible; the caps are the only parts to be removed when cleaning water surfaces of the economizer.

The cleaning mechanism of the Sturtevant economizer consists of a patent interchangeable bevel edge triple staggered scraper with lifter rods and guides operated by an improved pulley motion and positive reversing wheel. The cast iron scraper bars with tapered slots which receive the tapered lugs on the scrapers cause the scrapers to scrape pipes on the upward movement and clear them on the downward movement. The scrapers, scraper bars and guards are easily removed and replaced if necessary.

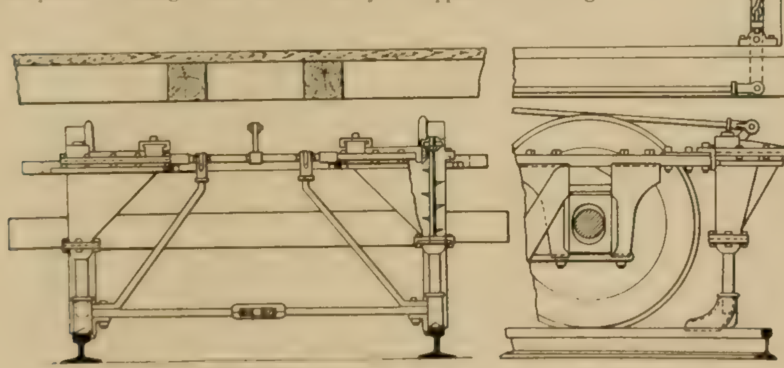
Cast iron soot-pit doors are provided as a means of cleaning out the soot chamber. Before leaving the works each economizer is tested by hydraulic pressure to 350 lb. per sq. in., and when erected to 250 lb. pressure.

A New Track Sander.

We illustrate herewith a new track sander for electric cars which has been invented by Mr. Henry Fresh and patented by the Emergency Car Brake Co., of Cumberland, Md. This sander consists of a waterproof hopper built on the truck, an agitator to loosen the sand, a double-port valve to ensure the flow of sand, and a shoe to deposit the sand on the rail without loss.

The hopper is a steel casting, in one piece, the top or dome and the bottom bowl being fitted with a lap-flange union, machined and provided with rubber gaskets, bolted firmly together. The opening in the dome, for filling, is fitted with a cap in the same manner, locking itself over the rim on the collar by giving the cap one-half turn with a wrench and drawing the cap tight, making the hopper water-tight. The hopper is porcelain lined throughout, giving for the interior a dry and smooth surface and preventing damp sand and corrosion.

The valves are provided with two ports, and in case one of the ports should become choked the other will pass sufficient sand. The lower disk is placed in the lower pot of the hopper, and the other is rigidly attached to the agitator bar connecting with the operating bar. The disks operate one over the other. When the sand is needed the ports are brought over each other by the upper disk making one-half revolution, and when closed it is turned back, making a tight valve, preventing the loss of sand and also preventing water from entering at the bottom. The upper disk has a porcelain surface on top.



FRESH TRACK SANDER

The agitator is provided with six teeth or cutters, which loosen the sand that may become compact from the vibration of the truck. The gear wheels are located in the dome, where they are kept free from sand, as well as mud or snow. The shaft of the gear wheel is connected to the operating bar by a sleeve coupling.

The shoe for distributing sand on the rail embodies an economical feature to which attention is called. It makes a positive sander, putting the sand where it is needed at all times, whether on a curve or straight track. The shoe is a steel casting and the sand is conveyed from the hopper to the shoe through a two-inch hose. The shoe has a 6-in. base on the rail, with an opening in the bottom, two inches wide from front to tip, forming a channel to distribute sand so it will not roll off the sides of the rail. The shoe is provided with an inside flange to guide through curves, and projections to attach to the adjusting and hanger bars, the latter connecting the shoes to the operating bar with lugs and jaws, the shoes being raised and lowered as the sander is applied or the sander closed.

This sander is operated by one lever at one movement. The operating bar is connected to the lever by drawbars running back to the king bolt and then to the operating bar, being connected near the center to allow the truck to swing on curves. The lever is of a double type; by taking hold of the front part, pulling back pulls the catch out of the base. The lever operates freely without catching, and when put back holds itself securely.

The hopper can be attached to the different styles of trucks by slightly altering the attachments. Each hopper has a capacity of more than 1,200 cubic inches, and by reason of the economical distribution this is equivalent to double the amount of ordinary sanders. The opening for filling is on the inside of the hopper near the center of the truck, 16 in. from the wheels, which serves to protect it from mud, snow and water from the wheels. All the valves and operating parts are enclosed to insure the operation of the sander in the worst weather, and every part and bushing is made tight with gaskets or bushings.

Supplymen's Association.

At the meeting of the Manufacturers' Committee of the American Street Railway Association, held in New York, July 21st, a number of committees were appointed to look after the details of the St. Louis convention. These are as follows:

Reception—George J. Kobusch, St. Louis, chairman, with power to appoint the other members of his committee, number not limited.

Printing—Fred. S. Kenfield and James H. McGraw.

Badges—W. B. Albright, E. H. Baker and D. M. Brady.

Permanent Organization—John A. Brill, J. R. Lovejoy and R. W. Meade.

Besides these a committee consisting of W. J. Cooke, George J. Kobusch and Arthur Hartwell was appointed to confer with the executive committee of the American Street Railway Association as to the extent to which the annual banquet be placed under the jurisdiction of the Manufacturers' Association.

The dues for membership for the current year were placed at $30. There are no exhibits and this fee does not include the use of any space for exhibit purposes. The sum of $500 was appropriated for use of the badge committee.

Richard W. Meade was chosen secretary of the Manufacturers' Committee. The secretary's office is at 621 Broadway, New York.

New Orleans Notes.

The New Orleans Railways Co. is making preparations for the erection of a $1,250,000 railway, light and power plant, which was projected by the corporation some months ago and described in detail in the "Review" for Dec. 20, 1903. Work on this project has been commenced. The completed plant will consist of two generating divisions, one for railway purposes only, and the other for commercial electric lighting and for the running of sub-stations. Both engine divisions will be run by one boiler plant comprising sixteen batteries of two boilers each. The building for the railway division was completed last autumn and now has three new engines in operation. Half of the new boiler plant will be erected behind the new engine division; the old power house will then be torn down and the remaining boilers and the new engine division erected. Although it has not been definitely decided, in all probability steam turbines will be erected in the new division. The three units in

the completed division are direct connected to 36 and 80 x [illegible] in. vertical cross compound [illegible] engines. The projected new generating division will be capable of developing 20,000 kw capacity for lighting and commercial purposes.

In pursuance with the law enacted by the last session of the Louisiana General Assembly, the New Orleans Railways Co. is fitting its cars with vestibules, the work involving, according to the published statement of the president, an expenditure of about $100 per car for about 700 cars. The company has built a number of cars with vestibules having windows which can be lowered into the frame. There is now being agitated a movement for the installation of the "bicycle seat" for motormen. This, however, is only obligatory in one city, while the vestibule law applies to all cars in the state.

The prospect of the Gulf Coast Electric Railway Co. line connecting the larger cities of the Gulf on the Mississippi and Louisiana shore is growing more tangible, and the Coast Electric Railway Co. has been organized with capital stock of $100,000. W. R. Penny was elected president; O. S. Williams, superintendent of construction and secretary; Col. W. W. Hungerford, manager and chief engineer. The directors, besides those named, are A. D. Hormanson and Capt. S. P. Moorman.

A charter has been granted to the Greenville & Leland Electric Railroad Co. This company was organized at Greenville, Miss., to build an electric line from Greenville to Leland, a distance of about fifteen miles, with a number of small towns on the route.

The New Orleans Railways Co. is considering the sale of a number of its old cars and the purchase of new and larger cars to replace them. The old cars are chiefly single truck vehicles, while the new equipment is to be of large size, double truck cars, some of which will be fitted with two trolley poles. The new cars will not be purchased until arrangements are made for the disposition of the old cars, which are still in good condition.

Jail Sentence for Dishonest Conductor.

George B. Ray, alias Ford M. Kinney, alias Philips, alias John Purdy, was arrested June 22nd last at Fort Lee, N. J., charged by the New Jersey & Hudson River Railway & Ferry Co. with embezzlement. He was tried July 20th and 21st and was found guilty, as charged, and was sentenced July 25th to four months' imprisonment in the Hackensack, N. J., jail. This was the prisoner's first conviction. He was arrested four years ago, charged with grand larceny in Pine Island, N. Y., but was not prosecuted. Ray, or Purdy, as he was known at Hackensack, collected more fares than he turned in. His arrest and subsequent conviction were brought about through the Drummond's Detective Agency, of New York City, which is doing a great deal of satisfactory work in this connection.

Chicago Franchises.

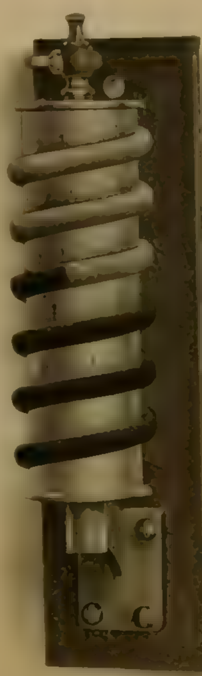
The local transportation committee of the Chicago City Council has completed the draft of a proposed franchise for the Chicago City Railway Co. The report enumerates fifteen advantages which will be secured to the city. Inasmuch as this ordinance will not be presented to the council until after the summer vacation and as the ordinance, if passed, would have to be accepted by the railway company, it is scarcely worth while to enter into an extended discussion of its provisions at this time. The principal features, however, are: The surrender of the 99-year claim of the company in consideration of an extension for all lines of 13 years, at the end of which time the city shall have an option to purchase without paying for any of its claims under former grants. Second, 5 per cent of the gross receipts is to go to the city during the period of reconstruction of the lines and 10 per cent of the gross receipts for the remainder of the term. Third, provision for universal transfer with other companies operating in the city, and joint use of tracks.

This ordinance if passed, and accepted by the company, would deliver the latter, bound and gagged, into the hands of the city, and having in mind the attitude the city has heretofore held towards the street railways, and elevated roads as well, one can form a fair idea of the treatment that would be accorded in the future.

The Montreal Street Railway Co. has erected a number of pretentious waiting rooms in different parts of Montreal.

A New Draft Gage.

The importance of being able to tell at a glance the chimney draft is fully recognized by the operating engineer. The necessity of knowing the pressures maintained, where quantities of air are moved, is becoming more apparent to ventilating engineers. In testing gas engines for their thermal efficiency, the pressure of the gas as well as the barometer readings must be accurately recorded if correct results are desired.



SARGENT DRAFT GAGE.

For such purposes, an ordinary U shaped glass tube has been used and the difference of the level of the liquid in the two legs taken as the pressure. Aside from the fact that one can seldom read closer than ¼ in. on account of the menisci varying with the direction of movement of the liquid and that one must take two readings and add or subtract to get the correct result, and that the tube is fragile and often gets broken, the device gives good results.

In order to read closer than ¼ in. a glass tube has been used in an inclined position, giving 10 in. travel for 1 in. rise. This makes the readings finer, but limits the range for practical purposes, as a tube showing a difference of pressure of 6 in. would be 5 ft. long.

The necessity of accurate determinations and the desirability of a strong, portable, direct-reading, ornamented, unbreakable draft gage or manometer, which can be mounted on a gage board and which can be read to one hundredth of an inch and of a capacity of 6 in. pressure or vacuum, led to the invention of the instrument herewith illustrated. It consists of a nickel plated brass cylinder, closed at both ends, encircled with a spiral groove in which is wound a transparent flexible celluloid tube, the bottom end of which is cemented in and communicates with the interior of the brass chamber.

An extension of its lower head passes through the bracket, which supports the gage, yet allows it to be revolved at will, around its vertical axis. The whole device is mounted on a finished board or can be attached to a gage board if desired.

A small hose cock, to which a rubber tube can be attached, admits pressure through the top head of cylinder. Distilled water, usually colored, is put in the cylinder through this cock until the zero mark is reached on the scale.

Pressure will cause the level of the liquid to ascend in the tube and for every inch of vertical rise it will travel around the cylinder, a distance of about 9 in., which is divided into 100 equal parts. The angle of the tube is such that the plane of the miniscus is radial, making close reading possible. The cylinder can be rotated so that the level of the liquid comes on the front side.

Rarefaction causes the liquid to descend, and by adjusting the cock any degree of steadiness of the level in the tube may be obtained. The upper end of the tube is closed with a screwed brass plug and the inlet cock is shut when the gage is carried about, maintaining the liquid in place without danger of spilling. As the tube is tough and elastic, it is not liable to be broken. The whole device is 3 in. diameter by about 12 in. long and weighs about 3 lb.

This instrument was invented by Mr. C. E. Sargent, of Chicago, and is made by Schaeffer & Budenberg.

The first parlor car service to be inaugurated on an electric railway will be operated between Columbus and Zanesville, Ohio.

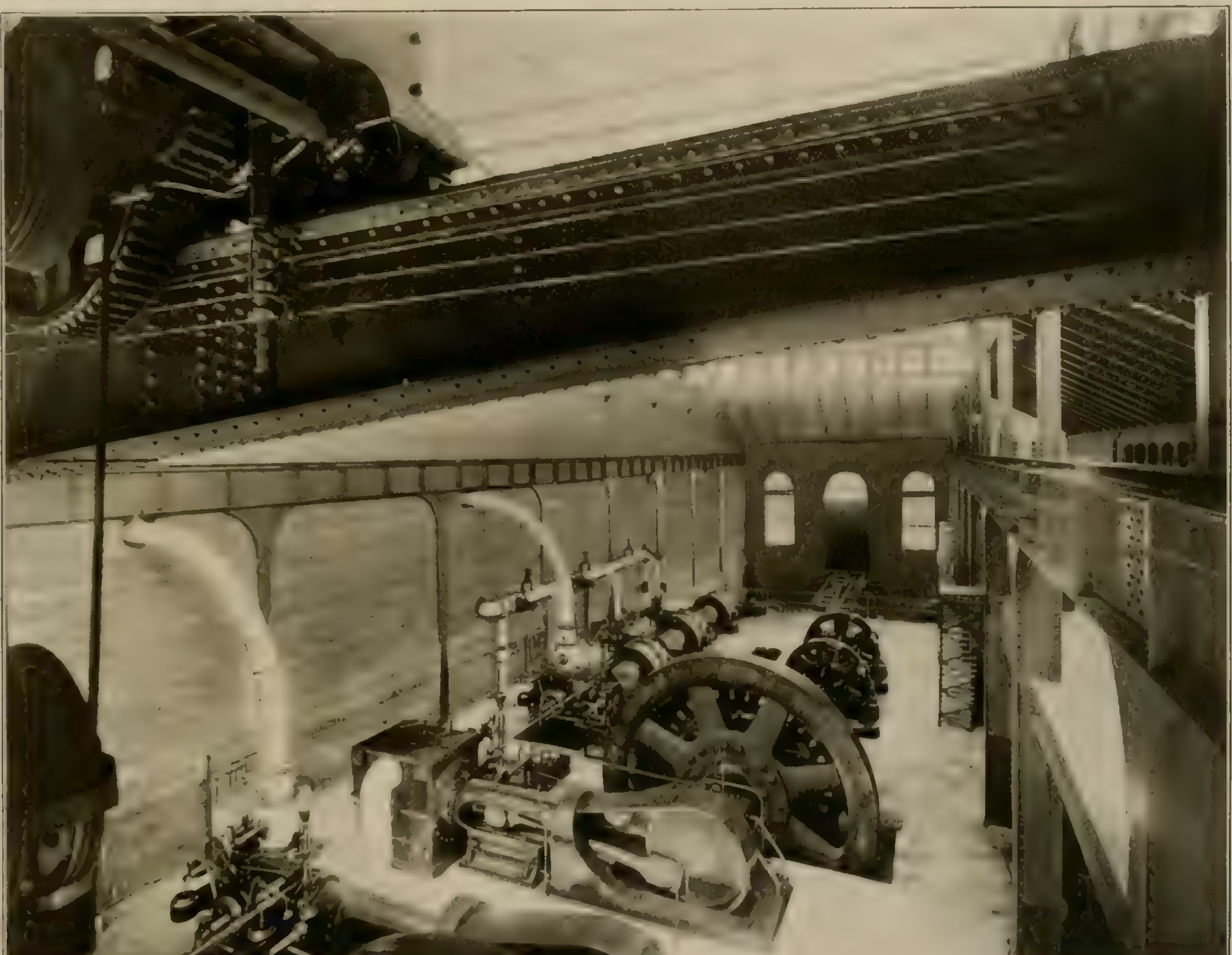
STREET RAILWAY REVIEW

Vol. XIV — SEPTEMBER 20, 1904 — No. 9

Third-Rail System of the Scioto Valley Traction Co., Columbus, Ohio.

The Scioto Valley Traction Co., of Columbus, Ohio, has the distinction of being the first company in that state to introduce the third-rail system of current distribution, a fact that is rather surprising when it is considered that Ohio was for several years the scene of greatest activity in electric interurban railway building. There are in connection with the construction, equipment and operation of this line a number of very interesting features, aside from those which mark it as an example of good electric railway construction. The two divisions now connecting Columbus with Circleville and Lancaster constitute one of the comparatively few high speed electric roads.

The company was incorporated Sept. 8, 1899, with a capital of $100,000, the original plan being to build an interurban line from the city limits of Columbus to Chillicothe. In December, 1900, the capital was increased to $1,000,000, and Jan. 7, 1901, the company amended its articles of incorporation, enlarging the scope of the enterprise to include electric railways from Columbus to Lancaster, from Circleville to Washington Court House and from Circleville to Lancaster, in addition to the Columbus and Chillicothe line at first contemplated. At the time of the organization the Everett-Moore syndicate, of Cleveland, subscribed for a large majority of the stock. As a result of the financial difficulties, which in 1902 required the Everett-Moore syndicate to withdraw from a number of its electric railway interests, the Scioto Valley undertaking was assumed by Columbus and Cincinnati capitalists, Edwin R. Sharp being made treasurer of the new "Scioto Valley pool," as the interests carrying out the construction of the line are known locally.



ENGINE AND GENERATOR ROOM, POWER PLANT OF THE SCIOTO VALLEY TRACTION CO.

Of the lines provided for in the articles of incorporation, only the two more important have been built, those connecting Lancaster and Circleville with Columbus. The line to Lancaster was first opened for traffic July 22, 1904, and the line to Circleville Aug. 3,

1904. From the center of Columbus to the south limits of the city the Scioto Valley company makes use of the Central Market Street Railway Co.'s line and of the interurban loop used by the other interurban companies entering Columbus. The loop which is in the business center of Columbus comprises .588 miles of track and the city line from the loop to the corporate line on Parsons Ave. is 3.488 miles. From the corporation line the Scioto Valley company laid a double track on Parsons Ave., for a distance of 1,300 ft., this highway being occupied under a 25-year grant from the county commissioners. From this point south to Obetz Junction, which is 3.66 miles from the city limits, a double track line is constructed on a private right of way. At Obetz Junction the two divisions diverge, one running south to Circleville, a distance of 19.74 miles from Obetz Junction or 27.35 miles from the center of Columbus. The second division runs from Obetz Junction southeast to the city limits of Lancaster, the business district of Lancaster being reached over the line of the city company, 1 mile of track being used by the interurban cars. The distance from Obetz Junction to the city limits of Lancaster is 22.64 miles and the total distance from the center of Columbus to the center of Lancaster is 31.34 miles. All of the Lancaster division from a point 1,300 ft. south of the city limits of Columbus, except through the village of Groveport, is constructed over a private right of way, all of which is owned in fee except 3 2-3 miles along the Ohio & Erie Canal which is held under lease from the State Board of Public Works. Adjoining this leased portion of the right of way the company has purchased property varying from 10 ft. to 50 ft. in width so that the right of way may be widened if it is found desirable to do so. On the Circleville division a private right of way was secured to within 500 ft. of the corporation line of Circleville, all being owned by the company in fee. It should also be mentioned that on the Lancaster division the company owns in fee the right of way through the villages of Canal Winchester and Carroll.

OVERHEAD CROSSING WITH HOCKING VALLEY, SHOWING APPROACHES.

The company contemplates extending the Circleville division to Chillicothe, which will constitute an addition of 21.3 miles of track. The right of way from Circleville to Kingston has been purchased and the survey for this route from Kingston to Chillicothe is now in progress.

The territory served by the Scioto Valley company is in a very great measure tributary to the city of Columbus, which is its wholesale and retail center. From Lancaster, Circleville and also Chillicothe it is necessary to pass through Columbus in order to reach the larger cities of the state, except that Chillicothe has a through road to Cincinnati. This condition assures the Scioto Valley Traction Co. a large traffic. The company is in competition with the Hocking Valley on one division and Norfolk & Western on the other. From Circleville to Columbus the electric route is nearly four miles shorter than that by steam and between Lancaster and Columbus the distance by the two routes is practically the same, distances on the steam lines being measured from railroad station to railroad station, which in all cases are from 8 to 15 minutes' walk from the business districts. Operating with a speed of 30 miles per hour between terminals the electric line can make the same time between terminal points as the steam roads, giving patrons a more frequnt service at a lower rate. The rates on the Hocking Valley between Lancaster and Columbus are 95 cents one way and $1.75 for the round trip as against 60 cents and $1 respectively, on the Scioto Valley. On the Norfolk & Western the rates between Circleville and Columbus are 95 cents one way and $1.75 for the round trip, as against 55 cents and $1, respectively, on the Scioto Valley.

Of the towns served by the Scioto Valley line, Columbus is the capital of the state and the seat of the Ohio State University and an important manufacturing city. Circleville, Chillicothe and Lancaster are all county seats and manufacturing centers of considerable importance. On the Lancastér line is located the Methodist Assembly and Camping grounds, an important factor in increasing summer traffic. The population of the several municipalities served by the lines now operating is given in the following table, which also includes similar data for the route of extension between Circleville and Chillicothe:

	1900 Census	
Columbus, population within city limits	125,560	
Lancaster Division.		
Lancaster	8,991	
Greenfield Township	2,455	
Bloom Township	2,600	
Part of Pleasant, Berne and Hocking	3,750	
Part of Violet	1,500	
Madison	1,545	
		20,841
Circleville Division.		
Circleville	6,991	
Circleville Township	670	
Washington Township	1,405	
Part of Wayne and Jackson	1,500	
Walnut	1,945	
Harrison	2,590	
Madison	1,090	
Part of Scioto	700	
Hamilton	1,860	
Part of Marion	3,000	
		21,751
Chillicothe Division.		
Chillicothe	12,976	
Scioto Township	2,455	
Springfield Township	1,345	
Part of Franklin, Twin, Huntington and Union	4,000	
Green	2,264	
Part of Colerain	500	
Pickaway	1,695	
Part of Salt Creek	600	
		25,775

Track Construction.

In order to permit a high speed schedule, grades have been reduced wherever it was possible to do so and outside of the city curves of long radius have been adopted. Except within the limits of municipal corporations, and for short distances near Columbus and Lancaster the maximum grade is 1 per cent. In Circleville the grade is for 200 ft. between two and three per cent. In Lockbourne and Groveport there are short distances in which the grade is 2 per cent, and near Columbus and Lancaster grades of 1½ per cent for a few hundred feet are necessary. Eighty per cent of the Circleville division is constructed on tangents and of the curves, four-fifths have radii of 1,910 ft. or more, being curves of 3° or less. On the Lancaster division, two-thirds of the line is on tangents and seven-tenths of the curves have the minimum radius of 1,910 ft.

The track is of standard construction with 70-lb. T-rails in 33-ft lengths, laid on oak or chestnut ties 6 in. by 8 in. by 8 ft., spaced 2 ft between centers. The entire line is ballasted with 14 in. of gravel. Ballast was distributed automatically by the use of the Rodger convertible ballast and construction cars, the gravel being dropped into the track while the train was in motion, and distributed over the ties by a car attached to the end of the train, thus saving two handlings as compared with the usual method of throwing it off cars, and then shoveling back into the track. The time and expense saved by this method are a very important item.

GENERAL VIEW OF POWER PLANT AND COAL HANDLING APPARATUS.

The third rail is of 100-lb. section supported on vitrified clay insulators with the center line at a distance of 27 in. from the gage line of the track rail with the top surface 6 in. above the top of the track rail.

None of the crossings with steam railroads, except one which is in the city of Columbus, is at grade. The friendly relations which obtain between the Hocking Valley and the Norfolk & Western railroads, which are paralleled by the two divisions of the Scioto Valley company, enabled the latter to make satisfactory arrangements for eliminating grade crossings with these lines. The electric line is carried over the four tracks of the Hocking Valley on a plate girder steel bridge with stone abutments, the approaches to which are 4,000 ft. and 3,000 ft. respectively. The cost of this crossing was divided between the two companies, the Scioto Valley company furnishing the right of way and making the fill and the steam railroad doing the masonry work and erecting the bridge. Near Reese's station on the Lancaster division is an under-crossing with the Norfolk & Western, the Hocking Valley is also crossed on this division by an under-crossing at Carroll. On the Circleville division an under-crossing with the Norfolk & Western is made at Ritts. All bridges and culverts, except two bridges over the Ohio & Erie Canal, are of stone and iron.

INTERIOR OF SUB-STATION—SCIOTO VALLEY TRACTION CO.

The track rails are bonded with two Mayer & Englund G 3 C protected bonds at each joint, and cross bonds of No. 0000 section are placed at frequent intervals. The conductor rails are bonded with two G O and two L 3 bonds, giving an aggregate cross section of 1,500,000 cm. The bonds were furnished by the Mayer & Englund Co., and the insulators by the Standard Vitrified Conduit Co., of New York. At street crossings and other points where it is

BOILER ROOM, SHOWING PIPING—POWER PLANT SCIOTO VALLEY TRACTION COMPANY.

necessary to break the conductor rails, the connection is made by means of lead covered cables laid in vitrified pipe conduits, a plan which permits of the cables being removed and replaced without any excavation being required.

At road crossings "Climax" cattle guards are used. At frequent intervals along the right of way are steel posts carrying signs which read: "Private Property—Electric Third Rail—Danger—Keep Out."

The overhead trolley is used only within the corporate limits of Circleville, Lancaster, Groveport and Columbus and for 1,300 ft. just outside of Columbus.

Power House and Sub-Stations.

The main power station is located near Big Walnut Creek at the point of crossing by the Circleville division and is about two miles south of Obetz Junction. There are four sub-stations now in operation including the one in the main power station. The others are at Asheville, Canal Winchester and Hooker. The power station building is of steel and brick with tile roof and concrete floors, being entirely fireproof. The building is 188 ft. by 115 ft. in ground dimensions, the south walls being 37½ ft. high and the distance from the grade line to the arch of the roof 55 ft. The boiler room is separated from the rest of the building by a north and south wall, this room being 184 x 46 ft. inside dimensions. The station has been designed for 4,000 kw. normal capacity, only half of the power equipment being installed at this time, however.

In the boiler room there are four Franklin water-tube boilers, each with 4,884 sq. ft. of heating surface, arranged in batteries of two, all of them being located on one side of the stack, which is in the center of the building. The boilers are equipped with Roney automatic stokers and operated normally at 150 lb. pressure. Midway of the length of the boiler room and near the division wall is a Custodis stack 10 ft. inside and 200 ft. high.

In the boiler room immediately in front of the stack is a coal bunker of 100 tons capacity, this bunker being placed at sufficient height to permit of its discharging into the coal bucket of 1,500 lb. capacity, which is suspended from a track placed overhead in front of the boilers. This bucket is loaded from the large bunker and then pushed by hand into the proper position for supplying the stoker hoppers. This arrangement is well shown in one of the accompanying engravings.

There are a number of novel features in the design of the piping for this station. A very good general idea of the steam piping will be had from the illustrations showing the interior of the boiler room.

On the boiler room side of the wall separating the boiler and engine rooms are mounted two vertical separators and receivers which are connected by a 10-in. equalizer main consisting of four 90° bends. From each boiler is an 8-in. lead, the two for the south battery being carried to the south separator and the two from the north battery to the north separator. The engine leads are 10 in. diameter.

When boilers are installed in the other end of the station to occupy the space on the opposite side of the stack similar steam piping will be placed at that end and the two receivers nearer the stack joined by an equalizer pipe. For operating the auxiliary apparatus a 10-in. lead is taken from the receiver nearer the stack and carried down to supply a 10-in. header mounted on the engine room back of the three exciter engines. From this auxiliary header a 6-in. loop is carried down into the engine room basement to supply the dry vacuum and circulating pumps.

The feed water piping consists of two 4-in. mains carried on the wall at the rear of the boilers and joined at the ends, forming a loop. For each battery of boilers a 3-in. pipe line is taken from one branch of the feed main, carried alongside the battery, then up and across the two boilers and down the other side and returned to the second branch of the main loop. This arrangement permits either battery to be supplied through either branch of the feed water loop.

The main generator units, of which there are now two installed, consist of two Hamilton-Corliss cross compound engines with cylinders 26 and 52 x 48 in., direct connected to Bullock generators operating at 94 r. p. m. and delivering three-phase, 25 frequency current at a potential of 375 volts. These units occupy in the south end of the engine room space corresponding to that occupied by the boilers now installed. Three steam driven generators are installed for furnishing current for auxiliary apparatus, lighting the station and exciting the main generators. These each comprise a 150 h. p. simple engine manufactured by the Harrisburg Foundry & Machine Works, direct connected to a 100-kw. 125-volt Bullock generator. In normal operation one of these is used for supplying exciting current, one is used for lighting and driving the auxiliary apparatus, and the third is held as a reserve.

BOILER ROOM, SHOWING COAL BUNKER AND DISTRIBUTING CAR.

The boiler feed pumps are two 7 x 10 in. triplex pumps made by the Goulds Manufacturing Co., Seneca Falls, N. Y., and driven by 20-h. p., 110-volt direct current Westinghouse motors. Each pump is of sufficient capacity to supply the boilers when two 1,000 kw units are operated.

The water supply is taken from Big Walnut Creek and as it was unfit for boiler feed purposes without purification a water softening plant has been installed by the New York Continental Jewel Filtration Co. This plant has a capacity of 4,000 gallons of water per hour. The condensing system was installed by the Alberger Condensing Co., and consists of one barometric tube condenser, two dry vacuum pumps and two centrifugal pumps for supplying circulating water. Both the vacuum pumps and the circulating pumps are steam driven, the latter being direct connected to Harrisburg simple engines. One of these is sufficient to supply the condenser when operated at full capacity. The great variation in the water level of the creek, which amounts to 19 ft., made it necessary to sink a well in the basement of the power plant and connect it with the creek by an intake which should be under water at all times. The circulating pumps take suction from this well.

The boiler feed is heated in a Wainright feed water heater, manufactured by the Taunton Locomotive Works. This heater receives the exhaust from the exciter and pumping engines. The coal handling apparatus was installed by the Jeffrey Manufacturing Co., of Columbus, O., and consists of a clam shell grab bucket of 1½ tons capacity, operated by electricity and traveling upon an overhead track. By means of the bucket coal can be unloaded from cars of the gondola type and carried over to the bunker in the station or to a storage pile. The general design of the coal conveying machinery is seen from the engraving showing the exterior of the power house; this view also shows the filtration plant in the background.

The output from the main generators is delivered to six 370-kw. Bullock oil-cooled transformers. These raise the potential to 27,000 volts. The connections from the transformers to the bus bars are through G. E. type H oil switches, with knife switches for isolating the oil switches when it becomes necessary to make repairs on them.

The bus bar structure occupies the basement at the east side of the building, the transformers and oil switches being located on the main floor directly above, with the switchboard for the direct current feeders and the control panels for the high tension switches in the gallery above the transformers.

The bus bars are No. 00 wire, mounted on G. E. glass insulators, the structure being of the standard type, with brick walls and concrete slabs separating the different phases. The bus bars are divided into four sections by knife switches so that any portion may be isolated when making repairs. The high tension panels now installed, are as follows, beginning at the south end: Two generator panels, one spare feeder panel, the first rotary panel for the main station sub-station, one feeder panel for the Asheville sub-station, one feeder panel for supplying the Canal Winchester and Hooker sub-stations, the second panel for the second rotary converter in the main station sub-station.

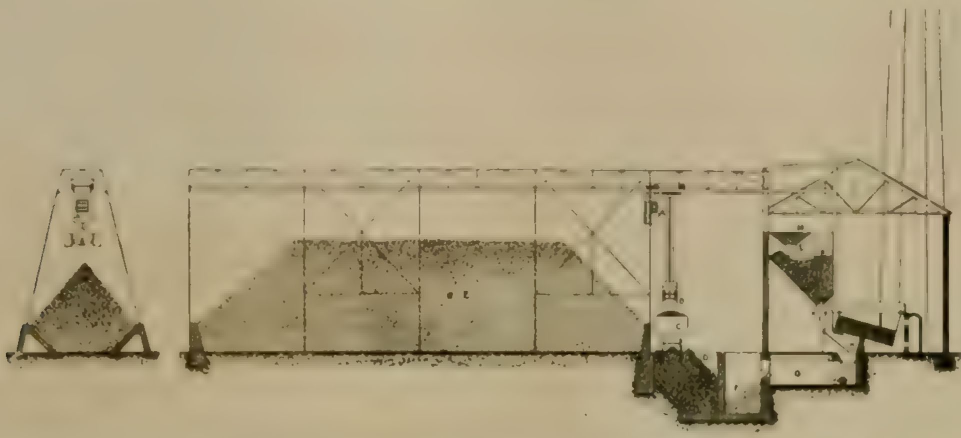
GENERAL VIEW OF ENGINE AND GENERATOR ROOM FROM WEST END, SHOWING SWITCHBOARD IN GALLERY.

The arrangement of high tension bus bars, oil switches and transformers is shown by half-tone engravings of the interior of the station and by plan drawing showing the horizontal cross-section.

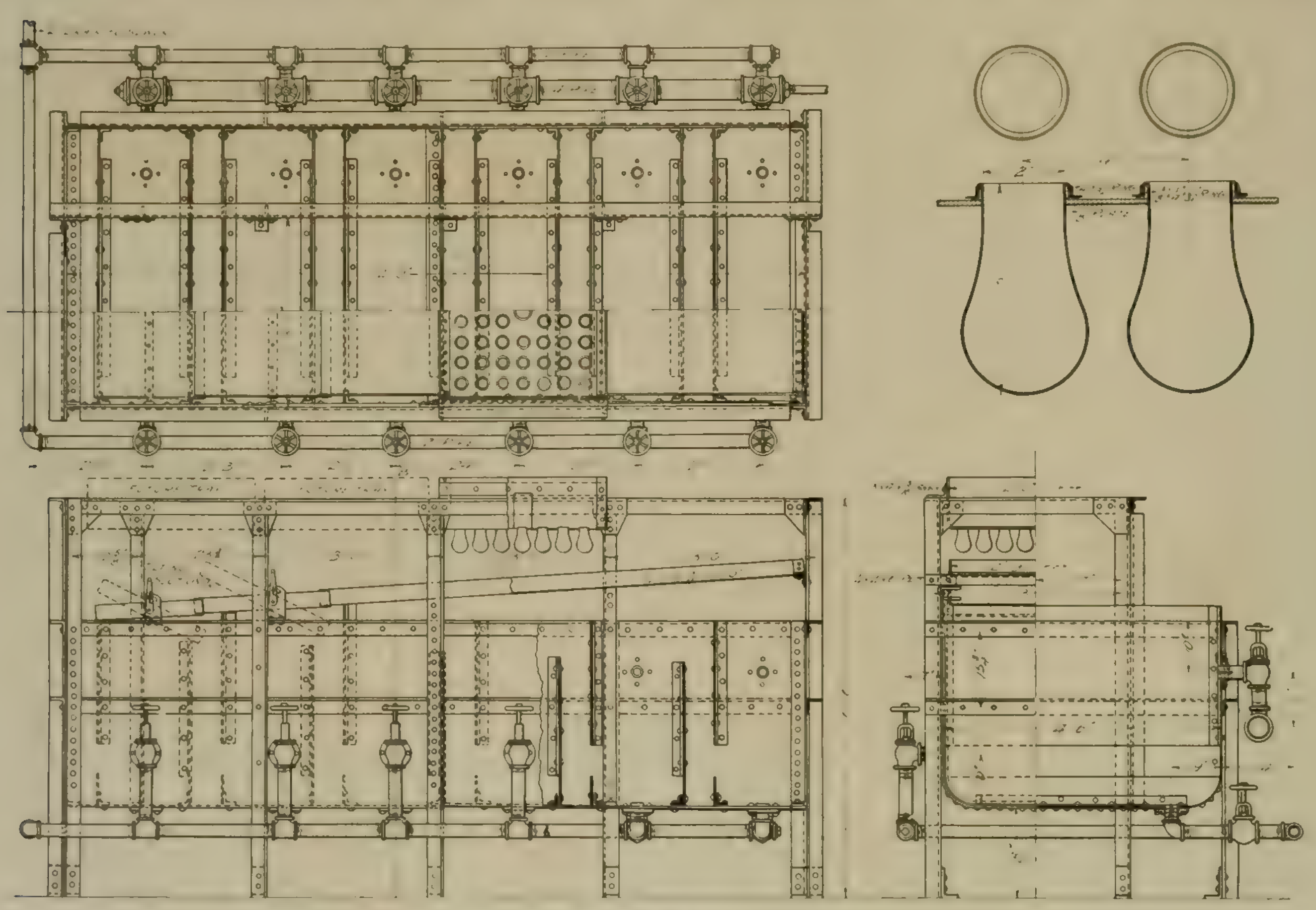
The station is equipped with a very complete gravity oiling system, the oil being returned to a filter in the basement. The oil is clarified first by passage through filter bags about 2 in. in diameter

by 5 in. deep made of canton flannel, and then by passing through a separating tank with baffle plates arranged as shown in one of the accompanying illustrations.

The sub-station equipment for the main power plant consists of two 400-kw. Bullock rotary converters operating at 500 r.p.m., and delivering current at 600 volts. The alternating current for the main station sub-station is not taken direct from the generator but is stepped down through three 150-kw. Wagner transformers from the high potential bus bars. At all of the sub-stations the rotaries are started from the alternating current side, there being connections to the transformers to give half the working potential for starting



SECTION THROUGH BOILER HOUSE AND COAL STORAGE.



OIL FILTERING PLANT.

The three sub-stations located at Asheville, Canal Winchester and Hooker are all similar, being designed to receive two 400-kw. rotary converters, only one being installed in each station at this time. The sub-station buildings, like the power station, are of fireproof construction and are 40x60 ft. in ground dimensions by 30 ft. in height. The general design of these buildings is admirable in that they are substantially constructed with no attempt at useless ornamentation.

The present equipment of each of these three stations consists of a 400-kw. Bullock rotary converter, furnishing direct current at 600 volts and three 150-kw., 25-cycle Wagner oil cooled transformers for stepping down the three-phase current from 27,000 volts to 375 volts. The oil switches for controlling the high tension current are placed in compartments at the side of the building with bus bars supported overhead near the ceiling. Knife switches are provided to isolate the oil switches and also the static interrupters, ready access to these switches being had by means of a gallery over the oil switches. The bus bars and high tension leads are supported on insulators mounted on iron pins which are carried on pipe brackets.

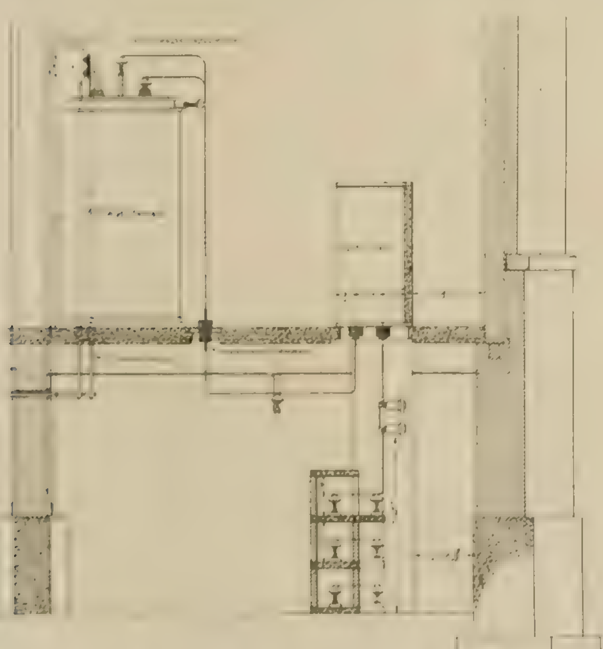
Electric Line Construction.

The high tension line from the power station to the sub-stations is substantially built. The poles are 40 ft. long with tops 7 in. in diameter, and are spaced 100 ft. apart. Two cross-arms are mounted on each pole, the top cross arm being 4½x5½x70 in. long designed for two pins and insulators. The lower cross arm is 4½x5½x100 in. long and has space for four pins and insulators. This allows two three phase lines of three wires each to be installed; only one line is now installed. The insulators are Locke No. 307 of brown porcelain, supported on locust pins 11 in. long. The pins and insulators were supplied by the Ohio Brass Co., and the conductors by the Pittsburg Reduction Co. Each conductor is of aluminum equivalent to a No. 2 B. & S. copper wire, and is of seven strands. The three phase conductors are arranged in the form of an equilateral triangle 30 in. on a side.

One line extends from the power station along the Lancaster division to the sub-station at Canal Winchester and at Hooker. The other line extends along the Circleville division to the sub-station at Asheville. Each of these lines can be duplicated when it is found desirable.

Car Equipment.

The rolling stock comprises 11 passenger cars, all of which are provided with smoking compartments, and two freight motor cars. These were built by the American Car & Foundry Co., and measure 60 ft. over bumpers and 8 ft. 6 in. wide over all. This car is considerably longer than the interurban car generally used, giving greater seating capacity and also a car that can be operated at high speeds more satisfactorily than can shorter cars. The weight empty is 42 tons each. The equipment consists of four G. E. No. 66 motors on each car with the type M multiple unit control. The trucks are the Brill No. 27 E-2 type with 36-in. steel tired wheels, made by the Standard Steel Works, and 6¼-in. axles. All of the cars are fitted with Westinghouse combination straight air and automatic air brake equipments and with hand brakes. The brakes were furnished by the Westinghouse Traction Brake Co. and the air compressors by the National Electric Co. Van Dorn couplers are used. The seats



SECTION SHOWING BUS BARS AND TRANSFORMERS IN MAIN STATION.

accommodate 72 passengers and are of the Hale & Kilburn walk over type. The Consolidated Car Heating Co.'s electric heaters and Ohmer 12-bank fare registers are in all the passenger cars.

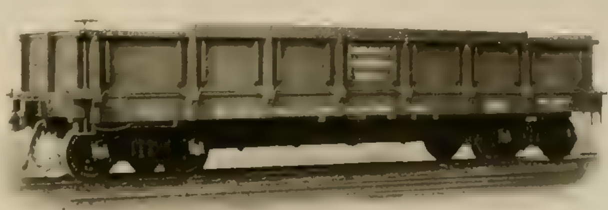
For construction work the company has eight Rodger center and side dump ballast cars and one track plow, or distributing car. The ballast car embodies practically three cars in one, as it can be quickly converted into a side-dump construction car, a center-dump hopper ballast car or into a flat-bottom gondola for general freight or coal service.

Car Dispatching.

The train dispatching system adopted by the Scioto Valley Trac-

TRAIN ON SCIOTO VALLEY LINE.

tion Co. is the steam railroad standard, using telephone instead of telegraph for transmitting orders. All train orders are written on the standard forms No. 19 or 31 X. No. 19, which is the order enlarging rights given by the time-table, requires no signature except that of the operator, while form 31 X, which restricts rights



RODGER BALLAST CAR.

given by the time-table, must be signed by the conductor of all trains affected by it. Unless the train orders are written by the man receiving them, as at telephone booth, for example, they must be released by a clearance card which is made at the time the order is delivered. When the order is transmitted by telephone and the conductor is himself taking it down, there is, of course, no reason for a clearance card.

The following rules have been adopted for the hiring of employes for the train service:

A motorman must have had experience in working under the standard rules governing the operation of steam railroads and must pass the prescribed examination.

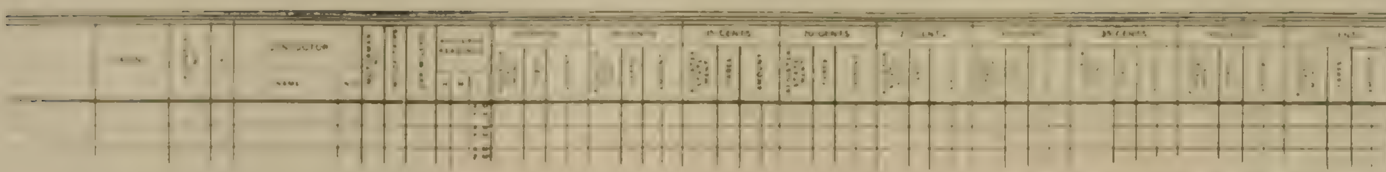
Men who have had no experience will be hired as conductors but after four months' service they must pass satisfactorily the motormen's examination.

The examination which the motormen must pass before entering the service and all conductors after four months, comprises the following questions:

QUESTIONS FOR EXAMINATION IN TRANSPORTATION RULES.

How are extra trains designated?
Which is superior, right or class?
What is a train of superior right?
What is a train of superor class?
How would you proceed on the road on a regular train when time changed?
When can a new train on a new time table, which has no corresponding number on the preceding time table, run?
Where do trains take their date?
How are signals to be used and what is required of you?
Where should those giving signals locate themselves?
If in doubt as to the meaning of a signal, what would you do?
In backing the train what would you do on the disappearance from view of the trainmen or lamp by which signals are given?
What is the meaning of the explosion of one torpedo?
What is the meaning of the explosion of two torpedoes not more than two hundred feet apart?
When should headlights be concealed?

SCIOTO VALLEY TRACTION CO. Record



COLUMN HEADINGS OF CAR RECORD FORM.

When there is more than one train to take siding when should motorman of first train cover headlight?

How are signals displayed on rear of trains when running?

How displayed when into clear at meeting or passing points?

What is the duty of a motorman when carrying green signal?

What response should be given?

Is it necessary to call attention of section and bridge men to signals?

Are you excused from responsibility for not seeing signals of passing trains?

What is the meaning of a signal imperfectly displayed or the absence of a signal at a place where signals are usually shown?

What is necessary for a train to ascertain before leaving its initial station on any district or junction point?

What would train do that is leaving its initial station or junction, when a train of the same class running in the same direction is overdue?

When trains of the same class meet, which will take siding?

How much time will you clear main track of approaching train?

Suppose you have to pull by and back in, what would you do first?

When trains of the same class meet what is the rule?

What exception is there and what is necessary?

Suppose you were on a south bound train and arrived at the regular schedule meeting point of a train of the same class, how long would you wait?

Suppose you were on a north bound train that was late, how would you figure to clear the schedule of the same class train in making a meeting point?

How much will you have to clear at the regular meeting point?

How much must inferior trains clear the time of superior class trains at meeting points?

How much must an inferior train keep off the time of a superior train moving in the same direction?

How much must trains moving in the same direction keep apart, and what is the exception?

When a train fails to clear main track by the time required by the rule, what must be done?

What precaution must be taken by train carrying flagman when the opposing train is met to make it impossible for them to leave before being notified?

When do regular trains lose their rights and class?

What precaution must be taken for work trains to occupy main track on the time of second class and superior trains?

Is it necessary to stop before crossing draw bridges and railroad crossings?

Where view is obstructed what precaution must be taken?

What precaution is necessary when train is occupying main track between switches at stations designated on time card?

Do you understand inferior trains must protect against superior class trains?

Who is responsible as a general rule for rear end collisions at stations?

What is necessary when trains are doing work at commercial spurs located at other than regular stations?

If you are on an extra not running on a schedule or advised by orders of trains ahead what is required?

When a train stops between stations or is delayed under circumstances in which it may be overtaken by another train, what is the first duty?

SUB-STATION AND TRAIN TOWER.

State what signals a flagman should take and how he would protect his train?

What will you do when a passenger train is expected in ten minutes or you hear an approaching train after being called in?

If there is no passenger train due in ten minutes and no train is in sight or hearing when you are called in, what will you do?

When is it necessary to use fusees after being called in and how would you use them?

What would you do on the approach of a train before you had reached the required distance?

If you are recalled before you reach the required distance what would you do?

If it is necessary to protect the front end of train should it be done in same manner?

What would you do in case it was necessary to check a following train before flagman could get back in case the speed of your train had been reduced?

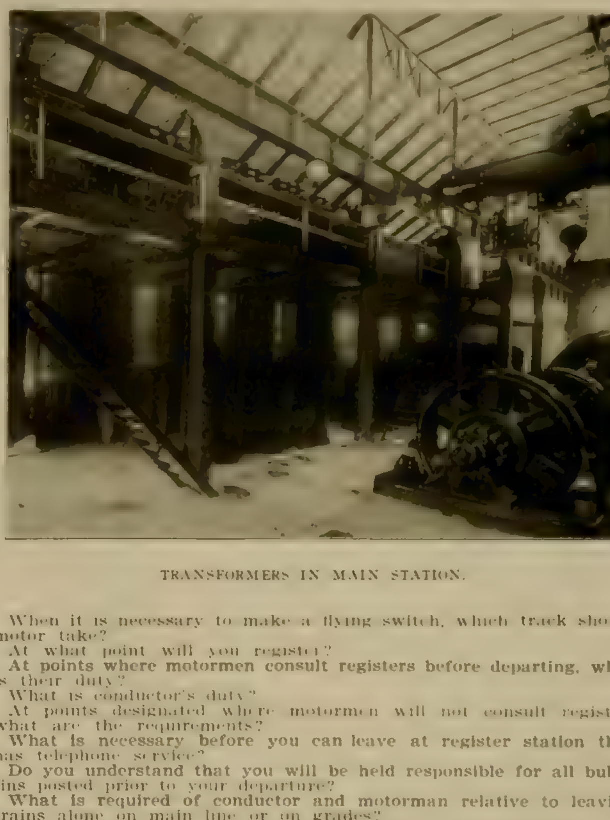
Who must know that brakeman, flagman and fireman understand the rules relative to the protection of trains and the use of proper signals?

What is the duty of the motorman on hearing the explosion of a torpedo?

What is required when he hears two torpedoes explode?

How should messages or orders respecting the movements of trains condition of bridges or track, be given?

What precaution is required of motormen on trains approaching stations where trains are receiving and discharging passengers?



TRANSFORMERS IN MAIN STATION.

When it is necessary to make a flying switch, which track should motor take?

At what point will you register?

At points where motormen consult registers before departing, what is their duty?

What is conductor's duty?

At points designated where motormen will not consult register, what are the requirements?

What is necessary before you can leave at register station that has telephone service?

Do you understand that you will be held responsible for all bulletins posted prior to your departure?

What is required of conductor and motorman relative to leaving trains alone on main line or on grades?

Can you assume the right to take the time of another train?

When trains meet, is it necessary that each must be positively identified to the other?

What is required of a brakeman approaching and passing all stations, or where speed is liable to be reduced?

These questions are printed upon a sheet folded to form four pages 8½x14 in., sufficient space being left for entering answers on the same sheet, and this is filed as part of the man's record.

Telephone booths are placed at all sidings, which are about 2½ miles apart, and at the power house, car house and offices. At the telephone booth a switch for cutting out the instrument when not in use is provided.

At stations where there are agents, train crews register in a book printed in the standard form, showing motorman, conductor, train number, number of motor car and number of the last bulletin on the board at the time of departure of train and memorandum of the signals carried. The dispatcher's train sheet is also of the standard form which has been illustrated in the "Review."

Rates of Fare and Tickets

The rate of fare established is approximately two cents per mile with a reduction of approximately 10 per cent on round-trip trickets.

of Car No. for Month of 190

	REMARKS
[illegible]	

(SIZE OF ORIGINAL, 32 X 21 IN., WITH 70 HORIZONTAL LINES.)

Thus, the fare from Columbus to Circleville, 20.78 miles, is 55 cents and the round trip is $1.00. The rate to Sheldon, 25.30 miles, is the same. On distances for which the single fare is less than 15 cents no reduction for round trips is made. Rates from points not named in the tariff schedule are the same as to the next point beyond. Children over five years and under twelve years are charged at half rate, which is in no case less than 5 cents for a single trip and less than 10 cents for a round trip.

Stations at which ticket agents will be established are Circleville, Asheville, Lockbourne, Columbus, Groveport, Canal Winchester and Lancaster.

The return tickets are of the form reproduced in one of the engravings in which the two portions of the ticket have been torn apart and rearranged to show both the going coupon and returning coupon. In the original, the conductor's stub or the going coupon, is arranged on the first page and the return coupon on the third page of the ticket when folded down the middle. The conductor's punch marks indicate the points between which the ticket will be honored, the amount paid, the date, and whether it was a half or whole fare.

In this connection, some details concerning the plan of accounting for ticket sales, ticket collections, cash fare collections, etc., will be of interest.

The accounting department has been organized under the supervision of Mr. J. S. M. Goodloe, C. P. A., resident partner at Columbus of Messrs. Patterson, Teele & Dennis, Certified Public Accountants, of New York, Boston, Baltimore and Columbus, who have been retained by the Scioto Valley Traction Co., to prepare and install the accounting system and open the books of the company.

It is a well recognized principle in railroad accounting that earnings and ticket sales are not synonymous and in practice a number of the larger street railway companies as well as steam roads make provision for assigning to each month or each day a proper proportion of earnings as distinguished from ticket sales. A method of showing these on the books that is extensively used, is when tickets are sold, to credit "outstanding tickets" and charge cash. Then each day, as the tickets are collected, the proper amounts corresponding to their value are charged to "outstanding tickets," by crediting earnings, thus reducing the liability.

On city lines where tickets are of one value only, the determination of the amounts to be thus charged to outstanding tickets and credited to earnings is done, ascertained by counting the tickets. On interurban lines where round trip tickets, single trip tickets, excursion tickets, etc., are sold between various stations, a greater amount of work is involved in determining the proportion of the total amount of these tickets which should be credited to the earnings for any given date and possibly for these reasons, many of the small companies ignore the difference that exists between receipts and earnings for the day or month in which the cash is collected.

The method of handling tickets for the Scioto Valley company is as follows:

Tickets used will be printed on four colors of paper with two colors of ink; thus, the colors of the paper will serve to mark first, the two operating divisions (Circleville division and Lancaster division), and second, to separate the tickets sold by agents from those sold by conductors. The two colors of ink serve to distinguish the going coupon from the returning coupon.

When the tickets are first sorted after being turned in by the conductor, they are separated into the going and return coupons, the number and value of going coupons giving the charge to be made to the conductor for ticket sales. From the tickets turned in there is made up in the auditor's office the conductor's report of tickets sold. Added to this are the data from the register (which is of the Ohmer recording type with 12 indications, from 5 to 60 cents inclusive, by intervals of 5 cents, and one for tickets), giving the number and value of the cash fares collected. The form in which this report of conductors' sales appears is shown in one of the accompanying blanks.

The revenue value is assigned to each coupon of each ticket, thus a round trip ticket sold for 20 cents has two coupons of 10 cents each. A round trip ticket that sells for 35 cents has the one coupon, the going ticket, valued at 18 cents and one coupon, the returning ticket, valued at 17 cents, the odd cent being assigned to the going ticket in each case. All of the tickets turned in by the conductor are then totaled by means of the Burroughs arithmometer, the result being that the cash fares and the revenue on tickets collected on the car constitute the sum which is credited to earnings. It will be ob-

The Scioto Valley Traction Company

No.

Daily Statement of Ticket Sales 190

Agent Conductor

FORM	Consecutive Numbers		Total	Spoiled	Number of Tickets Sold						Ticket Sales				
	Commencing	Closing			One Way	R T	Half Fare One Way	Half Fare R. T.	Special	Total	No	Rate	Amount	Lancaster Division	Circleville Division
												$ .05			
												10			
												15			

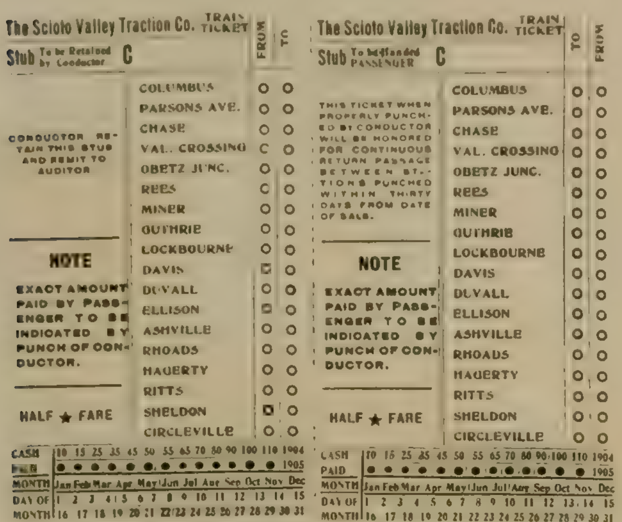
(SIZE OF ORIGINAL, 8½ X 11 IN.)

Train No.	Car No	Opening No.	Clos. No.
Tickets, Form L.			
" " C.			
Cash Fare Receipts, Form C. L.			
No. Passengers Carried in Columbus			

SECTION OF CONDUCTOR'S DAILY REPORT. (ORIGINAL IS 6½ X 10 IN. WITH 10 SUCH RULINGS.)

served that the conductor's cash receipts from tickets are determined from the going tickets only, whereas the earnings from tickets are computed by means of the arithmometer from all of the tickets both going and returning, collected on that trip.

The report of tickets sold and the earnings from tickets having been determined, the tickets are next distributed in cases which consist of 100 compartments arranged in 10 tiers of 10 compartments each. Across the top of the box and down the left-hand side are the numbers 1 to 10 inclusive, the numbers across the top giving the number of hundreds or fractions thereof comprised in the ticket number, while the number of the rows at the left-hand side indicate the number of thousands, or fractions thereof in the ticket. Thus, all tickets from 3100 to 3199 inclusive would be placed in the third compartment from the left in the second row from the top, these



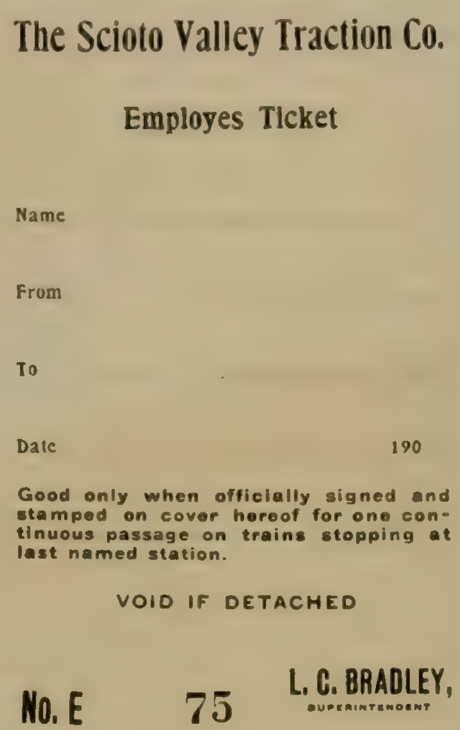
ROUND TRIP TICKET. (ORIGINAL $4\frac{3}{4} \times 4\frac{1}{4}$ IN.)

tickets constituting the 31st hundred. At intervals of a few days the tickets in each compartment are compared and as soon as the two coupons bearing the same number have been returned they are thrown out to be destroyed, so that after each sorting the case contains the going portions of these tickets for which the return coupon is yet outstanding. At the end of the month the coupons corresponding to the unused tickets are filed in a smaller case. After a sufficient length of time, say 60 days, the number of tickets yet outstanding as a liability is so small that the going portions not yet matched up may be destroyed and an entry made in a memorandum book as a more convenient method of keeping track of them.

The object in separating the earnings from the receipts is to show what the real earnings are which have to be compared with the operating expenses, giving exact information as to what the road is earning, both gross and net, and accurate data as to the earnings per car mile independent of the irregular manner in which receipts from sales of tickets vary.

The record of each car is kept on a large form, the column headings of which we reproduce. This form is 32 in. wide by 21 in long and is ruled for 70 horizontal lines. On these the car is identified by its number, the register used for this car, the conductor, by name and number of his register key, and the motorman by number, and the number of trips and the car mileage are entered. From the register indication the number of each class of fares is taken and the amounts entered in the proper column, summarizing the number of cash fares and the amounts. After the columns for itemizing fares is the column of totals for number of passengers, and amounts. Under each denomination of fares there are three columns, one for the registry statement, one for the number of fares found by subtracting consecutive registration statements and one for the amounts. Under ticket collections are columns for the register statement; the number of fares, paid and dead head; the revenue, and the amount that the register is over or short. The rest of the columns provide space for entering the summary with the debit to conductors, cash received, and the amount short or over.

For the use of employes, tickets of the form reproduced herewith are used. When used for a single trip, the name, starting point and destination, and date are entered on the face. The conductor to whom the ticket is presented is required to mark on it the date and train number. By this means the manager is enabled to keep track of the trips made by employes and any abuse of the tickets can be determined at once as the train number gives a check on the exact time when the holder of the ticket reached his destination and the corresponding train number for the return trip shows when he returned. The tickets, which are $4\frac{3}{8}$ in. by 3 in. in size, are bound in books of 60, the pass proper being on the cover. A book is issued to an individual for use between designated points. When used by



him one of the tickets, all of which are numbered to correspond with the cover, is pulled out and taken up by the conductor. When all of the tickets have been used the conductor takes up the cover and returns it to the office. Each ticket has printed on the back the following:

"CONDITIONS. This ticket is not transferable, and is void if presented by any other than the person named, and if any alteration or addition is made upon it. The person accepting and using this ticket, in consideration of receiving the same, voluntarily assumes all risks of accidents and damages and expressly agrees that the Scioto Valley Traction Co. shall not be regarded as a common carrier, nor as liable to him for any injury to his person which may occur while using this ticket whether caused by negligence of the company's agents or otherwise."

The Scioto Valley property belongs to and was built by a so-called pool, which was managed by the following gentlemen as trustees and agents representing investors: A. B. Voorheis, of the Union Savings Bank & Trust Co., of Cincinnati; J. C. Hooven, president of the Hooven, Owens, Rentschler Co., Hamilton, Ohio; E. R. Sharp, president of the State Savings Bank & Trust Co., Columbus; E. K. Stewart, vice-president and general manager of the Columbus Railway & Light Co., and Frank A. Davis, president Citizens Telephone Co., of Columbus.

The officers of the Scioto Valley Traction Co. are: President and general manager, F. A. Davis; treasurer, E. R. Sharp; general superintendent, L. C. Bradley.

The operation of the road is in charge of Mr. L. C. Bradley, who assumed that position on April 5, 1904. Mr. Bradley will be remembered as superintendent of the Puget Sound Electric Ry., the third rail interurban line operating between Seattle and Tacoma, Wash.

W. E. Baker & Co., of New York, were electrical engineers, in charge of the construction of the power house, sub-station and transmission lines.

Mr. A. W. Jones of Columbus, was chief engineer, in charge of track construction.

The Fayet-Chamonix-Martigni Electric Ry.

BY ENRICO BIGNAMI.

VIADUCT SAINTE MARIE ON CHAMONIX RAILWAY.

This new road which may for brevity be called the Chamonix railway, from the name of the city to which the immortal melodies of Donizzetti have given especial renown, is now approaching the completion of its connection to another electric railway from Martigni to Cuatelard, in Switzerland. This new road will especially interest the Alpine climbers of the world for the reason that Chamonix is not only one of the most picturesque localities of the Alps but is also one of the most important excursion centers. It is from Chamonix that travelers generally start for the ascent of Mont Blanc and the Aiguilles Rouges, some of which have never been ascended in spite of the many attempts of the most intrepid Alpine climbers, while others are only accessible at the cost of great efforts and of great danger

The road is 36 km. long, of which 10 km. have been in operation for about a year and 9 km. more will be completed next year, which will connect Chamonix with Argentiere. The work on the roadway has been in hand since last September and the construction of the bridges, stations and power houses is well advanced. The route of the last 9 km. between Argentiere and the Swiss frontier has been finally surveyed. The route of the line already in operation follows the valley of the Arve and various crossings of this river have necessitated the erection of seven large bridges, five of which are metal bridges of 25 to 45 m. span and one masonry bridge 25 m. long, and the viaduct of St. Marie, which has a central span of 25 meters at which point it is 50 m. high and seven spans of 15 m., two of which are built on a curve of 200 m. radius. The line has four stations which are at Cheddes, Servoz, Houches and Bossons. The current for the operation of the road is continuous and is generated in two power houses. One of these is at Servoz, from which one end of the line is fed, and this station utilizes water power from the Arve, where a head of 40 m. is available and the amount of water varies from 12 cu. m. in the summer time to 6 cu. m in the winter. The other station is at Chevants, which also utilizes water power from the Arve River, the available supply varying from 11½ cu. m. in summer to 5 or 6 cu. m. in winter, under a head of 94 m.

The equipment of both systems comprises four continuous current generators of 200 kw. capacity, each coupled by means of elastic clutches to horizontal shaft turbines, and two exciter sets of 40 kw. capacity, each driven by turbines of the same type. Three generator and one exciter in reserve. The roadbed is laid with generator and one exciter in reserve. The road bed is laid with T-rails, 12 m. in length, and weighing 34.2 kg. per m. The gage is 1 m. and the current is delivered to the car motors by mean of a third rail.

In order to avoid accidents due to the location of the third rai

VILLAGE OF PRAZ D'EN HAUT AND VIEW OF THE AGUILLES VERTES ON CHAMONIX RAILWAY.

so near the ground, under a tension of from 500 to 550 volts, the third rail is protected in front of all the stations and for a length of 10 meters on each side of grade crossings by a wooden covering. The insulation of the third rail is obtained by means of wooden blocks treated with paraffine, which are mounted on the ends of two consecutive ties. The rolling stock was built by the Société

ARRANGEMENT OF THIRD RAIL.

Nouvelle des Etablissments de l'Horme et de la Buire, of Lyons, and the electrical equipment was installed by the Société d'Electricite Alioth of Münchenstein-Bale. The rolling stock comprises 80 motor cars and a number of lighter trail cars. All the motor cars can be either operated singly or in trains, and cars are controlled by a single operator in either case. In order to attain this result a special and very ingenious controller was devised by M. Auvert,

VIEW OF STATION, SHOWING PROTECTED THIRD RAIL.

which operates most satisfactorily. The 80 motor cars may be classified as follows: Sixteen electric locomotives, 36 first and second class passenger cars, which differ only in their interior arrangement, and 28 express and freight cars, some of which are [illegible] and weigh 20 tons without load, dump cars weighing 19½ tons, the [illegible] weighing 18½ tons, unloaded. All of these different cars are mounted on the same kind of trucks, the latter being composed of a frame mounted on two axles with a track brake and equipped with an electric motor on each axle. The apparatus for collecting current is of finished cast steel and these are arranged so that they can follow or leave the third rail without shock. The third rail is curved down slightly at each interruption, so that the shoe enters or leaves it on an inclined plane. The arrangement of the motors offered great difficulties but the solution adopted gave unexpectedly good results. The motors are placed at right angles to the axles and transmit the motion through a beveled pinion, which is geared to the axles through an elastic pinion which contains in its lower part a lubricant for the purpose of avoiding the wear on the teeth. The motors are of the four pole type with two consequent poles and the polepieces of the frame are of mild steel and constitute a tight case of two parts, which are bolted to each other by horizontal joint. This frame completely envelops the commutator brushes, the armature and the field windings. All are wound on metal spools, each section being separately insulated. These spools are easily replaced and the winding is of copper strip

3 mm thick. The armature is in series with the field and has a toothed core. The winding comprises 113 interchangeable sections and the collector is made of 113 sections of pure copper. The brushes are arranged in such a way that they can be inspected with the greatest facility by means of two openings made for this purpose in the upper shell of the motor. It may also be added that the pressure of the brushes is maintained absolutely invariable by a special device and there is no visible sparking on the commutator whether the current is zero or 200 amperes, even when a quick reversal of the armature is made. This condition is taken advantage of in braking by means of short circuiting the motors, which results in a very positive and striking braking effect. The two motors being always coupled in parallel it is only necessary to reverse the direction of the current in the armatures to obtain a very quick stop, even on heavy grades, and this is accomplished with the greatest security. In fact, the wheels always continue to turn at a very small velocity and never skid, which is an excellent condition for avoiding the loss of adhesion which ordinarily occurs from rapid braking. The effect of braking in this manner is equally good whether there is current on the line or not.

As has been already mentioned, all the cars of a train are controlled simultaneously by the motorman of the forward car or locomotive by means of compressed air motors. These have the advantage of making the regulation as simple as possible. The controller is extremely simple, comprising only five forward and five reverse positions and only permits of coupling the motors in parallel. The first four speeds in both directions are obtained by interpolating suitable resistance in the motor circuit and the fifth speed is obtained by shunting the field. This controller is designed for a cylindrical commutator and is provided with a junction box so that in case of trouble with one motor it can be put out of circuit. When the cars are operated singly the controller is manipulated by hand by means of a removable handle. This handle is taken off under the usual operating conditions, that is to say, when the cars are coupled into trains. Each car is equipped with one of these controllers.

The flat cars are provided with a special controller for operating the cars in the car house. The controller resistances are of two types, both of which are composed of a continuous ribbon of nickeline. The two types differ principally in size. To protect the motors and all the electrical apparatus in the cars there has been installed on each car near the controller an automatic cut out with a magnetic blow out, and this is placed so as to be easily accessible. The lighting of each motor car consists of two parallel groups of five lamps in series; the signal lights consist of oil lamps. In order to avoid the variations in the lamps due to the inevitable changes of voltage according to the profile of the road, each motor car is provided with a special arrangement for automatically regulating the voltage of the lighting circuit. This apparatus is patented by the Société Alioth in France and Germany. The lamps are chosen so that they burn at a normal candle power at the lowest voltage which could occur normally, then as the voltage of the line increases an automatic device inserts resistances which are again cut out of the circuit as the voltage drops. This regulator is absolutely insensible to shocks of the car for the reason that the movable part is always in equilibrium. This is considered a great advance in the art of car lighting as it overcomes a difficulty which always exists in this branch of lighting.

The heating of the cars is secured by means of electric radiators which are operated by means of a switch giving three degrees of heat. It may be added that the third position of the switch is never used as the first two positions are always sufficient, even when the weather is most rigorous.

The principal station on the line between Chamonix and Argentiere will be at the latter place, which contains a number of splendid hotels and which has also given its name to one of the most beautiful and important glaciers of Mt. Blanc. At Argentiere may be seen one of the most marvelous panoramas, an idea of which can be obtained from one of the accompanying illustrations. The station at Praz d'en Haut will be the most important on the line between Argentiere and Martigni. This little village is surmounted by the Aiguilles Vertes and the Dome du Dru. A view of this beautiful panorama is also shown in one of the accompanying illustrations.

The Small Road and the Manager.

BY [illegible] M. LEVINSON, MANAGER SHREVEPORT TRACTION CO., AND HIGHLAND PARK TRACTION CO., SHREVEPORT, LA.

The advent of the street railway in cities of 20,000 population and less, with a service justifying from 6 to 12 cars only, and with a public demand and franchise requirement of short headway, regularity of service and freedom from interruption of every character, has created in the Street Railway industry a field difficult to fill.

With limited revenues, the directors cannot afford the salary list attending the creation of such offices as Chief Engineer, Claim Agent, Purchasing Agent, Master Mechanic, Superintendents, Advertising Agent, etc., rendering it necessary, from point of economy, to combine as far as possible the executives of all of these essential departments in one man—the Manager. To him falls the task of instructing student motormen and conductors, explaining the power plant to the new engineer, helping the lineman in stormy weather, surfacing and lining track and laying pavement when the track foreman is sick, entertaining the committee who wants the donation of a day's receipts, asking and persuading the city authorities for permission to make some improvement for the railway and the city, watching out for and attempting to prevent hostile legislation, etc.

The manager of a small road who expects to show to his president an operating statement having the right proportion of expenses to receipts, without doing so at the expense of the physical condition of the property in his charge, must have his business well in hand at all times and under all conditions.

The absence of this man, in many instances under the writer's observation, has called for the receiver, and has yielded many opportunities to shrewd speculators for profitable returns on short term investments. A capable manager is but a short time resurrecting a property whose weakness in receipts, and strength in disbursements, is apparent to the casual observer.

A century of experience will avail but little to the man who lacks the qualities of quickly discovering what is necessary to secure for his company every dollar received on his cars, and to curtail expenses in every way consistent with the efficiency of employes and with good service.

His cars must be kept up physically and cleanly. No motorman should have grounds in testifying in a damage suit that controller or brake was defective. Smooth track with spiral curves, automatic switches, steel bridges, guard rails, etc., and a margin of safety in running time, coupled with regularity, and polite conductors, go to make the anticipated dividend.

For these results we must look to the manager and his ideas. The latter are of course expected to fill in a measure the same plural role as their superior.

For instance, the cashier and bookkeeper must know how to operate a car and do so on evenings and Sunday afternoons, besides collecting bills for motor service, looking after incoming freight supplies, etc., and the other work more in line with his principal duties.

The engineer must help the barn men in forging and carpenter work, run a lathe and drill press, and do the babbitting for cars, engines and generators.

The barn man, like a cashier, runs a car evenings and Sundays, winds armatures, paints, and helps the lineman.

The lineman, during the summer, is busy starting electric fans, cutting them out, soliciting motor business, and runs an extra car to base ball games or the theater. In the winter, he is placed regularly on a car.

The track foreman, during the rainy and cold season, is also used on a car.

By these means the organization is kept intact, a repetition of voluminous instruction is avoided, and the business conducted with the least possible expense. In times of construction, or reconstruction, of course extra help is necessary.

The Lima (O.) Electric Railway & Light Co. has a very interesting exhibit at the Allen County Fair, which includes electrical devices that may be used for heating flatirons, operating sewing machines, cooking with a chafing dish, or for making tea.

Some Operating Features of the Electric Railway System Controlled by the Public Service Corporation of New Jersey.

BY A. H. STANLEY, GENERAL SUPERINTENDENT.

The property of the Public Service Corporation comprises 550 miles of overhead trolley system, in the state of New Jersey, extending from the Hudson River on the east to the Orange Mountains on the west, and from Paterson on the north, south to South Amboy and New Brunswick. The system comprises city, suburban and interurban lines, and included within the property are two wagon lifts for elevating wagons from the Hudson River shore to the top of the hill which skirts the Hudson River north from Jersey City. The company also owns and operates a plank toll road and a line of ferries connecting the state of New Jersey at Bayonne, with Staten Island, N. Y., at Port Richmond.

The territory covered by the company's property is approximately 50 miles long by 20 miles wide. In this territory the lines operate through about 75 different municipalities, ranging from a city of 260,000 inhabitants to boroughs of approximately 600 inhabitants, the boundary lines in a great many instances being purely imaginary and having no physical distinction, in many instances well populated streets being the dividing line between two large cities. Very few of the lines serve one municipality alone, some of them running through as many as 10 municipalities, without reference to the Jersey City-Trenton through line which runs through 15 municipalities, all of which have their own peculiar conditions affecting the rates of fare, necessitating the overlapping of fares on the entire length of the line.

Practically the entire territory is of a very hilly nature, with many narrow and congested streets and highways, especially in the towns along the Hudson River with its vast steam railroad and ferry terminals to and from New York City, with all the attendant heavy truckage and cartage. The natural trend of traffic is toward New York City in the morning, and from there in the evening, necessitating the merging of a great many lines at the ferry terminals at Jersey City, Hoboken and Weehawken, and at the steam railroad stations in Newark. It is estimated that about 300,000 people cross the Hudson River daily.

The Hackensack and Passaic Rivers run directly through the territory from Jersey City to Paterson, necessitating the use of draw bridges on all lines crossing the rivers, the service on which is subject to numerous interuptions, due to heavy river traffic.

The tunnel which is about completed connecting Jersey City and Hoboken with New York City will greatly relieve the congestion, and the possibility of running cars from different points in New Jersey to different points in New York City is receiving serious consideration. The question of high speed lines, connecting some of the larger municipalities, across the meadows lying between Newark and Jersey City, is also being given considerable thought. The possible use of the Morris & Essex Canal, now almost abandoned as a waterway, offers splendid opportunity for a three-track high speed line through part of the territory.

The length of the lines and the excessive grades have necessitated on the majority of the lines the use of four-motor cars, which are equipped with Brill 27-G trucks and four Westinghouse No. 68 motors. The length of the car body is 28 ft., 8 in., with 6-ft. platforms divided into two sections by a rail. At the present time all of the cars are built to run in either direction, in connection with the use of crossovers located at different points on the lines. Loops and Ys at the terminals, and connections at intersecting lines, are being gradually put in, with a view to operating all of the cars in one direction, thus doing away with the necessity for controllers, brakes, etc. on the rear platform, leaving a clear space for passengers. This also permits of having the registers at one end of the car, where they can be seen plainly by both passengers and inspectors.

HORSE SHOE INCLINE AT HILLSIDE AVE., HOBOKEN

After a careful investigation and thorough study of the question, it has been decided that a 28-ft. car body is the longest that is desirable for city service. A car of any greater length offers too many opportunities for passengers to ride free, and makes it impossible for a conductor to get all of the fares. As compared with a longer body it reduces the dead weight to be pulled over the roads during the greater number of the hours the car is in service when the riding is light. We are of the opinion that there is a limit to the length of headway under which cars on any particular line should be run; longer cars on long headway do not give so good service as shorter cars on shorter headway.

On all cars operating on the city lines having only cash fares or transfers, two registers are used, one on which cash fares only are registered, and the other, tickets and transfers. On all the other lines having in excess of two classes of fares, the Ohmer fare register is used, in connection with identification checks to aid the conductor in knowing how far the passenger is entitled to ride.

Additional car houses are gradually being constructed, with a view to operating each line from its own car house, located at the

tenance, offering better facilities for the inspection of cars each trip and avoiding the congestion of men at different lines at one point, which increases opportunity for exchanges of transfers, etc. The car houses are not built with a view to covering all of the

WAGON LIFT AT HOBOKEN—PUBLIC SERVICE CORPORATION.

cars in service, but with the intention of having the operating cars outside, and having only the pits, washrooms and shops under cover; of course with buildings for the conductors and motormen, with the necessary locker rooms, club rooms, etc., and offices for the clerks and division superintendent. For the cars lying idle in the off season, storage sheds very close to the main shops are being erected. The storage shed is of mill construction, with three tracks

TOLL GATE, FAIRVIEW, N. J.

to the bay, separated by heavy brick walls, and tar and gravel roof. The outer bays are ventilated with windows, and the inner bays with roof ventilators. Minor repairs to the cars are made at the shops at the different car houses, and the cars are put through the main shops each year.

The majority of the double truck cars are equipped with stored air brakes, carrying a pressure of 275 to 325 lb. and are charged at their respective car houses, consuming about 45 seconds in the operation. The air brake compressors and compressing stations have been installed by the National Electric Co. Five compressing stations and 276 cars will be equipped this fall.

A new transfer system now going into effect will provide for individual transfers for each conductor, with distinctive colors for each line. The transfers will contain the badge number of the conductor to be used by him exclusively.

A special feature is made of the use of special cars for parties, etc. Illuminated cars have been provided, and we have under construction now a private car, containing a buffet, sideboards, etc. The rates are reasonable and a large business is being developed.

A general system of parks covering the entire territory is under consideration, on lines similar to that of Proctor's circuit, whereby entertainments of a high class can be moved to different parts of the territory during the season. We believe that it is preferable that these parks be conducted by outside amusement companies rather than by the company itself.

The length of some of the lines and the congestion of the traffic at certain hours has encouraged the thought of the use of trailers, and plans are being gradually worked out now with a view to developing a special type of car for trailer service on the lines where the grades are not excessive.

The Electric Railway Properties Operated by the Public Service Corporation of New Jersey.

The Public Service Corporation of New Jersey was incorporated in May, 1903, for the purpose of controlling and operating nearly all the electric traction systems in northern New Jersey. In addition to its large electric railway holdings, the Corporation controls the gas and electric lighting interests of the greater part of the State of New Jersey.

The Corporation controls the North Jersey Street Railway Co., the Jersey City, Hoboken & Paterson Street Railway Co., Orange & Passaic Valley Railway Co., the Elizabeth, Plainfield & Central Jersey Railway Co., Elizabeth & Raritan River Street Railway Co., and the United Electric Co. of New Jersey. It leases the property of the South Orange & Maplewood Traction Co. and various gas and electric lighting companies which were previously operating independently. The Corporation also controls certain electric railway, gas and lighting properties in Camden, Trenton and the southern portion of New Jersey, but these properties are operated under distinct managements and are not included with the systems of northern New Jersey.

The electric railway lines in the northern part of New Jersey which are operated under the control of the Public Service Corporation, comprise about 550 miles of electric railway track. The lines have been built at different periods by the underlying companies and present a wide variation in track and overhead construction. A large portion of the track is laid with 7-in. Trilby girder rails on stone ballast, and filled between the ties and paved to the top of the rail. This is the practice now followed by the Corporation in new work in cities and towns. All new work in city and village streets will be cast welded, the company owning its own cast welding outfit.

The Corporation owns approximately 1,700 cars.

The main repair shops are located on the Plank Road, near Newark, and these were very fully described in the "Street Railway Review" for April, 1902.

For operating purposes, the electric railway system is divided into four districts.

District No. 1 covers the territory in Hudson and Bergen Counties, comprising about 132 miles. Included in this district is the Bergen Turnpike line, which is a toll road upon which tolls are still collected. Other property controlled by the District Superintendent's office of District No. 1 is the Jersey City Wagon Elevator, the People's Elevator at Weehawken and the port Richmond & Bergen Point Ferry Co.

There are situated in District No. 1 six ferry terminals from which operate 11 ferry lines, to and from New York City. These ferries carry an enormous number of people to and from New York during the morning and evening hours, and it is estimated that 300,-

000 people living in New Jersey do business in New York City daily. Some idea of the traffic concentrated at the ferry terminals on the Jersey side may be had from the following statistics: At the Pennsylvania Ferry terminal in Jersey City during the commission hours, an average of 105 electric cars are moved per hour, and the average number of passengers handled at this terminal during the rush hours is 6,500 per hour. During the non-commission hours, the average from this terminal is 72 cars per hour and 2,800 passengers per hour. At the Delaware, Lackawanna & Western R. R. terminal at Hoboken during the commission hours, the average cars per hour are 115 and the average passengers carried per hour 7,000, during the non-commission hours at this point the average number of cars per hour is 64 and the average number of passengers carried 2,800.

During commission hours the average number of cars operating from all the ferry terminals in District No. 1 is 339 cars per hour, and the average number of passengers carried is 20,550 per hour, during the non-commission hours at these terminals the average is 201 cars per hour, carrying an average of 7,730 passengers per hour.

The Port Richmond & Bergen Point Ferry is located at the extreme southerly end of Hudson County. Boats from Bergen Point operate to Port Richmond, Staten Island, State of New York, through the Kill Von Kull, which is a body of water 1,600 ft. wide. During the non-commission hours, the schedule is three boats per hour; during the commission hours, six boats per hour. The average number of passengers carried, during the commission hours is 1,500, during the non-commission hours 500 per hour. This ferry is an outlet for the people in Hudson County to Midland and South Beach, which are across, on the opposite side of Staten Island, and are accessible by the lines of the Staten Island Rapid Transit Co. The Corporation has two boats in service, the "B. M. Shanley" and the "Public Service." The "B. M. Shanley" is 140 ft. long and 50 ft. beam. The "Public Service" is 146 ft. long and 50 ft. beam.

The elevator of the People's Elevating Co. is located in Weehawken, Hudson County. This elevator, whose lift is 300 ft. long, is cut in through rock, on the side of the Palisades, and is constructed of timbers 8 x 12, with steel ties. The cages or cars are constructed of steel. The tonnage per car is 80 tons a lift. The counter balance construction consists of one pull cable and two safety cables, attached to one car, operated on a drum, which is ro-

MAP OF THE RAILWAY SYSTEM OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY

Organization of Construction Department, Public Service Corporation of New Jersey.

- General Superintendent, A. H. Stanley
  - Real Estate Investigator, W. J. Ramsey
  - Superintendent of Construction, E. A. Packe
    - Assistant Engineer, P. A. Clerkin
      - Engineering Corps.
      - Draftsmen and Clerks
      - Track Foremen
        - Trackmen and Laborers
  - Chief Engineer, D. F. Carver
    - Air Brake Inspector, W. P. Wiswall
      - Mechanics and Laborers
    - Assistant Engineer, Martin Schreiber
      - Engineering Corps.
      - Building Foremen
        - Foremen Carpenters and Painters
          - Mechanics and Laborers

Organization of Operating Department, Public Service Corporation of New Jersey.

- General Superintendent.
  - Traffic Superintendent.
    - Schedule Maker. Clerks.
  - Superintendent of Employment
    - Investigators. Clerks.
  - Superintendent of Trucking.
    - Stablemen.
  - Superintendent District No. 1.
    - Division Superintendents.
      - Assistant Div. Supt. Clerks. Carhouse Men.
    - Superintendent of Ferries.
      - Pilots, Engineers, Firemen, Watchmen, etc.
    - Engineers Wagon Elevators.
      - Collectors. Watchmen.
    - Superintendent Toll Roads.
      - Toll Gate Keepers.
    - Clerks. Special Officer. Telephone Operator.
  - Superintendent District No. 2.
    - Clerks.
    - Division Superintendents.
      - Assistant Div. Supt. Clerks. Carhouse Men.
  - Superintendent District No. 3.
    - Clerks.
    - Division Superintendents.
      - Assistant Div. Supt. Clerks. Carhouse Men.
  - Superintendent District No 4.
    - Clerks.
    - Division Superintendents.
      - Assistant Div. Supt. Clerks. Carhouse Men.
  - Chief Engineer.
    - General Master Mechanic.
      - General Repair Shop. Paint Shop. Storekeeper
    - Superintendent Rolling Equipment Dist. No. 1.
      - Depot Repair Shops.
    - Superintendent Rolling Equipment Dist. Nos. 2 and 3.
      - Depot Repair Shops.
    - Superintendent Rolling Equipment Dist. No. 4.
      - Depot Repair Shops.
    - Superintendent of Lines Dist. Nos. 1 and 2.
      - Emergency and Maintenance Crews. Bonders.
    - Superintendent of Lines Dist. Nos. 1 and 3.
      - Emergency and Maintenance Crews. Bonders.
    - Superintendent of Lines Dist. No. 4
      - Emergency and Maintenance Crews. Bonders.
    - Roadmaster Dist. No. 1.
      - Trackmen and Clerks.
    - Roadmaster Dist. No. 2.
      - Trackmen and Clerks.
    - Roadmaster Dist. Nos. 1 and 3.
      - Trackmen and Clerks.
    - Roadmaster Dist. No. 4.
      - Trackmen and Clerks.
    - Assistant Engineer.
      - Draftsmen. Accountant. Stenographer. Office Force.

Officers, Operating Department.

Organization Chart—Operating Department Street Railway Dept. Public Service Corp'n of New Jersey.

- General Superintendent, A. H. Stanley.
  - Superintendent of Employment, Albert Eastman.
  - Superintendent of Trucking, Hugh Brooks.
  - Superintendent District No. 1, N. W. Bolen.
    - Division Superintendents District No. 1: W. F. Revoire, West Hoboken; A. J. Bliss, Hoboken; Daniel Beatty, Montgomery St., Jersey City; E. L. Williams, Greenville.
  - Superintendent District No. 2, A. W. Pratt.
    - Division Superintendents District No. 2: C. W. Roe, Broad St. and Miller St.; C. H. Coe, Roseville, South Orange and Maplewood; Geo. Duck, South Orange; J. J. Gettings, Plank Road, Springfield Ave.; P. McDermott, Harrison; A. M. Stewart, Montclair, Orange and Passaic Valley.
  - Superintendent District No. 3, T. W. McAndrews.
  - Superintendent District No. 4, F. H. Brown.
    - Division Superintendents District No. 4; R. Eick, Elizabeth; T. J. McGuire, Westfield and Plainfield.
  - Chief Engineer, D. F. Carver.
    - General Master Mechanic, P. J. Connors. Superintendents Rolling Equipment, Districts Nos. 1, 2, 3 and 4: T. S. Adams, J. M. Yount, G. C. Killeen. Superintendents of Lines, Districts Nos. 1, 2, 3 and 4: C. S. Dunn, W. S. Jackson, E. J. Belcher.
    - Roadmasters Districts Nos. 1, 2, 3 and 4: J. W. Leahy, W. Parkin, W. M. Bayles, H. L. Freeman.
    - Assistant Engineer, C. M. Breder.

tated by two 150 h. p. Westinghouse motors, and one 50 h. p. motor which works the hydraulic pump for brake usage, or to bring the car in the pocket without causing a jar.

The Jersey City Wagon Elevator is in Jersey City. It is constructed of 8 x 12 timbers and steel ties. Cars are constructed of yellow pine, with steel tie rods. It has one safety and one pull cable, and is operated by four W. P. 50 motors. The hydraulic pump used at this elevator is controlled by one W. P. 50 motor. The car will accommodate three wagons or trucks. These elevators are in operation from 6 a. m. to 7:30 p. m. week days but are not operated on Sundays. The elevators are a great convenience to the trucking people, as the roads leading to the top of the Palisades are very steep. Rate of fare, light wagon or truck 10 cents, loaded truck 15 cents, excursion ticket 25 cents. Special rates for machinery.

The Bergen Turnpike Toll Road is located in Bergen County. This road was organized in 1853, with four toll gates. At present only three gates are operated, one at Fairview, one at Little Ferry and one at the town line of Hackensack. The road terminates at Main street, Hackensack. It is macadamized and 60 ft. wide. The Bergen Turnpike electric line, which operates over this road, is of single track construction, with turnouts. The turnouts are governed by the Jackson electric signals.

District No. 2 comprises about 180 miles and includes the territory in and around the city of Newark. Most of the lines in this district run through thickly populated streets, many of which are narrow and congested. All of the cars of this district and many from the other districts pass through the business center of the city of Newark at Broad and Market streets, this corner being a common transfer point.

District No. 3 includes the territory in and around the city of Paterson and the lines include city and suburban service. The mileage in this district is about 75 miles.

District No. 4 comprises about 144 miles of track and the lines are nearly all fast suburban and interurban lines, serving a farming district. A through electric service is given from Jersey City to Trenton.

The officers of the Public Service Corporation are as follows: President, Thomas N. McCarter; assistant to president, Col. Edwin W. Hine; secretary, F. W. Evans; treasurer, J. P. Dusenberry; comptroller, P. S. Young; claim agent, John P. Feeney; general auditor, M. R. Boylan; general superintendent railway department, Albert H. Stanley; chief engineer, D. F. Carver; purchasing agent, J. A. Pearson.

Power Facilities of the Public Service Corporation.

At the present time power for operating the extensive street railway system of the Public Service Corporation is generated in twelve different stations, all of which have been taken over with the acquisition of the underlying properties. Most of them are combined railway and lighting plants, and although they were built to serve the best interests of the independent companies by which they were erected, they do not meet all the requirements in design and location of the united system. For the most part, these stations contain direct current apparatus for railway purposes, although during the past few months alternating current in some cases has been applied to electric railway operation through the medium of sub-stations. An entire new scheme of power generation and distribution for the entire system is now being worked out by the company's engineers.

The following is a brief summary of the present power situation. In the near future, however, many changes will undoubtedly be made in the arrangement:

The load in Essex County is carried by Coal St. station on the Passaic River, Newark. This station has a capacity of 5,800 kw. in direct-current and 9,000 kw. in alternating-current apparatus.

The Secaucus power station has a capacity of 1,125 kw. in direct-current apparatus and 3,150 kw. in alternating-current. This station is at present carrying the sub-station loads at Passaic, Hackensack, New Durham and Palisade Ave.

The Hoboken power station contains 2,400 kw. in direct-current apparatus.

The power station at Orange has a capacity of 450 kw. in direct current apparatus.

There are two small generating stations in Jersey City, one at Grand St. with 2,350 kw. direct-current capacity and one at Palisade Ave. with 1,500 kw. direct-current capacity.

The district around Paterson is fed from the Paterson station, which has a capacity of 2,000 kw. direct current. There is also a small station at Passaic of 500 kw. capacity. Near this station is a sub-station fed from the Secaucus plant. The capacity of the Paterson station will be added to as the load in that district requires.

The suburban territory embraced in District No. 4 is served by the Elizabeth station with 1,225 kw. capacity; the Cranford station with 1,600 kw. capacity; the Plainfield station with one machine of 225 kw. capacity; the Milltown station with 1,100 kw. capacity. There is also a power house at Metuchen which sends alternating current to a small sub-station near Bound Brook.

The new power house scheme now in course of development for the Public Service system includes as its central feature the construction of a main power house on the Jersey Meadows, near the Hackensack River, west of Jersey City. The design of this station calls for vertical steam turbine units of the Curtis type. The station will furnish power for both railway and lighting and will provide for the growth of business in both Essex and Hudson Counties for the next two years. It will also make it possible, if desirable, to close down several of the present small generating stations. Current will be generated as 60 and 25-cycle, 13,000-volt, three-phase, and will be distributed by conduits to sub-stations in Jersey City and Hoboken, and by trunk tie-lines across the meadows to the Newark power station on Passaic River, through which it will be fed to the sub-stations in Essex County. The turbine units for railway purposes will be 5,000 kw. capacity each, and for lighting 3,000 kw. each.

For the coming year, or until this new central station (which will be known as the Marion station) can produce current, the Coal St. station in Newark will feed across the transmission tie-line over the meadows to sub-stations in Jersey City at Palisade Ave. and at the "Junction." The former sub-station is already in operation and the latter will be built early in the spring of 1905.

The power department of the Public Service Corporation is an organization distinct from the railway, the railway department taking current from the power house switchboards by meter.

The general manager of the power department is Mr. S. Farrand. Mr. J. P. Whittlesey is chief engineer; Mr. E. H. Stevens is general superintendent in charge of operation of plants; Mr. P. C. Oscanyan is assistant to the general manager and superintendent of construction.

The Pittsburg, McKeesport & Connellsville Railway Co., on September 21st, purchased the Pittsburg, McKeesport & Greensburg company's system, paying therefor in the neighborhood of $2,000,000. This gives the former company the largest rural system in Pennsylvania. When completed the line will be nearly 70 miles long.

Car House Practice Followed by the Public Service Corporation.

The new car house at Paterson is notable, inasmuch as it is one of the newest and the largest operating barns owned by the Public Service Corporation. The building was designed and partly constructed by the old company, but was completed and equipped after the new organization came into control.

The structure is of brick, covering an area of 600 x 100 ft., with a capacity of 115 43-ft. cars. There is a clear height under the trusses of 17 ft. The slate roof is one-fifth pitch with steel trusses of the Fink pattern, placed on 16-ft. 10-in. centers.

Along the entire length and at the ridge there is a galvanized iron and skylight glass louvre.

Seven tracks run the entire length of the building, while the two east tracks begin 270 ft. from the front to make room for the office, shops, etc., which are 18 ft. wide and extend two stories in height, each story having 12 ft. of head room. The first floor of the latter area, beginning at the front, is subdivided into superintendent's office, 33 ft. long; private lavatory, 7 ft. 6 in.; men's toilet, 13 ft. 8 in.; starter's and receiver's office, 50 ft.; repair shop, 104 ft., and sand room, 15 ft. The upper floor consists of a club room, 124 ft. long and an extra room 104 ft. The basement under offices has a boiler room 50 ft. long, a storeroom 15 ft., and an extra room 12 ft.

The men's club room is furnished with pooltable, shuffleboard and various other games, also writing tables, books and current literature. The Corporation employs a secretary to look after this apartment. There are 250 expanded metal lockers for the employes, these having solid steel backs and sides with ¾-in. mesh doors and are 6 ft. high, 12 in. wide and 18 in. deep.

All the heavy tool equipment of the Paterson shops is direct-connected to motors for driving.

On account of the extensive area of this car house the fire risk is of the gravest importance, and the Corporation has taken special precautions. However, the apparatus here installed to a considerable extent follows the standard adopted, and represents the system carried out by the Corporation and as recently installed at a number of other car houses.

All the trolley wire is carried on barn hangers in wooden troughs bolted fast to the bottom of the trusses, so that the danger of short circuits and grounds on the iron work is entirely eliminated.

The lighting consists of a complete installation of arc and incandescent low voltage alternating-current illuminating systems. The light for the barn proper is obtained from 12 Manhattan enclosed arc lamps, with wire netting around the globes.

INTERIOR PATERSON CAR HOUSE, PUBLIC SERVICE CORPORATION

The current that drives the motors of the direct-connected machine tools is also taken from the city's power circuit, and all wiring is carefully done in iron pipe conduits.

The offices, shop and pits are wired in conduits for incandescent lights and very carefully installed in reference to insulation.

Ordinary methods of lighting pits generally involve a great deal

of trouble, particularly where extension lamps are brought into play. The wires are continually getting short circuited or grounded by being scuffed or broken as the car repair proceeds. The Paterson barn has four pits, 100 ft. long, that are very satisfactorily conduit wired for stationary incandescent lamps with metal reflectors. Each pit has 12 lights with six on each side, the spacing staggered.

PATERSON CAR HOUSE—EXTERIOR.

The lamp receptacle is placed on the side of a tie, directly under the rail and facing the longitudinal direction of the pit. Lamps are exceedingly well protected in this position, and sufficient light is obtained for workmen to readily examine or repair any part of the running gear of cars.

Besides the ordinary water connection, there is an independent 6-in. water main, run from the 12-in. main in the street through the entire length of the barn. From the 6-in. main connections are taken for seven fire hydrants. Four are placed close along the east wall and three along the west wall. There is in the street a main gate valve and also an extra gate installed with each fire hydrant, so that any hydrant may be out of service for repairing without interfering with the operation of the remaining ones. The fire hydrant adopted as standard is the 4-in. solid stream, frost proof Corey, each equipped with a 14-in. hand wheel permanently fastened so that the valve may be opened at any moment, and also 100 ft. of 2½-in. rubber-lined hose couplings, fitted with Higby threads, and 10-in. by 1¼-in. brass hosepipe. Hose is attached to every hydrant and stored on hose racks placed on the wall. The racks consist of three pieces of white pine, 2 in. by 6 ft. by 5 ft. with pegs, 1½ in. in diameter, placed 8 ft. apart. This type of rack has proved very serviceable for quick access and easy inspection of hose. Spanner wrenches are also provided with each rack.

ORANGE CAR HOUSE.

Twenty "Underwriters" fire extinguishers are distributed throughout the building. These are placed on neatly constructed wooden shelves where they may be readily handled and are plainly visible.

A 50-gallon "Underwriters" chemical engine with hose and nozzle is also provided in the starter's and receiver's rooms, ready for emergency service.

Sixteen sets of fire pails are placed in standard racks and fastened to the walls about the barn. Each set has two round bottom 10-qt. fire buckets, one pail being filled with brine and the other pail with sand.

One of the most important and reliable appliances on the property is the auxiliary fire alarm system. This was installed and is maintained by the New York & New Jersey Fire Alarm Co. There are seven fire alarm boxes, distributed around the building, and they are connected to a main alarm box on the front of the building, and which are in turn wired up to the city's fire alarm circuit. In case of fire, an alarm may be immediately turned in from any part of the barn. In a test, a fire company reported on the grounds in three minutes after an auxiliary fire alarm box had been pulled. Two electric bells are situated in the superintendent's office, one ringing in case any of the alarm boxes are pulled and the other sounding should any part of the auxiliary system get out of working order.

From 7 p. m. to 7 a. m. a watchman's clock system is in effect. The Neuman's watchman's clock is the adopted standard, and there are 16 stations around the property where the watchman reports every hour.

Another unique and useful idea is carried out in the installation of red incandescent lamps placed over all fire extinguishers, and blue lamps over fire alarm boxes in the barn, which are kept burning during the night so that these appliances may be readily located.

Every day there are stored upwards of 100 cars in the Paterson car barn from 12 p. m. to 5 a. m., and the property has now been in service for over a year.

As already mentioned, the Paterson barn was only furnished and equipped by the Public Service Corporation, and although it represents the new organization's ideas and system as to the protective appliances, equipment, etc., it does not represent the principle that is now carried out as to shelter for operating cars. No more covered car barns will be erected for operating purposes, but cars are to be kept in open yards over night. Buildings will be erected for storage barns, offices, men's quarters and repair shops.

In all cases of permanent buildings, heavy mill construction will be strictly adhered to, as this is considered by far the best from the operator's point of view in case of fire.

For the important repairs, the cars are taken from all parts of the system to the Corporation's shops at West Hoboken or at the Plank Road shops, Newark. All minor repairs are taken care of at the auxiliary repair shops such as the one at Paterson.

Eureka Automatic Signals at Utica.

Mr. Edward Hammett of the Eureka Automatic Electric Signal Co., of Lansford, Pa., made an interesting exhibit at the New York State Convention of a complete working block, representing the block signal system of the company. Several new features were shown, and the exhibit attracted considerable attention from the delegates in attendance. Mr. Hammett states that the signal is now being used on the Utica & Mohawk Valley Ry. and the Schenectady Ry., as well as on numerous other electric roads in different parts of the country.

BY TROLLEY THROUGH EASTERN AND WESTERN NEW ENGLAND. Compiled by Robert H. Derrah, Boston, Mass. This is the library edition of Mr. Derrah's New England trolley guides, which were originally published separately, but in this edition have been combined. The work comprises 259 pages, exclusive of the indexes. It is bound in cloth boards and is voluminously illustrated with half-tone views and maps. It is unquestionably the most complete and the most attractive publication of the kind, containing as it does everything concerning New England trolley roads and trolley trips that the excursionist can possibly desire to know.

The Cleveland Electric Ry. uses the Goldschmidt "Thermit" welding process.

An Interesting Draw Bridge Built Mostly of Wood in Forty Working Days.

BY MARTIN SCHREIBER, ASSISTANT ENGINEER, PUBLIC SERVICE CORPORATION OF NEW JERSEY

On the White Line of the Public Service Corporation, between Paterson and Hoboken, N. J., there is an interesting piece of engineering work in the way of a temporary draw bridge, built over the Passaic River, at Passaic. The Passaic River is navigable at this point, and it is necessary to maintain a draw-bridge to accommodate the boats plying up and down the river. Until the severe flood of October, 1903, the tracks crossed over the County bridge. After this bridge was taken away by the high water, through traffic was discontinued, the passengers being compelled to transfer to cars on the opposite sides of the river. The people were taken over the stream in a steam launch, but later made use of a temporary bridge erected by the county, and put in service the early part of the following April.

The transferring of passengers proved to be very unsatisfactory, especially so during the winter months, and the dissatisfaction soon began to show itself by a very material decrease in the receipts of the line. A new draw-bridge was contemplated by the county authorities, but it was clear that at least two years would pass before the new draw could be put into service, and that a great deal of money would be lost by impairing traffic for so long a time. So the officials of the Public Service Corporation decided to build a temporary trolley bridge of its own, that would accommodate a single track, and on private right of way.

After serious delays in securing permits, franchises, etc., for a proposed bridge on the south side of the county's temporary bridge, work was commenced on May 4, 1904, and through traffic was resumed between Paterson and Hoboken on June 23, 1904. A lift bridge with 40 ft. clear opening, of steel plate girders, wooden hoisting frame and 280 lineal feet of pile trestle approaches, was put into working service in 50 days, in fact, it required only 40 actual working days. The total cost of steel, trestle, track, overhead work and everything to complete the bridge, was very nearly $12,000.

Fig. 1 gives a general idea of the draw as it appears when closed, or in its normal position. The white sign board seen in the picture is on the county's temporary wooden bridge, which is more clearly shown in Fig. 2, showing the draw open. Referring to the photographs, the trestle work on the left or west of the draw, consists of pile bents placed on 15-ft. centers. Each bent has four spruce piles driven to solid footing, and covered with 12-in. by 12-in. by 9-ft. caps, fastened with ⅞ x 24-in. dock spikes. Every bent is cross-braced with two 3 x 12-in. planks run in opposite directions and on opposite sides of the piles. The bracing is made fast with ¾-in. bolts to all the piles that it crosses. Alternate bents have two pairs of 4 x 12-in. longitudinal X braces on opposite sides and bolted to piles and caps. Notched over the caps are provided two pairs of 8 x 16-in. stringer timbers with 2-in. separators, joints being broken on alternate bents. The stringers are also fastened to the caps with ⅞ x 24-in. dock spikes. The ties are 6-in. by 8-in. by 8-ft. on 18-in. centers, dapped, and each spiked to stringer with two ⅝ x 12-in. spikes. Guard logs 6 x 8-in. are run along and notched over every tie. Fig. 3 gives a transverse view of trestle on the west side of the draw opening.

The trestle work on the east side of draw-opening is similar to that on the west, except that the bents that support the hoisting frame, which is the upright structure shown in photographs, consist of nine piles each, as shown in Fig. 4. The abutments for plate girders consist of 27 piles each, or three rows of 9 piles on 2-ft. centers. Over the piles are spiked three 12-in. by 12-in. by 24-ft. caps, and then over the caps are two tiers of solid flooring of 12 x 12-in. so that the finished abutments are 6 ft. wide and 24 ft. long. Fig. 5 is side elevation of abutments.

At first it was intended to construct the entire bascule span of steel, but not a structural shop could be found that would promise a delivery of the entire job in less than three months. So it was

FIG. 1—DRAW BRIDGE CLOSED

decided to build the girders out of stock steel, and construct the truss work out of wood and iron rods. On May 18th all of the bents were capped and work was immediately begun to erect the hoisting frame, which is 60 ft. high and 61 ft. long. Most of the framework was done on the ground, so that as much of the labor as possible could be avoided after the trusses were got into the air. Very nearly all of the timber used was 8 x 12-in. sticks, except those used on the curve, which were 4 x 16 cut down to 4 x 12 to get the required parabolic sweep. The entire framework consists of two pairs of 8 x 12-in. twin trusses on 15-ft. 6-in. centers, each pair of trusses 10⅜ in. apart. In constructing the curves or runs, short lengths of timber were taken advantage of to get the required curvature. Bolting the 4 x 12-in. pieces together and breaking joints made up the 8 x 12-in. finished run. In fastening the 4 x 12-in. pieces together, two rows of bolts were used, one along each edge on 2-in. centers and staggered.

All the truss members were mortised and tenoned, using a 4 x 6-in. tenon and 1¼-in. oak pins. Any member subject to tensile strain was paralleled with 1-in. wrought iron rods. The erection of the high framing over the water was greatly facilitated by making use of a pile driver and its rigging. All lumber used throughout the work was Southern long leaf yellow pine, there being 20,000 ft. board measure in the hoisting frame alone.

Fig. 5 shows the draw 11 days before the entire bridge was in service. The four curves or runs, two on each side of the hoisting frame, were re-enforced by spiking along their top surface four ¾-in. 60-lb. T-rails. The T-rails also formed guides for the counter-weights.

FIG. 2—DRAW BRIDGE—OPEN.

The longitudinal plate girders, 48 ft. 6 in. long and 3 ft. deep, are on 6-ft. centers, and weigh, complete with end girders and dead load of ties, rails, etc., 29,100 lb. Each counter-weight is a special casting 4 ft. 6 in. by 23 in., weighing, stripped, 10,000 lb., and has additional weights so that it may be increased to 11,680 lb. It was found that 10,300 lb. very nearly balanced the bridge when it was in any position. Flexible plow steel ⅞-in. cables are fastened to end of bridge and run over cast-iron sheaves on top of the frame to the counter-weights. The lower cables seen in the illustration are ½-in. flexible plow steel hauling lines, snubbed to the top of the frame and run over single blocks, fastened to the end of bridge, thence back over a snatch block in top of the truss, and down to drums of the hoisting engine in the operator's house.

The hoisting engine is of the Lidgerwood Manufacturing Co's. make with two 24-in. drums, fitted with friction hand lever and friction foot lever brakes, and is directly connected to a series motor. The foot lever brakes were connected so that both drums could be operated simultaneously in the process of lowering the bridge. The hoisting engine was one found in stock without the motor attachment. An old street-car motor was placed and connected to the hoist at the company's repair shops. The first time the bridge was raised the hauling line on one side became slack through failure of a temporary snatch block to operate perfectly. However, the bridge was so evenly balanced by the counter-weights that there was no difficulty met with in raising or lowering with a single drum and single line.

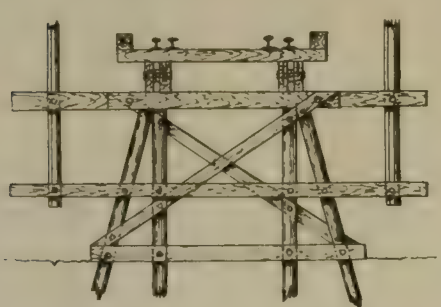


FIG. 3—BENTS 1, 2, 3, 4, 5, 6, 7, 8.

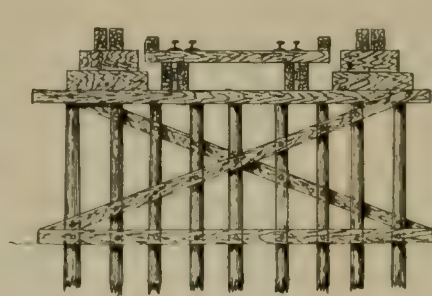


FIG. 4—BENTS 15, 16, 17, 18, SUPPORTING HOISTING FRAME.

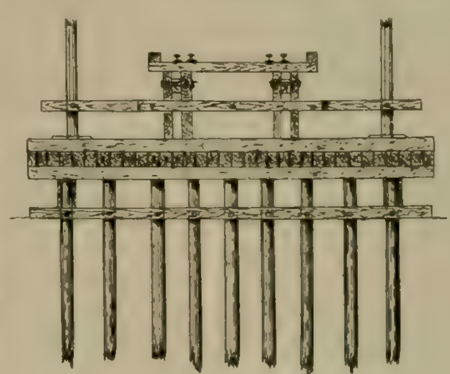


FIG. 5—BENTS 9, 10, 11,—ABUTMENT.

Several schemes were proposed for a suitable and efficient trolley wire. One that would be satisfactory when the bridge was down, and also be out of the way when the girders were raised. It was finally decided to use a small steel truss, hinged on to the wood frame similar in principle to the arrangement of the girders. Two rollers were placed on the ties at the extreme ends of the bridge, so that when it ascended the trolley truss would easily roll over the end. Fig. 1 shows the normal position of trolley, and Fig. 2 its location when the bridge is raising to accommodate a boat plying the

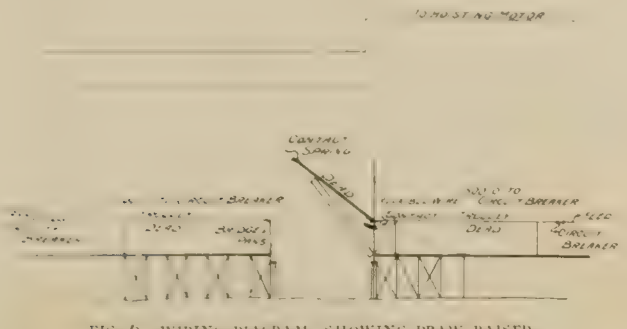


FIG. 6—WIRING DIAGRAM, SHOWING DRAW RAISED.

river. The trolley truss is 51 ft. 6 in. long and 18 in. square, made up of four 2 x 2 x ¼-in. angles, laced with ⅜ x 1¼-in. straps. One end is rigidly fastened into an open cross girder that hinges in the wooden frame. A pine board is bolted all along the bottom of the lattice truss and to this are fastened barn hangers that support a No. 00 trolley wire. Both ends of the trolley wire terminate in bridge pans. The bridge pan on the east end of trolley truss matches with a stationary pan fastened to a cross piece between the upright timbers, of the gallows frame, and the bridge pan on the west end of trolley truss likewise matches with a stationary pan, fitted to the lattice truss support. The movable trolley wire is fed from the west end by means of a contact spring, while the connection on the east end of truss is accomplished simply by means of a flexible wire

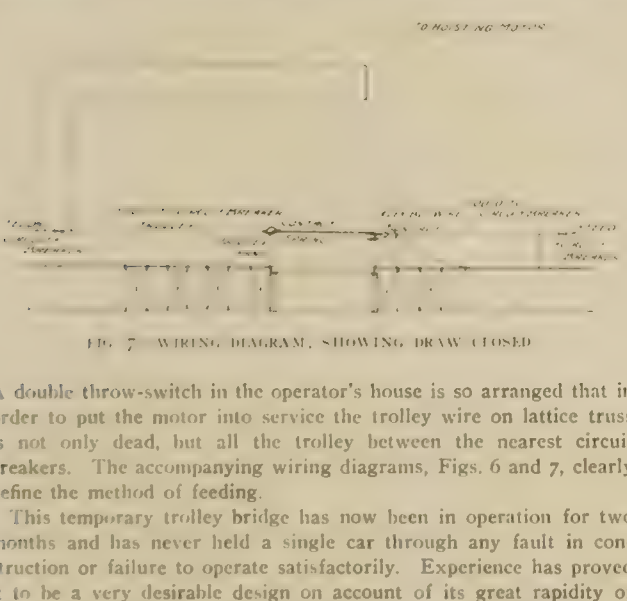


FIG. 7—WIRING DIAGRAM, SHOWING DRAW CLOSED.

A double throw-switch in the operator's house is so arranged that in order to put the motor into service the trolley wire on lattice truss is not only dead, but all the trolley between the nearest circuit breakers. The accompanying wiring diagrams, Figs. 6 and 7, clearly define the method of feeding.

This temporary trolley bridge has now been in operation for two months and has never held a single car through any fault in construction or failure to operate satisfactorily. Experience has proved it to be a very desirable design on account of its great rapidity of operation. The importance of the latter is particularly evident when it often requires 40 minutes to open and close the temporary county bridge as compared with four minutes to open and close the lift-draw.

Concessions for Car Company Employes.

On St. Louis Day at the World's Fair the St. Louis Car Co., to render the occasion more enjoyable to its employes, gave each a white silk badge, suitably inscribed, which entitled the wearer and one other person to admission for half price, during certain hours, to the following Pike attractions: Fair Japan, Cumming's Wild West, Paris, German Tyrolean Alps, Asia, Creation, Siberia.

Notes on the Work of the Electric Railway Test Commission.

BY WILL SPALDING

A very complete series of tests of the economy of various braking systems has just been concluded on the cars of the St. Louis Transit Co. This company employs a storage air system with Ingersoll-Sergeant air compressing stations and Westinghouse storage air apparatus. There are several compressing stations in different parts of the city and large storage reservoirs are carried on each car. The first work undertaken was a series of economy tests on one of the compressing stations located at the entrance of Tower Grove Park. This station furnished the air supply for the Compton Heights and Park Ave. line cars, which have terminals at this station. The equipment of the station consists of two Ingersoll-Sergeant compound air compressors connected by chain drives to two Westinghouse 500-volt motors. The cylinders of these machines are 14½ and 6½ in. by 12 in. stroke. The pressure carried is 300 lb. per sq. in. The air is compressed in storage tanks on the cars. A

TESTING TRACK NEAR TRANSPORTATION BUILDING.

water circulating system is provided for regulating the air and city water may be used direct without the radiator. The tests occupied 24 hours and several auxiliary runs were made, one being with the use of city water for cooling. Readings were taken of the temperatures, pressures and electrical quantities at each start and stop of the compressor, one machine being used. When the car was charged the compressor was stopped and the amount of air supply was measured by the temperature and pressure reading before and after charging. A careful record was kept of the air consumption of each car.

Practically all of the motormen, when they had a full tank of air under 280 lb. pressure used a great deal more air than they did after the air was drawn down during one or two trips. On the first trip the pressure was reduced about 80 lb. and on the second trip there was less reduction although the same drop in pressure would mean less actual air used. A few of the men operated very regularly and drew their air pressure down about 40 lb. each round trip of about 10 miles. It appears that considerable reduction in air consumption might be brought about by making the motormen more familiar with the operation of the braking apparatus.

These tests were followed by tests on a car using the Westinghouse system and also on one equipped with Christensen apparatus. Several seats were partitioned off in the cars and instruments were mounted on small benches. Careful records were kept of the air consumption and the method of stopping in addition to the air brake tests proper. A record was made of amperes consumed by means of an Armstrong ammeter and the speed was recorded by means of a Boyer speed recorder and also a magneto tachometer. The ammeter readings showed some interesting variations between the runs of the different motormen. With poor motormen the acceleration was entirely too fast for the comfort of passengers and the ammeter showed practically an instantaneous rise of current and

the air consumption was also excessive. With good motorman smooth acceleration was secured and the ammeter showed a curve closely approaching the ideal current curve for acceleration. The maximum current was also much smaller.

Tests of the Hunt storage battery locomotive in the court of the Palace of Electricity have been completed. These tests consist of runs with different loads and speeds, and determinations of the total tractive effort with different amounts of current and with different connections of two motors. In the last test the locomotive pulled against an 8-in. Strombaugh guy anchor sunk 5½ ft. in the ground. The pulls were registered by means of an air dynamometer designed by one of the observers. This dynamometer consisted of an air brake cylinder filled with oil with its piston connected to the draw bar by a suitable lever. The pressure was registered by means of a pressure gage attached to the cylinder and the latter was mounted on a swivel to permit of its being used on sharp curves. The tests were made on tangents and curves of 12 ft. radius.

Another interesting series of tests just concluded consists of the determination of losses in rail return with alternating current. These tests were conducted in the Bullock exhibit in the Palace of Electricity, the operating exhibit in this space being placed at the disposal of the commission. The tests were made with current varying from 25 to 600 amperes and from 10 to 60 cycles on 60-lb. and 80-lb. rails of the A. S. C. E. section; also on bar steel in various shapes and on gas pipe. The latter tests were made for the purpose of securing data for the purpose of separating the various kinds of losses occurring in the rails. The tests were conducted on a single length of rail and on account of the low voltage readings it was found necessary to use the three volt meter method of measuring power, and pressure transformers to step up the pressure for the instrument readings. A duplex cable has been run from the Bullock exhibit to the test tracks outside of the building and other experiments are to be carried on upon these tracks.

Dining Car on Aurora, Elgin & Chicago.

The Aurora, Elgin & Chicago Ry. recently introduced an innovation in street railway service in the shape of a buffet dining car which is believed to be the first attempt to feed passengers on an electric railway. The trial trip of this car was made on the evening of August 30th, on which occasion Mr. E. C. Faber, general manager; Mr. Leon T. Reinhard, traffic manager, and Mr. Charles Jones, chief engineer of the company, entertained a large party of newspaper representatives. The run from Fifth Ave., Chicago, to Aurora was made in one hour and from Wheaton to Elgin in 24

BUFFET CAR, AURORA, ELGIN & CHICAGO RY.

minutes. A speed of 60 miles an hour was attained a number of times during the trip, but the car rode as steady as a Pullman car and even the roughest part of the roadbed did not cause water to spill from the glasses.

The car weighs 42 tons complete and is mounted on Peckham trucks with extra heavy springs. It is equipped with four 125-h.p. G. E. No. 66 motors geared for 70 miles an hour. The body is 55 ft. long and is divided into two compartments which are separated by a pantry which is 6 ft. in length. The main compartment occupies about three-fourths of the car and both compartments are fitted up in a similar manner. The body was built by the Niles Car Co. and its interior is finished in weathered oak in verdigris green with cream colored ceiling. The general appearance of both exterior and interior is shown in the accompanying illustration. The tables are of the type used in ordinary Pullman cars and there are no stationary seats, all of the chairs being of wicker with cushioned

INTERIOR OF BUFFET CAR

seats. When all the tables are in place 28 people may be served at one time.

The company is putting this car in service as an experiment and the extent to which this service may be increased depends upon the patronage which it receives. At first it will be chartered by private parties and will afterwards be put into regular service if there appears to be a demand for it. It is arranged so that it may be used either as a dining car or parlor car, or one end can be used as a parlor car and the other end as a dining car.

Accidents.

August 15th two cars of the Mobile Light & Railway Co., Mobile, Ala., collided and several persons were injured, the motorman probably fatally.

August 17th in a rear-end collision at Jersey City, N. J., 15 persons were injured. Both cars were badly wrecked.

August 17th a brake chain on a trolley car of the Camden & Trenton Railway Co's. line parted near Delair, N. J., and the car was overturned; 1 man was killed and 9 persons injured.

August 17th a Colorado Ave. car of the Chicago Union Traction Co. struck a train on the Chicago Great Western R. R.; five persons were killed and several injured.

August 18th at Peabody, Mass., five persons were injured, one probably fatally, in a head-on collision between two trolley cars on the Boston & Northern Street Railway Co's. Wakefield branch.

August 22nd in a rear-end collision between cars of the Creve Coeur division of the St. Louis Transit Co., 19 persons were injured.

August 24th, between 30 and 40 persons were injured in a head-on collision on the Rochester & Eastern Rapid railway. The accident was due to the overlooking of orders.

August 28th, 21 persons were injured in street car accidents in St. Louis; in one case a Jefferson Ave. car left the track on account of a misplaced switch and in another an Olive St. car and suburban car collided.

August 26th, two Public Service Corporation trolley cars collided in Passaic, N. J., and some 20 persons were injured.

September 6th eight persons were injured in a collision between two trains on the Lake Street Elevated railroad, Chicago, caused by a misplaced switch.

September 1st at Butler, Pa., a runaway car on the Butler Passenger Ry. crashed into another car at the foot of an incline and fifteen persons are reported injured.

September 3rd a Wabash passenger train struck a suburban trolley car at the Sarah St. crossing, St. Louis, and 7 persons were killed and 19 injured.

Some New Ideas in the Pleasure Resort Business.

BY RICHARD KANN, VICE PRESIDENT AND GENERAL MANAGER THE WHITE CITY, NEW HAVEN, CONN

About twenty-five years ago a man in Boston conceived the idea of building an amusement device at the end of the street-car line. He believed that if the attraction were free the street-car company would be willing to pay him a percentage of the increase in receipts resulting from the free attraction at the end of the line. The idea was tested and found to be profitable to the promoter and the street-car company. From that time until now, the idea has been gradually developed, although it has not by any means been completely worked out.

From Boston the man with the idea went to other cities and for some years had no competition of any sort. Later the free amusement idea gradually sheered away until amusement managers built summer resorts wherever the transportation facilities were sufficient to carry paying crowds to their resorts during the hot weather, and expected nothing from the trolley companies except front board advertising and competent service. The success of this kind of summer amusement business has also been demonstrated in Boston, where Revere Beach, 4,000 ft. long, supports eighteen independent amusement games. Nantasket has a fairly good assortment of amusement devices, and Point of Pines supports a summer theater and a few minor attractions. All of these are owned and controlled by individuals who are not interested in the transportation companies which run to the resorts.

In Pittsburg, Philadelphia and other cities the street railway companies have assumed direct management of the pleasure resorts, depending more largely upon their increased trolley business than upon the earning capacity of the parks themselves for financial returns. In San Francisco the stockholders and directors in the street car companies are also stockholders in the amusement resorts, which is also the case in many of the larger cities. But a majority of cities are without a resort of sufficient size to be self-supporting unless helped by an arrangement with the railway company.

New Haven, Conn., is the first city in the United States to support the newest idea in regard to summer amusement resorts and one which has never before been successfully operated. There is near New Haven a resort called Savin Rock which has a shore front, a summer theater, a number of small booths containing picture galleries, shooting galleries and fortune tellers. The trolley company gives balloon ascensions at intervals, band concerts, and from time to time aerial acts to attract crowds to Savin Rock.

This season a corporation headed by New York amusement men was formed and a complete summer amusement resort was built upon four acres of ground adjacent to Savin Rock Grove. Fifteen amusement devices were installed, including Shoot the Chutes, Scenic Railway, Circle Swing, Miniature Railway, Laugh

VIEW OF THE WHITE CITY FROM THE TOP OF THE CHUTES.

ing Gallery, Dancing Pavilion, Fairy Theater, Electric [illegible] and a number of smaller devices found in the average summer resort. The site was enclosed by a high fence and concrete walks were laid. The buildings erected were all of the same style of [illegible] architecture, painted with white enamel, and 12,000 incandescent lights were used for illuminating purposes. When the resort was opened the trolley business from New Haven proper was not only increased, but an enormous patronage from nearby towns which had populations aggregating 600,000 resulted.

By placing this park under a single management the great element of danger ever present in summer amusement resorts was eliminated. By installing several free attractions and giving open-air aerial acts, the owners of the park, which is known as The White City, were able to charge an admission fee of 10 cents. A police force was installed with positive instructions to eject disorderly and disreputable persons of both sexes. This resulted in obtaining almost instantly a reputation in decided contrast to most summer amusement parks, and in drawing a class of patronage which had never before been possible in that neighborhood. This feature of the summer amusement business is one that needs more careful consideration than perhaps any other.

In amusement parks without an enclosure, in which individual owners build devices of one description or another, the element of unfairness is apt to enter into their business transactions. A majority of the men who enter into the summer amusement business in a small way, and move from one park to another, or from one fair or carnival to another, as the case may be, are too often unscrupulous in their dealings. They do not hesitate to "short change" their patrons, or to operate games of chance in a manner which is disgusting to the public. And the history of summer amusement resorts has shown that no matter how favorable the opening of the first season has been, that wherever promiscuous management has prevailed, the second year's business has fallen off greatly and the third year the better class of patronage has been entirely lost. Therefore it seems extremely probable that in the future corporation management will prevail and more expensive and more complete resorts will be built.

Many failures in places of this kind have resulted through the inability of those concerned to select the most profitable amusement devices. In this connection there are three principles that should invariably be observed. First, the element of speed; second, the degree of safety, and third, the earning capacity as compared to the cost of construction and operation. The element of novelty, as is generally believed, is of very little consequence. The Merry-go-Round is one of the best examples of this fact. It has been in existence for 30 years and its earning capacity is as great this season as ever. This is because it is an amusement that appeals to children, and there will always be children. The first Merry-go-Round cost approximately $50. One was built last season at a cost of $150,000.

ARTIFICIAL LAKE AT THE WHITE CITY USED FOR SHOOT THE CHUTES AND OTHER AQUATIC ATTRACTIONS

A properly constructed Scenic Railway, which would cost not less than $18,000, has the next longest lease of life. The element of speed is accountable for the large patronage it always secures when properly located. It is an absolutely safe ride and it appeals to people of all ages.

The life of a Shoot the Chutes, on the other hand, is approximately three years. It is usually a short ride, a very fast one, and perfectly safe. A Scenic Railway, running four trains, with a capacity of 16 people to a train, should make a round trip in two minutes and five seconds. This gives it an earning capacity of approximately $1,400 per day. A Shoot the Chutes costs $15,000, and working ten boats should earn $900 on crowded days.

The Old Mill, an amusement device which has become quite popular in the last four years, provides a ride in boats through a sinuous canal, along the sides of which scenic effects of many different sorts are built, some of them showing plantation scenes with darkies singing, and others, arctic effects with glistening pinnacles of ice. The large mill wheel keeps the water at an elevation which allows the boats, containing six or eight people, to make the trip in three minutes. This device costs from $10,000 to $16,000, according to the length of the canal and the outside appearance of the building, and will easily earn $1,000 per day.

The Great Coal Mine, which, instead of canals, has tracks through papier mache tunnels and stopes, painted and decorated to represent the interior of a coal mine, and containing many wax figures of miners and mules, has an earning capacity of $1,600 per day. Its cars, containing 12 people, are carried by cables up two inclines and make the return trip on a gravity run. The first coal mine built in this country, at a cost of $12,000, made a net profit of $22,600.

A device new with last season is the Circle Swing, an apparatus consisting of a steel tower about 60 ft. in height, from which, on cross-arms, are suspended wicker-work cars seating from eight to twelve people. The cross-arms at the top of the tower are so arranged that they revolve horizontally on a center shaft operated by a motor, the cars being free to swing outward by centrifugal force as the speed increases. When taking in passengers the cars almost touch the ground at the base of the tower, and as the speed increases they swing outward until they attain a height of approximately 16 ft. above the ground and a corresponding distance from the starting point. Six cars are used, with a capacity of from four to twelve persons each, the trip requiring approximately five minutes. This device is absolutely safe and depends largely upon the element of speed for its patronage.

It would seem that with the tremendous earning capacity of successful devices, so well known, that each season would bring forth a number of new things. Amusement managers realize that the inventive minds of a great many people are at work upon these effects, but the dearth of really good ideas is remarkable. Those who spend their time in working out ideas for summer amusement resorts appear to strive for the element of novelty, which is not essential, and to overlook the cost of construction and the earning capacity. The Loop-the-Loop may be mentioned as a fair example of this phase of the question. Many "Loops" were built, but few are still running. It contained the element of speed without that of absolute safety, with a limited earning capacity. It was an extreme novelty, but it was not a repeater. A person who took one ride seldom took another.

The attractions which have been described may be designated as the outdoor features. The indoor features should also form a large percentage of the attractions of a complete resort. This, because the sun does not always shine, and it is not always hot. The old familiar vaudeville bill in the summer theater is still holding forth in many parts, but as a strong drawing card it is beginning to decrease gradually. The little opera company has proved to be a bad investment and the ordinary band of 15 or 17 pieces fails to draw very largely. There are, to replace these, attractions like the Johnstown Flood, a mechanically operated scenic effect showing the flood in miniature exactly as it occurred, which has proved to be very successful. This production is shown on a stage and consists of sections of steel scenery ranging in height from 2 ft. to 10 ft., according to the perspective. But in arrangement of new electrical cloud and rain effects, together with some almost marvelous sky lighting apparatus it is possible to produce a reproduction of the flood so vivid and so realistic that the performance has proved to be a very strong repeater. The Galveston Flood and the Fall of Pompeii, both of which are developments of this idea, have also proved to be tremendous money-makers. The entire production is operated by one man located in a switch room, so that from 10 to 20 performances may be given daily at very little expense, aside from the cost of light and power. Other mechanical devices, like a Trip to the Moon and the Submarine Boat, have never yet been known as losing ventures. But productions of this sort are only profitable where a considerable portion of the attendance is largely transient. It is necessary, in resorts where local patronage is largely depended upon, to change the bill frequently, [illegible] of the attraction of a mechanical nature.

Good music by an orchestra or band with a national reputation always draws, a fact which is demonstrated in one of the large cities, in which a trolley company expends about $42,000 each summer for music alone.

Under the head of free attractions also must come something that appeals to children. Last year the most successful of these was an apparatus known as the Down and Out, consisting of a large cylinder containing a spiral slide made of polished bamboo, from which there was scarcely any friction and no slivers. It was a laughter-provoking device and one which invariably made a crowd good natured, in which condition a crowd is always ready to spend money. This season the Chilkoot Pass produces the same effect, except that those who slide may be seen by the crowd, which was not possible with the spiral slide, except at the point where they slide out upon the pad through an opening at the bottom. The Chilkoot Pass has an incline of about 50 degrees. It is made of maple, set with the grain running towards the bottom to prevent slivers; it is 30 ft. wide and 50 ft. in length. At irregular intervals along the surface of the slide polished maple bumps are

THE CHILKOOT PASS AT THE WHITE CITY.

set. The small bumps are 3 ft. and the large ones 6 ft. in diameter at the base. They resemble slices cut from the surface of a polished maple ball about 10 ft. in diameter. They serve to change the direction of those who slide and to give them a series of quick bumps which lands them at the bottom on a pad in a more or less reckless and excited condition. The Chilkoot Pass, as built at The White City, has 12 bumps, which cost $400 to build. The balance of the incline and the frame work cost approximately $400 more. With a careful selection of the amusement devices mentioned, and with a proportionate population to draw from, amusement resorts of this character make a tremendous profit upon investment. There are very few complete resorts now in the country, and their receipts have shown a profit of from 80 to 100 per cent per annum on the investment. On the other hand, those resorts which consist of a number of amusement devices owned by separate individuals and not under single management deteriorate from year to year, and it may be safely predicted that within the next few years every large trolley company will arrange to have along its lines, a complete resort operated by a single individual or corporation.

The Illinois Tunnel Co., Chicago, has leased for 99 years from the Northwestern University a tract of 118,000 sq. ft. on the south branch of the Chicago River as a site for one of the power houses of the company.

Hydraulics in Connection with Electric Railway Work.

BY B. F. MORROW, MANAGER OPERATING DEPARTMENT, HUDSON RIVER WATER POWER CO., GLENS FALLS, N. Y.

The question of hydraulics in connection with the electric railway is one that has received considerable thought and attention, especially during the past ten years, when such wonderful strides have been made in long distance power transmission systems. Previous to that time, most of the trolley roads that were in operation were supplied with power generated by their own steam plants; except in rare cases where water power was available. But with the development of the power transmission business, water power companies found a new market for their supply and trolley companies were quick to realize the many advantages that water power possessed over steam power. The principal advantages of water power for this work are as follows:

1. A great saving in the cost of power.

2. Steady and reliable service and immunity from long interruptions or shutdowns.

3. It allows for the practical distribution of high voltage current to several sub-stations along the line for use on interurban work, superseding the plan of generating power at several independent steam plants.

It is quite unnecessary to go into details on the subject of the saving in the cost of water power as compared with steam power as these costs are already well known to be greatly in favor of the water power.

In order to maintain the second advantage, i. e., steady and reliable service, special consideration must be given to the installation of the apparatus, as in designing a hydraulic plant intended to furnish power for electric traction purposes one of the most important matters to be considered, next to the question of continuous service, is that of regulation. It cannot be expected that the railway company will operate satisfactorily and high speed interurban schedules be maintained unless a steady and reliable source of energy is supplied at all times; especially so when a large number of trolley lines parallel steam roads and so much attention is being paid by financial interests to the comparison between steam and electricity that too much attention cannot be given this important point. It is practically impossible to take care of the voltage regulation by the hydraulic governors alone as a number of important points have to be considered.

Under regulation the first point to receive attention is the regulation of the generators and transformers in the power station; second, is the line loss (a variable quantity depending on current delivered) which is always variable in street railway work; third, the regulation of the rotary converters and stepdown transformers used in connection with them; fourth, the direct current feeder losses. To take care of these it is necessary to have, in addition to hydraulic governors at the generating end of the line, a voltage regulator with a compounding device installed at the receiving station.

Hydraulic governors should be so designed and adjusted that the speed variation should not be more than 5 per cent when a part or the whole load is suddenly thrown off, and racing at no load should be entirely eliminated. If this latter defect is present, time is lost in restoring current to the system in case of an interruption; especially if the generators should drop out of phase. It is also a difficult matter to phase in rotary apparatus on the system if the frequency is unsteady. Governors can be adjusted too sensitively and can be made to operate on the slightest change of load, but the result of an adjustment of this kind is an increase in the maintenance cost of gears and water wheel parts such as are necessary to move the gates as they are working continuously. The speed variation limit given would seem perfectly satisfactory for any first class system.

In discussing a plant for this class of work, it is not deemed necessary by the writer to treat on the subject of the type of water wheel that should be used or the location of it, as this is always governed entirely by local conditions. It might be well, however, to say that the racks in front of the water wheels should have a gradual slope instead of being set perpendicular, as this will assist materially in cleaning them and removing ice and debris.

The racks platform should be enclosed by a house built down to the water's edge and should be heated during the winter months, as by doing this a considerable saving is made in the cost of labor, one man being able to do more work when he is protected from the inclemency of the weather than four men could if they were not.

Head gates for shutting off the water from the water wheels should be provided so that regular inspection can be made of the wheels from time to time, and necessary adjustments made that will not only lengthen the life but also increase the efficiency of the wheel.

If intake tubes are used from the head race to the water wheels, relief valves or stand pipes are necessary to relieve strains on the penstock and it seems a good idea to adjust the governors so that they will not close the gates entirely, but will close them to say 1-10 opening, thereby assisting materially in cutting down the strain on the penstocks to a minimum, as with a trolley load the variations have been as much as 100 per cent. It is, therefore, necessary to cut down water hammer effect to a minimum as when a large body of water is checked instantly, the strains to which the penstock is subjected can be readily imagined.

Generators and high tension transformers of any standard make have been so simplified that scarcely any trouble need be expected from this source, although extra coils for both should be carried in stock and facilities provided for repairs. On potentials over 25,000 volts, from experience, it would seem that the oil cooled transformer has some advantages over the air blast type, and special precautions should be taken in the transformer room to separate the transformers so that in case of fire or a short circuit, the trouble can be confined to one transformer and the necessary apparatus should be at hand to extinguish any fires.

Switchboards for this work should have the simplest and fewest number of switches and measuring instruments, installed at the generating station, and all metering should be done on the low tension side. The idea of installing all sorts of special meters and having the operators read them at short intervals does not mean much in the way of records and if the operator is giving more of his time than is necessary to his meters and switchboard readings, he is neglecting more important matters in connection with the operation of the plant. Recording instruments should be used where it is possible to do so, and while as a record they are not always accurate, they accomplish a great deal of good as a check on the operator and if a sub-station attendant should complain of anything out of the ordinary, it is easier to locate the trouble by use of the recording instruments than in any other way.

Too much attention cannot be paid to the arrangement of the high tension wires entering or leaving the power stations, and more delays and shutdowns have been caused in power stations by faults in this arrangement than by all other troubles combined. In leaving the station, the wires should be far enough apart so that in case an arc is established there will be no danger of the arc whipping up through the second circuit and interrupting the entire plant. Circuits should also be separated so that repair work or changes can be made on any one circuit while the others are energized or in use. This same point applies to sub-stations and many interesting and instructive papers have been written on this subject.

In handling the current at the receiving end of a long distance high transmission system, several points must be taken into consideration.

The use of synchronous apparatus makes it essential that the frequency be kept as nearly uniform as possible, therefore the question of a storage battery at the receiving end, is one that should receive special attention. The battery should be of such capacity that, in case of an interruption to service on the high tension line, it can take care of the more important lines on the trolley system for a few hours. In cities, where trolley lines cross steam roads at grade, it is an excellent idea to section the trolley line and have that section of line directly over the crossing fed directly from a storage battery

floating on the system. Where there are from eight to ten tracks at the crossing a motorman might be obliged to stop his car on the third or fourth track in order to save the life of some pedestrian and if the power on the high tension system should be suddenly interrupted, and no storage batteries were on the system, the trolley car would be left on the railway crossing exposed to the danger of a collision with express trains, whereas if a storage battery were in use, as indicated, an accident of this kind could be avoided. In some instances the steam roads enter and cross city streets at sharp curves and air brakes could not prevent an accident in case the trolley were stalled.

The storage battery could also assist in taking care of the peak loads. In some railway plants it is claimed to be good policy and cheaper to use steam power to assist the water power on peak loads (when storage batteries are not installed) but in case of an interruption at the hydraulic plant or on the transmission line, from ten to fifteen minutes would be required to start the steam plants and a total interruption would occur, unless the engine were running at the time the trouble occurred. With a storage battery, in a case of this kind, no time would be lost and a total interruption would be avoided.

The rotary converter itself, by means of its series or shunt field, can be adjusted to compensate for line losses by varying its power factor and in well designed machines no hunting is noticeable with a leading current as high as 5 per cent and where a number of sub-stations are on the same high tension line, the fields on the rotaries in one sub-station can be adjusted to compensate for losses in lines that feed other stations. It must be borne in mind, however, that where storage batteries are used and where one sub-station is run to feed other stations from the storage batteries, or in other words, when the rotaries are running inverted, the series field on the rotary should be cut out of circuit, as it will receive its current in the opposite direction and will have a tendency to demagnetize the field; it will practically have the same effect as a shunt motor running without a field. Speed limiting devices to operate the circuit breakers on the direct current side are extremely important and should be installed in every case.

The most important part of the hydro-electric transmission equipment is the pole line. The success of any power transmission system is in a multiplicity of circuits, and, if possible, separate pole lines over separate routes from generating station to sub-stations. This, of course, is not always possible and where two circuits are run on one pole line, in case the pole is struck by lightning and consumed, both circuits are interrupted and as a result a serious delay occurs, whereas if the two circuits were on separate and distinct pole lines the possibility or danger of a total interruption is rather remote. However, when two circuits are run on the same poles, it is good practice to run them in multiple as it cuts down the line loss and where time limit relays are installed on generator switches and instantaneous relays on the lines, in the event of trouble on the lines, the line that is in trouble will open while the other will not be interrupted. A sudden short circuit on one line might cause the voltage to drop on the system enough to throw the rotaries out of step and in this case a complete interruption would occur. When one stops to think that the generators, transformers and water wheels, also the receiving aparatus are carefully housed, while the transmission line is exposed at all times to wind, rain, sleet and snow and a variation in temperature at times from 30 degrees below zero to 90 degrees above, the strains to which the best constructed lines are subjected are apparent. The cross arms should be carefully inspected before painting. The pole specifications should be rigid and exacting and all poles that are below standard should be rejected, as one poor pole in 25,000 may cause a total interruption to the service. The question of suitable insulators is one that should receive special consideration and all of them should be examined and carefully tested before leaving the premises of the manufacturer and should be again examined and tested before they are installed on the transmission line.

Where the service is interrupted on a trolley system at frequent intervals, the public soon begins to lose confidence and years of good work may be injured by some slight mishap on the pole line that could have been avoided if more care had been taken in the construction of same. If trouble occurs in the central station or sub-station, available help is always at hand to remedy the defect, while on a pole line, a repair or emergency man may have to ride or walk ten miles to discover the trouble and then take some little time to make repairs.

In securing rights of way for a high tension line, consideration should be given to nearby trees and a clause inserted in the agreement giving the power company the right to trim trees from time to time, or from year to year, as some trees, such as the willow, grow very fast. The original right of way may have been obtained from one who has since sold out, and if the right to trim trees is not stipulated in the contract the new owners will make demands that will increase to a certain extent the maintenance charges on lines.

All telegraph and telephone lines should run under high tension lines as there is little danger, with size of wire and methods of construction used on high tension lines, of the wires breaking and dropping into the telephone or telegraph circuits. All high tension lines, where crossing other wires, should be protected by suitable nets underneath. This should also apply to railroad and other important crossings. The nets should be of such construction that it will be impossible for a large quantity of snow to settle on them, as if this were to happen and the snow were followed by a rain and then the entire mass frozen, a high wind upon the extra large surface exposed might cause swaying and break the poles or wires at the place the nets are used.

Special precaution should be taken in guying poles and high tension lines should be spaced so that there will be little or no danger of twigs or limbs blowing across the wires. It is considered good economy to make cross arms longer and exceed if possible the standard recommendations on distance between wires.

The private telephone is a necessary adjunct to both trolley and high tension systems, as it enables the operators on the cars or in the stations to always keep in touch with the chief operator and in case of line trouble on either high tension or direct current sides of the system, to make repairs and notify chief operator so that current can be restored without delay. On the high tension system where the private telephone runs on the same poles with the transmission line, the telephone leads should be brought down at regular intervals so that line inspection can be simplified and the patrolman can communicate with headquarters and in case of an accident he can be located and started on repair work. The telephone line should be transposed frequently so as to prevent induction and the instruments should be specially insulated so that in case of a ground on the line the person using the telephone could not be injured.

Where it is possible horseback patrol seems to give the best satisfaction, although in some cases walking is necessary.

A very serious problem in connection with any high tension distribution is that of lightning. The various arresters on the market are fairly efficient and do good work on comparatively low tension, but when the potential of the line exceeds 15,000 or 20,000 volts they do not work as well as on lower voltages, either presenting too great obstacle in the path of the lightning discharge or too little resistance to the working voltage. When a heavy discharge occurs, even if no damage is done to the apparatus, it tends to put a momentary short circuit on the line, opening the high tension breakers and interrupting the system. If the resistance of the arresters is sufficiently high to prevent enough current following the discharge to open the breakers it is apt to impede the passage of the discharge to such an extent as to cause it to damage the arresters or ground through some of the other apparatus.

It is possible that a trolley wire running parallel with a high tension line would afford some protection to the latter as the trolley supports would afford an easier path to ground than the high insulation of the transmission line. Also, along this same line, a wire run along on the pole tops or on the ends of the cross arms and grounded at short intervals should afford protection from lightning. While it may not always save apparatus in stations, it certainly protects the poles and the arresters on the end of the lines are expected to protect the apparatus, and should also take care of excessive rises in voltage due to resonance or other causes.

The future will certainly see remarkable advances along these lines and the possibilities of the repulsion motor for railway work will certainly open new fields for the engineer. Although it is difficult to predict with any degree of accuracy what the future holds in store for us it seems fair to assume that it will not be many years before the steam locomotive, that has done such excellent work, will be replaced by electricity, that wonderful agency that has wrought such changes in a few years.

Electric Railway Liability Insurance.

[illegible]
MASS.

Upon the organization of any new corporation one of the first questions discussed by the board of directors is that of insurance, and it is customary to delegate this matter of insurance to one of the officers of the company whose duty it is to see that policies are promptly placed with responsible companies covering the risk of both fire and accident.

In their early history, street railways were no exception to this custom and it was considered quite a "matter of course" to carry both fire and liability insurance. Today, so far as I know, there is not a reputable company, either foreign or domestic, that will issue a policy of liability insurance to a street railway company to cover the passenger and public hazard. There must be some excellent reason on the part of the casualty companies for refusing to accept this class of insurance. It cannot be that they have business enough without it. They are scouring the country with their army of agents looking for business. On account of the large premiums, and correspondingly large commissions, tremendous pressure is being brought to bear by the agents, and yet all the companies uniformly decline to accept this class of business, even though offered at rates that would seem almost prohibitory to the insured.

Within the last five years, at least two casualty companies making a specialty of street railway insurance have failed. They were stock companies, incorporated with abundant capital, and in each instance they assign as a reason for their failure, the street railway business. The mutual companies have entered the field, some organized exclusively for insuring street railways, and yet, in a few years, they have all met with disaster—not from any lack of business, for the street railways have been more than anxious to insure and have been ready to pay almost any rate. What is the reason for the continued failure of this class of insurance, while other lines, seemingly more hazardous, are carried with apparent success? The answer to this question at first advanced by the casualty companies was that there had not been sufficient experience to arrive at a proper rate or to fix the limit of liability, but that objection can hardly obtain at the present time, for it has been at least fifteen years since insurance of this character was first written, and thousands of policies have been issued at rates varying all the way from one-quarter of one per cent to ten per cent of the gross receipts. Is there not some practical solution of this important financial proposition?

The mutual companies have come nearer to making a success of this work than the stock companies. They have been carefully and economically managed; the claims have been promptly and wisely adjusted, the extreme hazard on account of great disasters has been protected by limiting the extent of liability; the rates have been reasonable and at the same time adequate; but the weak point has been, in every instance, the short term for which the policies have been written and the freedom allowed the railway companies in the matter of cancellation.

The history of these mutual companies has been briefly as follows: They start out with a few companies, say ten, and gradually grow to fifty or sixty, with annual premiums aggregating $100,000; everything runs smoothly for a year or two and then there is a head-on collision in which a large number of persons are badly hurt and some killed; perhaps a succession of two or three such accidents occurs within a year, and now mark the result.

The companies that have not had any bad accidents, anticipating disaster, begin to "duck" and send in their requests for cancellation; the premiums cease—in some instances have to be returned to the insured—and the insurance company goes to the wall, not because of accidents, but because its income is suddenly cut off and the numbers dwindle below the safety point; whereas, if the insurance company were given an opportunity to recover itself by the constantly recurring premiums, the law of average would soon assert itself as in other lines of insurance and the business would again resume its normal condition.

As a remedy for these existing conditions, I have the following plan of insurance to suggest for the consideration of street railway men:

Incorporate a company upon a plan similar to that adopted by the New England Fire Mutuals, the sole business of which shall be the insurance of street railways against damages arising from accidents. Do not issue policies until at least fifty carefully selected roads have been secured; establish a rate of ten per cent of the gross receipts, half of which shall be placed in a reserve fund and so invested that the profits shall revert to the companies insured, in the form of quarterly dividends. Make the term of insurance five years and withdraw from the companies insured the privilege of cancellation. Keep the reserve fund absolutely intact. If the active fund, out of which are paid the claims and expenses, becomes dangerously depleted, issue a small assessment of a quarter to one-half of one per cent to make up the deficiency, and in successful years issue at stated periods small cash dividends so as to preserve an equitable average, and I am fully convinced, from a careful study of this question extending over many years, that street railways can be safely and profitably insured at a rate that will average from year to year not less than three, and not more than five, per cent.

A company organized on such lines, with a fixed and substantial surplus, would strongly appeal to the smaller street railways that cannot well afford to maintain a thoroughly well-euipped claim department (and none other is of any use) and supply a much needed adjunct to the successful management of electric railways throughout the country.

Limited Service on the Indianapolis & Northwestern.

The Indianapolis & Northwestern Traction Co. on June 1st established a limited service reducing the time between La Fayette and Indianapolis, 69 miles, to two hours and thirty minutes. The regular schedule is three hours and fifteen minutes. Of the distance, 69 miles, 6½ are within the city limits where high speed is not practicable. The maximum speed made by special cars is about 62 miles per hour.

Four trains are operated each way per day between La Fayette and Indianapolis and between Crawfordsville and Indianapolis. The limited cars leave Indianapolis for La Fayette at 8:10 and 11:10 a. m. and 2:10 and 5:10 p. m. Returning they leave La Fayette at 8:00 and 11:00 a. m. and 2:00 and 5:00 p. m. The limited cars for Crawfordsville leave Indianapolis at 8:45 and 11:45 a. m. and 2:45 and 4:40 p. m., the leaving time from Crawfordsville being 8:05 and 11:05 a. m. and 2:05 and 5:05 p. m. The excess fare charged on limited cars is 20 cents from La Fayette to Indianapolis, 15 cents from Frankfort, 10 cents from Lebanon and 5 cents from Zionsville, these being the only stops made for passengers. The single one-way fare on the Northwestern line is based on the rate of 1½ cents per mile. Round trip tickets are sold at the rate of 1⅓ cents per mile, and the rate of the mileage books is 1¼ cents per mile. The general manager of the company, Mr. C. C. Reynolds, is very much gratified with the result of the special limited service, these cars being very popular with those having to make the through trip.

Free Newspaper Delivery.

The Indianapolis & Cincinnati Traction Co., for the accommodation of persons living near its line, and also as a courtesy to the newspapers, has undertaken the free carriage of newspapers on its cars. The papers must be properly wrapped and the package bear one of the company's free delivery stamps. The stamp is one inch square, gummed on the back and has printed on it in red the words "Free Delivery" and the company's trade mark. At the present time the number of newspapers thus carried is not so great as to cause inconvenience. Should the demand for this service increase, however, it will be necessary to make a charge for it commensurate with the service.

Pennsylvania Meeting Postponed.

We are advised by the secretary of the Pennsylvania Street Railway Association that the 1904 meeting of that association has been postponed until the regular meeting time in September, 1905. This seems to meet with the approval of all the members, inasmuch as so many of those interested are planning to visit St. Louis this fall.

EVANSVILLE & PRINCETON TRACTION CO.

MUNCIE, HARTFORD & FT. WAYNE RY.

Distinctive Devices for Electric Railways.

A number of electric railway companies have followed the example of the leading steam railroads in adopting distinctive designs or trade marks for use in advertising literature, on letter heads and for marking cars and other property of the company. The advantage of using such a device, especially if there can be incorporated with it a short name as a substitute for the longer corporate title of the company, is quite as great for an electric railway as for any other transportation company.

The tendency is to shorten the name by which a road is to be known to the public, and there are today thousands of persons who patronize railroads a great deal and know them by the short names but who have only vague ideas as to the complete titles. Travelers who are familiar with the "Monon" and the "Big Four" would probably have difficulty in giving the full names of these companies, and especially in saying whether they are railways or railroads. Other roads have adopted a part of the corporate title by which they preferred to be known. The New York Central, the Lake Shore, the Santa Fe, the Rock Island, the St. Paul, the Northwestern, and the Burlington are examples of these familiar to everyone.

We illustrate herewith a number of the devices which have been adopted by prominent electric railway companies. That of the Detroit United Ry. was chosen as being the best design submitted in a prize competition instituted something more than a year ago. This device is used in various sizes for prominently marking the advertising literature of the company, for its letter heads, business cards of employes and in marking property of various kinds.

The Eastern Ohio Traction Co., whose road is otherwise known as the "Maple Leaf Route," has a maple leaf bearing the letters "E. O. T." on a background of dark blue as its distinctive mark.

The Grand Rapids, Grand Haven & Muskegon has for its trade mark a perspective view of the front of one of its cars with the initials G. R., G. H. & M. enclosed in an ellipse bounded by three lines to represent the track and conductor rails, with ties radially spaced. This device is shown in red on the letter heads of the company.

The Evansville & Princeton Traction Co., of Princeton, Ind., has recently adopted a design very similar to that of the Grand Rapids, Grand Haven & Muskegon road. The difference is that the car occupies the dexter instead of the sinister side of the escutcheon and the border shows but two rails, this being an overhead trolley line. The color as used on stationery is red.

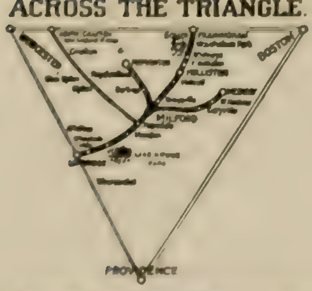
The Ft. Wayne & Southwestern Traction Co., which parallels the old Wabash & Erie Canal, has adopted the name "Canal Route," displayed on a scroll which also bears the monogram of the company. An objection to this design is the fact that the monogram, although artistic, is not legible and is difficult to read for one who does not know that the "Canal Route" is the Ft. Wayne & Southwestern Traction Co.

The Aurora, Elgin & Chicago Railway Co. has a device which is very appropriate, consisting as it does of a winged wheel, aptly

AURORA, ELGIN & CHICAGO RY.

PUBLIC SERVICE CORPORATION OF NEW JERSEY.

INTERURBAN RY., DES MOINES, IA.



MILFORD, HOLLISTON & FRAMINGHAM STREET RY.

PEORIA & PEKIN TERMINAL RAILWAY.

EASTERN OHIO TRACTION CO., CLEVELAND.

FT. WAYNE & SOUTHWESTERN TRACTION CO.

MAHONING VALLEY RAILWAY CO.

LACKAWANNA & WYOMING VALLEY RY.

conveying the idea of high speed on wheels, displayed in a circle together with the name of the company and an ornamented scroll. On the letter heads this device is printed to show white letters on a background of light green.

The Inter-Urban Railway Co., of Des Moines, Ia., has the letters "I U" displayed as a monogram in white on a circle of blue, the letters "RY CO" being added in smaller size.

The Mahoning Valley Railway Co. was among the first to adopt a trade mark. This consists of the letters "M V" in white on a black square, the square enclosed in a circle which is cross lined diagonally

GRAND RAPIDS, GRAND HAVEN & MUSKEGON RY.

INDIANAPOLIS & CINCINNATI TRACTION CO.

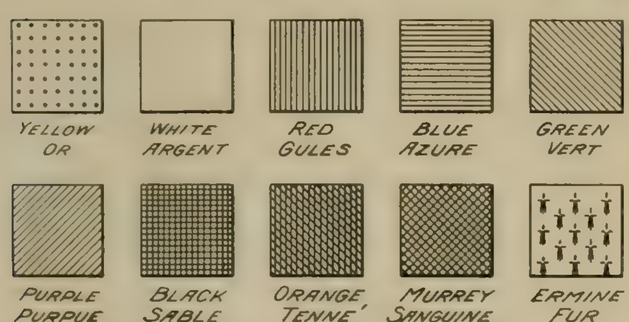
from the left top to right bottom. This design has been abandoned, the old Mahoning Valley having been merged in the Pennsylvania & Mahoning Valley Ry.

The Boston Elevated Railway Co. uses on its letter heads the corporate seal, bearing the company's name and the date of incorporation.

One of the happiest designs is that adopted by the San Francisco, Oakland & San Jose Railway Co., otherwise known as the "Key Route." This company serves Oakland, Piedmont and Berkley with a double track line extending down to the bay and over a long pier to the ferry slip. The appropriateness of this design is apparent upon reference to the illustration, the ferry terminal building lending itself readily to the outline of the key wards.

The trade mark of the Public Service Corporation of New Jersey consists of a black triangle having a white border and bearing the word "Public" in white letters, placed partly over and partly under a circle, which is red in color, with the word "Service" across the lower part in black letters. In the reproduction of the design red is indicated by a vertical shading and black is shown solid.

The Lackawanna & Wyoming Valley R. R. has as its device three



THE PRINCIPAL TINCTURES USED IN HERALDRY.

(The metals are gold and silver, represented by yellow and white; the colors are seven in number; there are various other furs besides the ermine shown.)

T-rails with the bottom flanges placed together in the form of a triangle, encircled by a laurel wreath and bearing the words "Laurel Line" and the initials "L. & W. V." This device is used in various colors, among which are red and green. The three rails for a third-rail line is very appropriate.

The Milford & Uxbridge Street Railway Co. owns and operates the Milford, Holliston & Framingham Street Ry. and has for its trade mark a map of the system displayed in a triangle the vertices of which are Worcester, Boston and Providence, and has for its motto the words, "Across the Triangle."

The Muncie, Hartford & Ft. Wayne Railway Co. marks its cars, the buttons on uniforms, stationary and advertising literature with a device which is a pun upon the name Hartford City, one of the towns on its line. The heart is in red with the words "Hartford Route" in white. Between these words the heart is crossed by a scroll in gold, bearing the initials of the company in black letters. It may be remarked that in this device colors have been so chosen as not to violate the fundamental rule of English heraldry that color shall not be charged upon color, nor metal upon metal.

The Indianapolis & Cincinnati Traction Co. has adopted for its device the letters C and I interlaced on a square, which is placed upon a circle. The shading used indicates the color of the circle and the letter I to be blue and that of the letter C to be black; the

square is white. This device was designed by Mr. A. A. Anderson, general superintendent of the company, who was general manager of the Mahoning Valley Railway Co., when the device for that company was adopted. The Indianapolis & Cincinnati Traction Co. puts this device on all of its time tables and stationery, and also on the newspaper free delivery stamps which it uses. When with the Mahoning Valley Railway Co., Mr. Anderson used lapel buttons bearing the company's trade mark in lieu of service stripes. Employes who had been three years in the service of the company were entitled to wear a silver button with the device in black enamel. Men who had been in service five years were entitled to wear a gold button on which the device was shown in green enamel.

The Peoria & Pekin Terminal Ry. connects the cities of Peoria and Pekin, Ill., and the company on its letter heads uses the diagram which we reproduce, showing the steam railroads which the electric line connects, illustrating in a graphic manner the importance of the system as a terminal connection.

While doubtless it is the configuration rather than the coloring which is intended to be distinctive in the design of the railroad trade marks, it is very easy to have the design indicate the coloring desired even when printed in black and white; all that is necessary is to have due regard to the conventions of heraldry. According to these conventions the various colors are indicated by lines and dots as in the accompanying diagram. Comparing this diagram with the descriptions already given of the various devices mentioned it is seen that the Mahoning Valley trade mark consists of white letters on a black square superimposed on a green circle.

The device of the Inter-Urban Railway Co., of Des Moines, which we have reproduced as white on black, by making the background shaded with horizontal lines instead of solid, could have been made to indicate the color as well as the outline. Similarly the background of the Aurora, Elgin & Chicago device should be shaded with lines in the same direction as that of the Mahoning Valley Traction Co., and it would then indicate a green color. The shading on the Boston Elevated Ry. seal indicates a blue background.

Since the use of distinctive devices such as those that have been described is constantly becoming more widespread, it is well worth while to pay some attention to the recognized rules according to which they should be employed. Not to follow the rules of heraldry in such matters is simply to refuse to admit the alphabet of the language that is being used, and the suggestion is made to our readers that when designing emblems for their respective companies reference should be had to some work on heraldry; failing that inspection of the illustrations in any of the standard dictionaries will show how to make a design reproduced in black and white as significant as if it were done in colors.

To continue the simile, when writing the words should be spelled correctly. Such an error in spelling, so to speak, is made in some applications of the trade mark of the Santa Fe system, which is a blue cross on a white circle that is inscribed in a blue square. The cross bears the words "Santa Fe," which in Spanish mean "Holy Faith," the combination being an admirable one. Whether the color is part of the trade mark, the color blue is so much used in the company's literature that if it is not it might well be con-

sidered part of the device. The same configuration is used on the baggage checks but the heraldic conventions have not been followed, so that instead of a blue cross on a white circle the design is so shaded as to indicate the cross in red on a white circle, with the upper left and lower right hand corners of the square green and the other two corners purple.

Some of the most striking examples of ignorance or carelessness in such matters are to be found in attempts to portray the arms of the United States. The arms of the United States were adopted by the Congress, June 20, 1782, as the device for the obverse of the Great Seal. At the first session of Congress after the adoption of the federal constitution the seal used by the United States in Congress assembled was adopted by a law passed Sept. 15, 1789, as the seal of the United States. Being thus determined by law it might be expected that the device would be sufficiently well known to insure it being depicted correctly when used on official documents or in Government buildings. An official publication of the State Department entitled "The Seal of the United States" and issued in 1892 gives a complete history of the seal and national arms, so there would seem to be little excuse for blunders in representing the device properly. Yet mistakes are numerous.

In the rotunda of the Congressional Library at Washington there are a number of stained glass windows in the design of which it was intended to show the national and state seals. The description in the handbook describing the building is as follows: "At the top, in the middle of each window is the great seal of the United States, surmounted by the American eagle. To the right and left are the seals of the states, three on each side, or six in each window, etc."

The device meant to represent the seal of the United States in these windows is a hybrid design incorrect in nearly every particular, and represents nothing. In it is shown a shield with seven red and six white vertical stripes in the lower part and a blue field with 13 white stars in the upper part. (In technical language the upper part of the shield is charged with mullets instead of stars; a star in heraldry has six points unless a greater number of points be named.) Above the shield is an eagle with the arrows in one talon and the olive branch in the other, the olive branch being on the sinister side (the right hand side as one faces the design).

Now, in the great seal, the olive branch is in the dexter talon of the eagle and the arrows in the sinister. The shield is borne on the breast of the eagle, and it has seven white and six red stripes (not seven red and six white) in the lower portion, and the upper portion or chief is solid blue. The 13 "mullets" are placed above the eagle's head on a background of blue sky, and not on the shield. Comparison of these descriptions will show how accuracy was sacrificed to art, so-called.

The device on the reverse of a twenty-dollar gold piece is that of the great seal; on most of the U. S. silver coins a similar device is used, the stars being placed differently, however, because of the small space available for a sky and glory.

Some years ago the War and Navy Departments of the United States issued orders altering the regulations defining the President's flag, and providing that the President's flag should be blue and bear the national arms in the center. As the press reports of that time are recalled, the War Department and Navy Department did not agree as to what constituted the national arms, the matter finally being referred to the State Department. The present army regulations provide that the President's flag shall bear the national arms as determined by the State Department. The date of this order was 1903 and in the absence of information to the contrary it is fair to presume that the flags as now used conform to the law defining the national arms.

The device on the President's flag as now used by the navy is correctly reproduced in every particular.

In the "Standard Dictionary," printed in 1899, the President's flag is shown with 13 five-pointed stars on the chief of the escutcheon and 13 five-pointed stars arranged in an arc over the eagle's head. This indicates that the flag used at that date was incorrect in these particulars or carelessness on the part of the experts who compiled the dictionary.

A similar blunder is seen in the widely circulated lithograph reproducing the proclamation of the President inviting other nations to take part in the Louisiana Purchase Exposition, where the artist, with more zeal than knowledge, shows the great seal in colors, with stars misplaced and stripes transposed, a mistake which is all the more apparent because of the single color reproduction of the impression of the great seal on the proclamation itself.

Another instance of ignoring heraldic conventions is to be seen in recent numbers of the "Century Magazine," where in the engraved headpiece for the article on "The Youth of Washington" the Washington arms are shown in white and yellow instead of white and red, as they should be.

Besides accuracy in drafting another point to be observed is that a design that is pleasing to the eye is not always appropriate. It may be recalled that in 1893, the time of the Columbian Exposition, one of the Chicago newspapers offered a prize for the best design for a flag emblematic of the city, and that chosen showed an inverted Y, in white on a background of terra cotta. This device was widely used on flags and shields at the time of the Fair, although it is believed that it was never officially adopted by the city. Undoubtedly the inverted Y was intended to represent the Chicago River, dividing the city into three parts, but unfortunately the Y is the shape of the scarf, known as a pall, which forms part of the vesture of a Roman Catholic prelate and in heraldry appears only in ecclesiastical arms. Doubtless the impropriety of the city of Chicago using such a distinctively ecclesiastical device is the reason for its being little used at the present time.

The Telephone in Street Railway Work at Pittsburg.

The entire electric railway system of Pittsburg and Allegheny County, comprising 450 miles of track, is operated by the Pittsburg Railways Co. This company is a subsidiary corporation of the Philadelphia Co., which, in addition to its street railway interests, controls nearly all of the natural gas, illuminating gas and electric lighting business in Pittsburg, Alleghany and surrounding territory. The executive departments of all these four interests center in one large office building located in the downtown district of Pittsburg. It will be understood therefore that these are conditions presenting an excellent field for the use of the telephone, not only for expediting the work of each of the four branches of the Philadelphia Co's. interests, but also as a means of uniting all the intricate subdivisions of the company's properties at the general offices in Pittsburg.

The management of the Philadelphia Co. has not been slow to recognize the possibilities of the telphone in this direction, and, by a comprehensive and skillful arrangement of private telephone lines, quick and satisfactory communication has been made possible throughout the entire organization, and between any department of the Philadelphia Co's. properties and any point reached by the local and long distance lines of the Bell telephone.

The Philadelphia Co. operates its own telephone exchange, which is located in its new office building at the corner of Sixth Ave. and Garland Alley, Pittsburg, and at this point center all the telephone lines from the long natural gas mains, illuminating gas plants, electric lighting plants and pole lines, and the various car houses, car barns and sub-stations of the electric railway system. This exchange is connected by 16 trunk lines with the central exchange of the local Bell company in Pittsburg, thus giving ample means of communicating with all outside local and long distance points. Two of these trunk lines are what are known as emergency lines and are used only for matters requiring the utmost haste, so that important business can always be handled no matter what the rush of business may be on the other lines.

The Philadelphia Co's. exchange is provided with a board of special design, receiving both common battery and magneto telephone lines, the common battery panels being at the ends with the magneto position in the center for long distance work.

One portion of the board is devoted exclusively to electric railway business. On the electric railway system alone there are over 225 miles of telephone lines and there are over 205 telphones in use for handling electric railway calls. These telephones are located in waiting rooms, at drug stores, at all car houses and depots, at

all power houses and substations, and at other points on the line where they are deemed necessary.

An important function served by the telephone system is the reporting and repairing of breakdowns and other troubles. To this end all the employes of the Philadelphia Co. work in unison even though the matter may be out of their own departments; for instance, the patrolmen who patrol the extensive natural gas lines are also on the lookout for breaks in the electric railway trans-

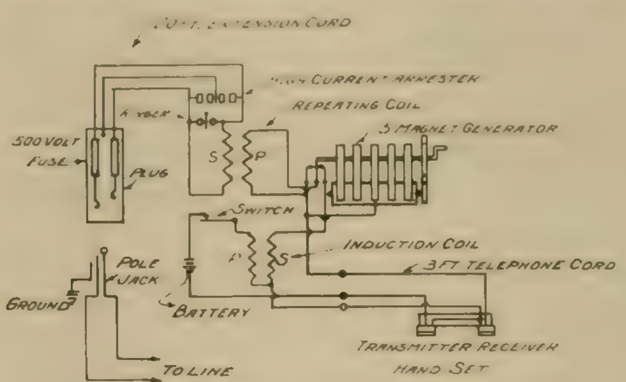
POLE JACK AND PLUG FOR PORTABLE STREET RAILWAY SET

mission lines, and, as soon as damage is noticed, they report the matter by telephone to the proper official. The electric railway emergency stations are all connected by direct wire to the private exchange, and their movements are directed by an official at the switchboard. All alarms of fire within the territory covered by the company's property are reported at the telephone exchange at the same time as the alarms are rung in the city fire stations. The operator in charge transmits orders to the nearest emergency crew if it appears that the company's property is liable to be affected in any way by the fire. The city telephone exchange has instructions that when the Philadelphia Co. exchange is called and the word "emergency" is added all interfering connections are to be broken instantly, and thus the company can act promptly in case of fire or accidents.

The Philadelphia Co. has an arrangement with the Bell Telephone Co. whereby conductors and motormen can use the automatic pay station system by giving their badge number and by so doing they obtain direct connection with the Philadelphia Co. exchange and report any breakage, accident, or delay to the proper authority.

It requires five telephone girls and one man at the private exchange to care for the regular daily business, and a suitable force is kept at the board all night. The exchange and the entire telephone system are under the charge of Mr. J. W. Boden, superintendent of telephones, who has been with the company for 19 years.

To meet the special requirements of electric railway service there



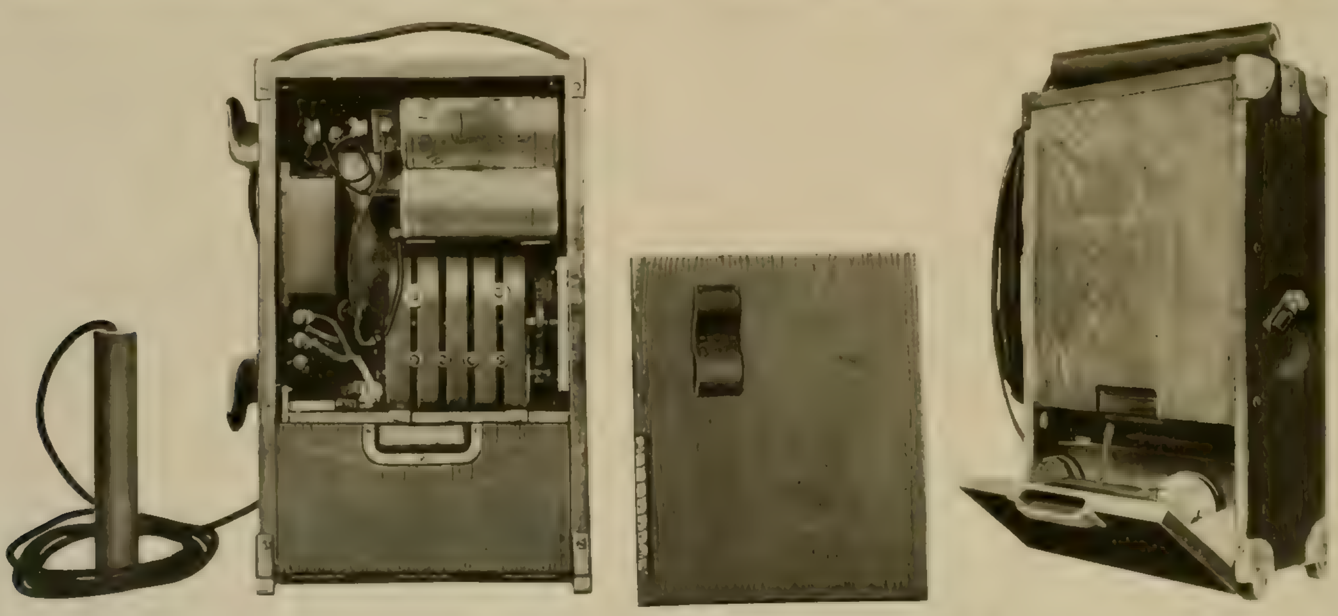
WIRING DIAGRAM—PORTABLE STREET CAR SET FOR PITTSBURG RAILWAYS CO.

has recently been developed for the Philadelphia Co. an entirely new type of portable telephone set which is now carried on all cars that make suburban or interurban runs. This instrument has been developed by the local Bell company of Pittsburg, which is known as the Central District & Printing Telegraph Co., and is made by the Western Electric Co. of Chicago.

The portable instrument is designed for use in connection with pole jacks which are located on the electric railway poles at frequent intervals. The apparatus is contained in a flat suit-case shaped box, 18½ in. high, 11½ in. wide and 5 in. deep, the entire set weighing about 25 lb. In the lower part of the box is a hinged tray in which is carried the combination transmitter and receiver, which is of the "knock-about" type. The upper part of the box contains the generator batteries, coils and protector, and has a cover which is held in place by screws. A plug and a cord are used for making the connections between the box and the pole jacks.

The batteries used are the regulation "Blue Bell" dry batteries.

The characteristic feature of the set is the precaution taken to



PORTABLE STREET RAILWAY TELEPHONE SET—PITTSBURG RAILWAYS CO.

protect the user of the telephone against shock from lightning or from high tension current wires that might by some chance come in contact with the telephone line.

Then the set has a high current protector of the air gap type consisting of two small pieces of carbon, separated by a thin sheet of mica, there being in addition in each set of carbons a small piece of fusible metal. When the high current jumps the air gap this metal fuses and makes a permanent ground, thus preventing damage to the box or the person. There are two sets of these carbons in each box.

The connection between the ground plate of the protector is made by the third wire of the extension cord of the plug, which when inserted in the pole jack makes contact with the permanent ground on the pole jack. As an additional precaution the telephone circuit within the portable box is not in metallic contact with the line circuit, as a repeating coil is inserted, thus tending to separate the wiring inside the box and the line wires. This is an additional protection to the party operating the set should the line wires become crossed in any manner with the transmission line.

The set contains a heavy 5-magnet generator for calling central which is provided with a folding type of crank handle, while a suitable ringer is inserted inside of the set should it be found necessary for the dispatcher or central office to call the portable set.

The plug by which connection is made with the pole jack is 10 in. long and is solidly made of brass, all insulating material being built-up mica. The reason for making the plug so large is to give room for two 500 volt Noark fuses, one of which is placed in series with each line wire. The plug is enclosed in heavy fiber tubing.

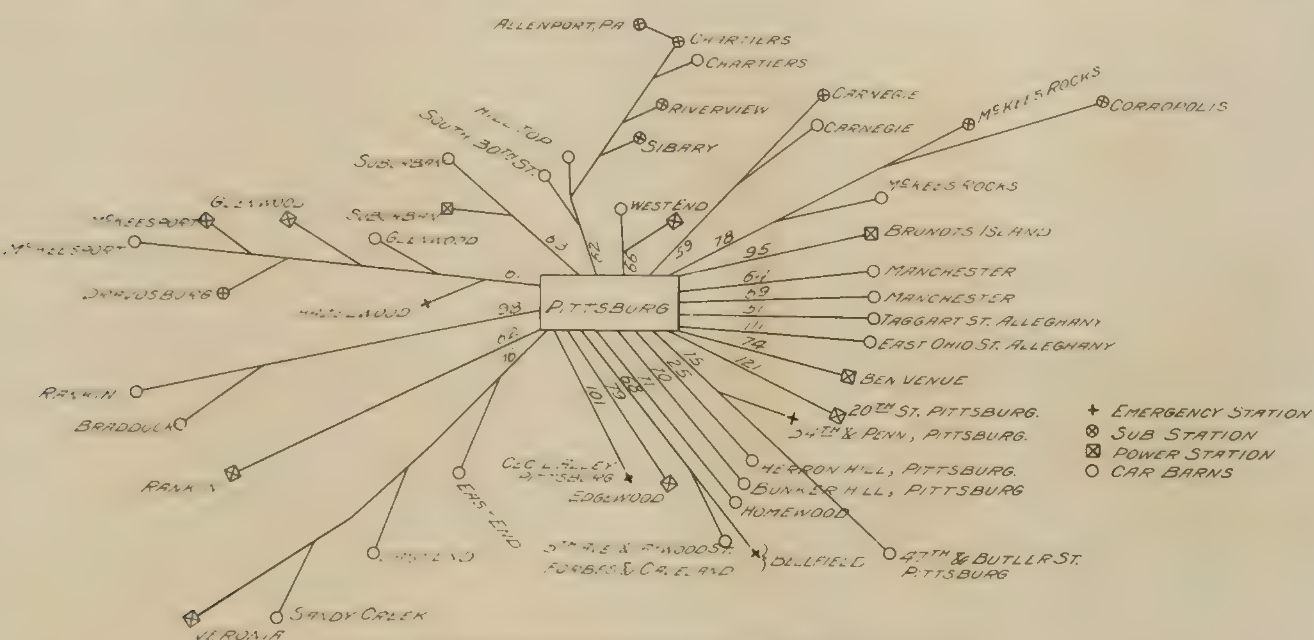


DIAGRAM SHOWING LOCATION OF TELEPHONES—PITTSBURG RAILWAYS CO.

The pole-jack consists of a cast iron canopy, which is fastened to the pole at a convenient height for a man to reach. The opening to the canopy is of course toward the ground in order to prevent moisture from entering. The line wires enter the canopy through the hollow bracket, and pass to the upper part of the canopy, where they make the necessary connections. The flaring sides of the canopy jack serve as an additional precaution against short circuiting in the same way as do the petticoats of a petticoat insulator. The jack has a removable cap at the top to give access to the connections.

Advertising in the Street Railway Business.

BY ANTHONY L. BEMIS, MANAGER, BROCKTON & PLYMOUTH STREET RAILWAY CO., PLYMOUTH, MASS.

One of the important problems before a street railway manager today is the question of how to advertise a road and park to the best advantage.

The first year that a park is opened to the public is usually the banner year. It is new and people who have been accustomed to going to one place season after season take to the new resort, especially if they find a change of program each week for 12 or more weeks, and enough of interest and newness to occupy the time evenings and Sundays.

The trolley ride to the park each year, being the same, becomes tiresome to the present uneasy generation, and unless the weather be extremely warm, the ride is not taken as frequently as if the attractions along the route were changed to a certain extent. These changes, then, must take place in the park itself, and the public must be informed of the fact.

There is a park in the vicinity of Boston which was installed in 1901, with a rustic theater having a seating capacity of 1,000, a dance hall accommodating 50 couples, a merry-go round, restaurant and hotel, row boats, canoes, naphtha launches, bath houses, together with other places of amusement. It occupies about seven acres with tall pine trees, and is located on the shore of a beautiful lake. It is certainly an ideal spot for pleasure seekers, but this beautiful surrounding does not appeal to the public enough, so that without special attractions they would cease to give their patronage.

The opening year the business was very good and it was considered a success.

In 1902 very little change was made in the grounds and attractions. Advertising on bill boards was done with three and eight-sheet posters in the towns in which the road operated, together with small advertisements in the different papers twice a week. Considerable of the interest created the first season still continued, but the attendance was not as large as the previous year, the weather conditions being practically the same for both years.

With the season of 1903 some new attractions were added, but vaudeville was the only attraction given in the theater. The advertising was increased by more news items in the various papers, as to the manner of shows, comments on the players, and the attendance in the theater. Flyers were placed in the cars each week, giving the name of the attraction and list of the players. Dasher signs were used on each end of the cars, which proved successful.

Neatly printed and well arranged folders, which described the attractions along the route through one of the prettiest woodland and lake regions in eastern Massachusetts, were issued. They were supplied with half-tone cuts of the points of historical interest in the towns through which the road passed. There was an excellent map 3½ x 6½ in., in colors, in the middle of the folder, which well fitted to the pocket. An attractive timetable was printed on the back of the folder, preceded by several artistic illustrations of the park. These folders cost 3½ cents each, and were distributed in high schools, lodge rooms, hotels, restaurants, and various public places within a radius of 50 miles. To show that such booklets were in great demand, the company received over 200 applications for these from different parts of the state, and during the summer it was noticed that many people coming over the road had these booklets. This manner of advertising was considered by the company as being profitable. The weather was not as favorable for park

BROCKTON & PLYMOUTH POSTER (ORIGINAL 21X29 IN.)

business as it had been for the last two years, but in view of this the receipts were about the same.

We turn now to the year 1904, which shows us that in New England the receipts of nearly every road, from park attendance, is considerably less than previous years. Why this is so no one is able to explain. This is not the case with the road and park in question. And why? Because advertising has made it what it is today.

The seating capacity of the theater has been increased to 2,000 and it has been able to more than pay for its operation, including the cost of each troupe, which has a week's stand at an expense of $300 to $400. The boats, canoes and launches, with the receipts from the concessioners on the grounds, pay the entire running expenses of the park, and for the first time in its existence it has been a decided success. There is a reason for this—it is advertising in the proper way.

This year the company issued an elaborate poster 21 x 29 in., in four colors, showing a lady fashionably dressed carrying a miniature open car, filled with people, under her arm. In the background is a view of the lake and park. On the lower left hand side is a description of the various attractions. The posters cost 25 cents each to print, and 1,000 were issued. One would think it extravagant to put so much money into advertising of this kind. The poster was made so elaborate that it would enable the company to place it for the season in the windows of the best stores in the various towns and cities within two hours' ride of the park. In order that the company might be sure that the posters would remain during the season, it issued two complimentary tickets each week over the road including reserved seats in the theater to each store that would place the poster in a position satisfactory to the company. These tickets were dated so that they were good for the week issued and void after 6 p. m. on Wednesdays and Saturdays, as on these days the attendance is so large that the company can not take care of free riders. By placing the posters in the windows, the bill board advertising, which had amounted to $225 the previous year, was dropped entirely, and it has been found that aside from the work the posters have done, persons holding complimentary poster tickets take their friends, which means they must pay their way the entire distance, the fare being 15 cents from each end of the route to the park, admission to the theater being 5, 10 and 15 cents.

These complimentary tickets are distributed each week by mail, and occasionally they are delivered in person. In this way the company is able to see that all posters are in place.

Dasher signs are used extensively on both ends of the cars. They measure 18 x 24 in., and are pasted on galvanized sheet iron, which is hung on the dasher. The cost of the paper is $1.25 per hundred sheets, the color being changed each week, together with the name of the performance.

The company has discontinued vaudeville altogether and now gives opera, musical and farce comedies, minstrels, and colored comedians.

Flyers, 5½ x 9½ in., are placed in the cars each week, on different colored paper, giving the name and nature of the performance, with statement of band concerts Sunday afternoon and evening, introducing between selections of the band special Sunday acts by the troupe. In addition to this, the names of the different attractions and leaving time of last car in either direction on the different nights, was found to be what the public demanded. The flyers cost 56 cents per hundred, and 5,000 were placed in the cars each week, there being none left by Saturday night.

Special excursions are run once a month for children under 15 years of age, who by paying 10 cents are entitled to a ride to and from any point on the line, together with reserved seat in the theater and a ride on the merry-go-round. In most every case the parents do not wish the children to go alone, and in view of the low rates, they would accompany them and pay regular fare.

Balloon ascensions, with a parachute leap, have been added as a special feature on days when the business is lightest, and this has proved a success.

Here, then, is a road which has demonstrated satisfactorily to itself that advertising in the proper manner is profitable.

Italian Engineers Visit Ampere, N. J.

The Crocker-Wheeler Co., of Ampere, N. J., entertained 45 distinguished electrical engineers and professors at its plant on August 31st. The guests were members of the Associazione Elettrotecnica Italiana, who are visiting the United States to attend the various electrical conventions to be held this month. Among those present were the president of the Associazione Elettrotecnica Italiana, Prof. Moise Ascoli, of the University of Rome; Prof. G. Fano, of the University of Turin; Prof. L. Lombardi, of the University of Naples; Prof. F. Lori, of the University of Padua, and Prof. M. Ancona, of the University of Milan. A luncheon was served, after which the visitors inspected the Crocker-Wheeler plant. A souvenir of the occasion was given to each guest, in the form of a photograph of a page from a note book of one of the engineers, giving a few facts concerning the plant and his impressions of it.

The headquarters of the interurbans of Cleveland, Ohio, was recently moved from the west entrance of the Williamson Building to a room on the south side of the square west of Ontario. All of the interurbans are now running around the southwest corner of the square, with the exception of the Northern Ohio Traction & Light Co. cars.

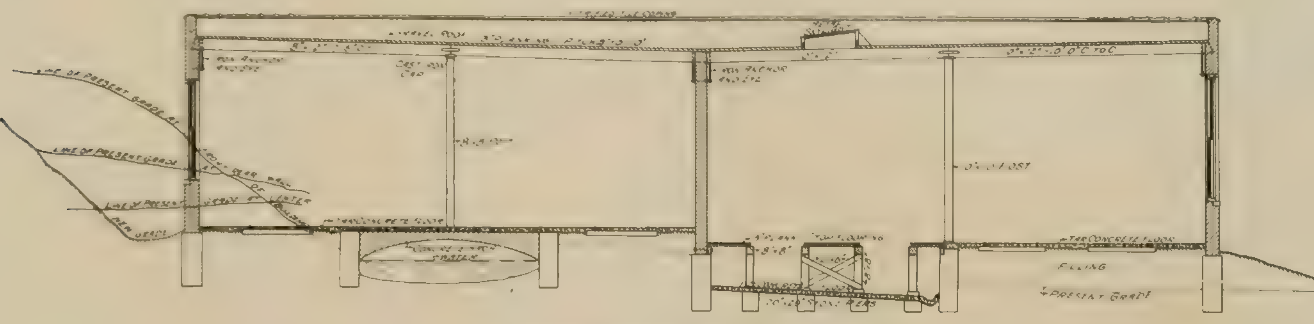
Mill Construction Car House and Office at Bristol.

The Bristol & Plainville Tramway Co., which, in addition to lighting and power business, operates about 13 miles of single track electric railway in the vicinity of Bristol, Conn., is building a new car house and office building which are interesting inasmuch as the principles of slow burning mill construction have been applied throughout. The possibilities and advantages of applying mill construction principles to electric railway car houses were pointed out in an article, contributed by Mr. J. O. De Wolf of W. B. Smith-Whaley & Co., published in the "Street Railway Review" for Aug 20, 1903. The principles as outlined in that article with the exception of minor details have been followed in the construction of the Bristol car house.

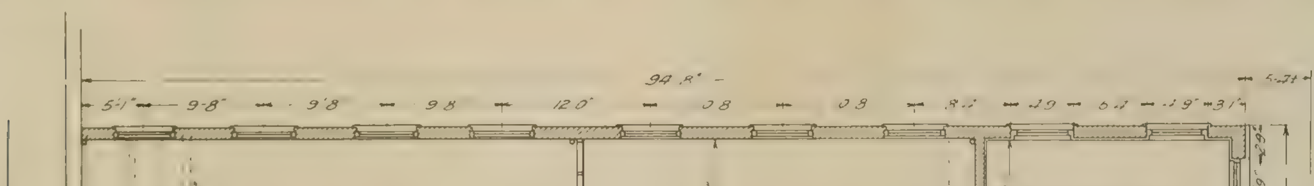
The new structure is a single story rectangular building, 94 ft wide and 140 ft deep. The office building adjoins the main car house and is 45 ft wide by 94 ft 8 in deep.

The rectangular building, comprising the car house, is divided into two sections by a 12 in. brick wall down the center. The outside walls are of brick, resting on stone foundations.

Each of the two sections of the house contain four tracks, running the full length of the building, one section being designed for an operating barn and the other for combined storage and repair work. The operating side has a cement-concrete floor and will be used chiefly for storing cars over night and for inspection and light repair work. The other section will be used for storage. Two of the tracks in the operating section are pit tracks, the rails resting upon 8 x 8 in. longitudinal stringers, carried upon 8 x 8-in. posts, which in turn rest upon stone piers. Each pair of the supporting posts are braced with 2 x 6 in. stuff. The pits are continuous under two sets of tracks, the pit flooring being concrete, this arrangement giving plenty of light and room for working under



SECTION THROUGH CAR HOUSE.



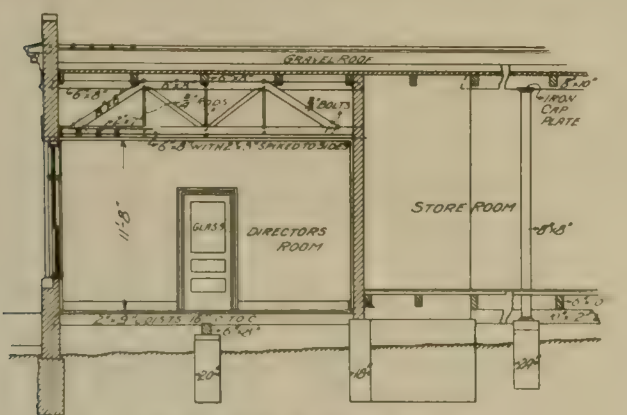
PLAN OF OFFICE BUILDING, BRISTOL & PLAINVILLE TRAMWAY CO.

STORAGE TRACKS.

the cars. A line of steam heating pipes runs between the two pit tracks under the floor, and it is believed this arrangement will give better results than if the steam piping was placed at the sides of the pits. The roof is of 3-in. planking with gravel covering and has

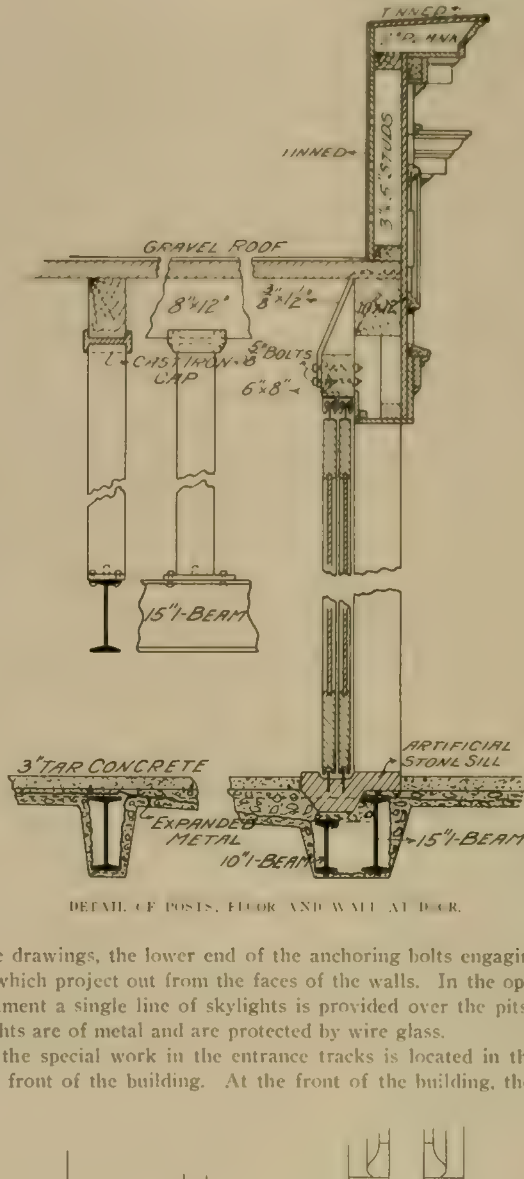
ARRANGEMENT OF PITS.

a pitch of ¼ in. in one foot from the outside walls to the center brick partition. In the operating section, the roof planking rests on 8 x 12-in. timbers, supported down the center of the section on 8 x 8-in. square wooden posts. In the other section, the roof timbers are 10 x 12 in. and are carried by a center line of 10 x 10-in. posts. In



SECTION THROUGH OFFICE BUILDING.

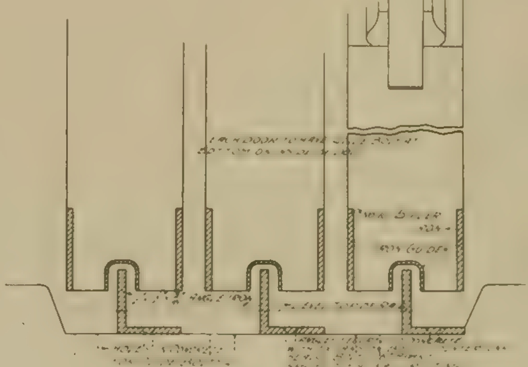
each case, the center line of posts rests on cast iron base plates, carried on stone piers. The ends of the roof timbers along the central line of posts rest on cast iron cap plates, and the ends of the timbers are held together over the tops of the posts by iron straps. There are no holding-down bolts or retaining bolts, the structure being held in place chiefly by its own weight. The outer ends of each set of roof timbers are carried by the brick walls, the ends resting in sockets cut into the walls. These ends of the roof timbers are held in place by iron anchors and eyes in the manner indicated



DETAIL OF POSTS, FLOOR AND WALL AT DOOR.

on the drawings, the lower end of the anchoring bolts engaging iron clips which project out from the faces of the walls. In the operating department a single line of skylights is provided over the pits. The skylights are of metal and are protected by wire glass.

All the special work in the entrance tracks is located in the yard at the front of the building. At the front of the building, there are



DETAIL OF BASE OF DOOR.

12 sliding doors, 2 on each line of tracks. The doors are of wood and slide on a trolley form of hanger, traveling on a track over the entrance to the building. The bottoms of the doors are guided by angle irons which are secured to the concrete flooring with expansion bolts, the angles of course being cut away at each rail crossing.

The construction of the car house was somewhat complicated by

the presence of a flowing stream which passed diagonally across the car house property. As this stream furnished water power for certain factories below the property, it became necessary to alter its course without destroying any of its fall. The difficulty was finally overcome by excavating a new channel for the stream underneath one section of the building. The roof of this channel is a steel and concrete arch upon which rest the posts supporting the roof of storage side of car house, and which also supports two of the tracks.

The office building is also of slow burning mill construction with brick walls and wooden roof and supporting timbers. As will be seen from the plan of the building, this structure contains the machine shop and oil house as well as conductors' and motormen's room, store room and general offices.

The new buildings were designed and constructed under the supervision of Mr. G. E. Cockings, manager of the Bristol & Plainville Tramway Co. The designing engineer was Mr. A. W. Sperry of New Haven and the architects were Brown & Von Beren of New Haven.

A Policy That Failed.

BY OBSERVER.

The factor essential to the success of an electric railroad is good management along practical lines. The manager or directing head should have knowledge in detail of operation, of motive power and rolling stock, as well as be thoroughly familiar with the financial end, when he is called on to operate the system without departments or responsible heads. Where the system is of such size that the general manager cannot handle it in detail and without appointing responsible heads of the various departments, confidence must exist between the heads of departments and the manager to insure success. The successful operation of each department must necessarily add to the degree of success achieved in the management of the system, and failure in a part will retard the smooth working of the whole. Each man should be adapted to his line and he should be given credit and opportunity to make his department a success.

There are several reasons why a department or branch of the system may fail. Incompetency of the heads of departments, restricted supplies and renewals and a restricted pay roll, along with the fact that the manager is not acquainted in detail with the various needs of the department and feels, in his fear from want of knowledge, that he cannot sanction all the supplies or take suggestions from the head of the department, whose experience may have been much greater along that particular line, but thinks that in order to make an impression things must be carried out as he believes best, regardless of the head of the department. This policy at once creates a want of confidence and, continued, will create a listlessness or "I don't care" policy in any department.

A very bad thing, and one which demoralizes a department, is for the manager to issue orders directly to the working force, regardless of the head of the department, or take into his confidence a workman on matters that he should lay before his immediate subordinate.

An experimental policy is often fatal to results and carries with it victims whose knowledge and experience taught them the enforcement would be fatal. A manager must study the conditions existing in the community in which he may be placed regarding wages and labor. While in some districts the pay to labor of all classes may be a minimum, the same policy applied in another zone may be disastrous.

A large electric system being consolidated under one management, and which adopted the three-phase system of transmission with machinery of the latest design, appointed a manager whose experience had been with direct-current systems, less in mileage and territory. The power house contained five compound engines and generators with five independent condensers in the basement. An engineer was appointed to have charge of 75 miles of transmission lines, sub-stations and power houses, steam and electrical, who was directly responsible to the manager. There was no automatic oiling system for any of the units in the power plant. The policy of the manager was that of minimum pay in every department.

As a rule in starting new systems having sub-stations, green operators must be procured and instructed in the operation of the station. This is no mean task, especially when the man to be instructed has not the first idea of what he is about to do. The conditions which govern the procuring of sub-station operators are the location and pay. On the system under consideration the operators were such as could be procured in the vicinity. The pay as set by the management was to be $25 per month, the operator to run the station 24 hours a day (a single operator per station), with work plenty and farmers paying good wages. The proposition that presented itself to the engineer was hard. The men approached on the subject of position simply resented the idea at the wages mentioned. The plea set forth was that they could get more money driving carts or with pick and shovel. When one was procured he would stay until the novelty wore off, then he became sick or someone in the family died. At the same time the engineer carried the responsibility of continued operation and all repairs or difficulties, and had no one to rely on but himself because the new men were powerless to assist. After a time an operator would become independent because he knew that the wages paid were small and it was a hard matter to procure others at the same figure, and each new operator meant that the ground must be gone over again, with added responsibility on the engineer in charge; no appeal to the manager could increase the pay.

Under such condition it was a hard matter to procure extra men in case of sickness of a regular operator, especially when substations were in the country. With operators having no knowledge of the machinery in their control except how to start and stop, if anything occurred it necessarily meant a close-down of that particular sub-station until the engineer could reach there and adjust the difficulty. Time and instruction made some changes, but the intellect procured was on a par with the pay.

Seventy-five miles of transmission line was patrolled by one man, who was expected to be on duty 24 hours a day. Twenty miles of line had to be inspected on foot; the rest was along the line of road and could be seen from the back of car. The pay for the service was set at $30 per month. The man was supposed to be a practical lineman. After accepting the position the route was covered for a few days until the novelty wore off, then it was found that that portion which had to be inspected on foot was omitted with a false report by the inspector for this portion of line; the consequence was, a dismissal. The plea was that the wages were not sufficient for the duty to be performed. The case was laid before the manager with an appeal for an increase of pay without effect. Another man was procured at same figure, with the same results as the first. The third man, who was a practical lineman, was secured at $35 per month. All went well until he was caught stealing wire and neglecting to inspect the line properly. His excuse for stealing was that the company considered him to be on duty continuously and at the same time did not pay enough for a man to live decently, and as he had no other chance to make any money above his wage it compelled him to steal or quit his job; also, that linemen on the d. c. side of the system were receiving pay at the rate of $55 to $60 per month. In the meantime trouble on the line was occurring due to the improper care of the inspection and a "don't care whether I do or not" disposition to do any work, as he felt that at that figure it was a hard matter to procure anyone else to do the work.

The engineer was informed that in operating the power plant the force in the engine room, which contained five cross-compound engines and generators with five independent condensers in the basement, all engines hand oiled, one engineer and one oiler per shift of 12 hours were all the men to be allowed. The oiler was to be a licensed engineer, and the engineer to be a machinist and expected to do all repairing; the engineer's pay to be $75 per month and that of the oiler-engineer to be $45. The night engineer was to receive $45, and the night oiler, $37.50. The oiler was to keep the machinery and engine room clean after the operating force was organized in the engine room. The fire room force was to consist of two firemen to seven water tube hand fired boilers, and the heaters and pumps were under their care. All coal had to be hauled to fire room, and by orders this must be done by one man, who must weigh all coal on his shift on a wheelbarrow run on a scale, wheel out his ashes and help clean fires, and if he had any spare time, unload coal from cars. The consumption of coal on each shift amounted to about 24 tons. The firemen were to receive $1.75 per 12-hour day; coal passer to receive $1.50 per day. With the conditions laid down the best talent in the engine room was procured that the wages would allow.

The head engineer was a good man as a machinist and steam engineer, but not experienced in handling electrical machinery. The other engineers and oilers ranged accordingly. After a short time there was dissatisfaction due to the duties involved and the small pay in proportion to existing wages at other places. Consequently it handicapped the engineer in charge, as it was impossible to get other qualified engineers to accept the position.

A plea for a higher salary so as to get experienced men was simply ignored and pronounced impossible. The importance of continuous operation and the loss incurred by stoppage of machinery was pointed out, but with no results. The plant must be operated on that basis and with men that could be procured at the figures named.

As an illustration of the result, in the absence of the engineer in charge of the department who was attending to duties at a distant point of the system the rotary nearest the power plant reversed the three direct-current generators at one time. The operating engineer, at $45 per month, shut down and tied up that portion of the system until the arrival of the engineer in charge from the other end of the system to reverse the generators and put them on the line. In the face of the trouble occurring, as it will occur with the best of equipment, there could be no change made. An order for one engineer to operate the shift was enforced until the state inspector stepped in and expressed his views on the matter, when an additional licensed oiler was hired.

It being the desire of the engineer in charge to have daily records of the station output, an order was given, to be passed on by the manager, to have a form printed, as it was evident that a time was coming when such records would be in demand for financial purposes. Five months after the order was submitted to the manager it lay on his desk under consideration. The expected demand came, and there was no official record of the power station.

One peculiar feature of this manager's policy was that heads of departments should be kept apart and not associate or express their views on matters relating to their departments, this being considered detrimental to discipline. A system of spying was in vogue and the head of a department was liable any time to receive notice of matters so trivial that it seemed that a practical manager could not have entertained the report at all.

An incident occurred where a knowledge of the matter cited would have saved a great deal of worry. One of the condensers lost its vacuum while a director of the company was in the power station. As is usual with compound engines, the valves began to rattle, and this makes quite a noise. The director threw up his hands in terror and exclaimed that the engines were in a horrible shape and going to pieces, and passed out of the power station before the vacuum was restored. The next day the engineer received a letter from the general manager's office stating: "Dear Sir: I am informed by expert authority that the engines in the power station are not being properly taken care of, and that this matter must have your immediate attention, as the property intrusted to your care is of immense value. Respectfully submitted, ———."

A merit system was in vogue on this railroad in which a record was kept of the head of each department. Ten demerits for censure was the limit and depreciated the man's ability in the eyes of the manager, regardless of conditions causing the demerit. In reviewing this matter it will be seen that with the conditions as stated the effort of a head of a department to make a success was almost useless and an impossibility. A manager should be of such a calibre as to know when the various departments are showing results, and should have a knowledge of detail, or else have confidence in the experience and ability of his subordinates, and should adopt a policy that will permit of practical operation and take into consideration the human side of the question also. While this policy was being tried the service was not as perfect as desired, the public's patience was sorely tried and the stockholders lost money without doubt. Under new management and a broader gaged policy things changed, service became better, due to increased wages, better intellect and an increased working force.

The Lake Shore Electric Railway Co. has just put into service the first of its new palace trolley cars, which are Pullman models. The interior has a full empire ceiling, with burlap covering, the upholstering is in brown and the metal work polished brass. The car will be heated by hot water and will seat about 60 persons.

Electric and Traction Mutual Insurance.

On August 1st, an organization committee, comprising Horace E. Andrews, president of the Cleveland Electric Railway Co., the Utica & Mohawk Valley Railway Co., and the Syracuse Rapid Transit Co.; Henry A. Everett, president of the Northern Ohio Traction & Light Co. and chairman of the Detroit United Ry.; Luther Allen, president of the Toledo & Western Railway Co.; F. F. Pomeroy, president, and A. E. Akins, vice-president of the Cleveland & Southwestern Traction Co.; Warren Bicknell, president, and F. W. Coen, secretary of the Lake Shore Electric Railway Co.; H. J. Davies, secretary of the Cleveland Electric Railway Co.; George L. Bishop, president of the Eastern Ohio Traction Co. and Northern Texas Traction Co.; Chas. W. Mason, president of the Cleveland, Painesville & Eastern Railroad Co.; and Henry N. Staats, an underwriter of acknowledged experience and ability, undertook the promotion and organization of mutual insurance for electric railway and lighting companies, and on August 16th the Electric Mutual Insurance Co. and the Traction Mutual Insurance Co. were incorporated under the factory mutual law of Ohio.

The prime object in the formation and organization of these companies is the combination of street, suburban and interurban railway and electric light and power companies in what may be called an agency under the name and title of Insurance Companies whose officers may devote their whole time to the study of the best methods of protecting their property against loss by fire and of reducing insurance to actual cost. The business of the Electric Mutual Insurance Co. is to be restricted to the insurance of electric light and electric power stations and their equipments, and that of the Traction Mutual Insurance Co. to the insurance of car houses, cars, motors, shops and other property owned or controlled by persons operating street, suburban and interurban railways. The advantages to be derived from an insurance organization of this kind are: The insurers are simply insuring risks of their own class; all commissions are done away with; the business of two companies being transacted from one office, the expense will be minimized, and by having two companies, each risk is confined to and must pay for losses occurring in its special class.

This plan of insurance is not new, but has been thoroughly tried and has proved most successful. It is the factory mutual plan and was introduced some years ago, the first Factory Mutual Co. being incorporated in 1835. It is now in existence and on July 1st paid dividends of 90 per cent from the basis rates charged. There are 35 factory mutual companies now in successful operation, and it will be interesting to note that there has never been a failure of a factory mutual company, no assessment has ever been made and they have always been able to declare dividends. The success of these companies is attributed to their strict adherence to well established principles of underwriting, embracing careful selection, thorough protection, and intelligent inspection of all properties insured. There is, therefore, no reason why these electric and traction mutual insurance companies cannot, under this plan of insurance, produce similar results. The companies are organized under the Factory Mutual Law of Ohio, which is a copy of the laws under which the factory mutuals of New England were incorporated.

The management of the companies will be under a board of directors of not fewer than 5 nor more than 21, chosen from the members and elected by the members of the companies. The moneys of the companies will be placed in depositories as designated by the board of directors. All business of the companies will be transacted directly by its members and no commissions will be paid for obtaining business. Executive officers and employes of the companies will be paid salaries commensurate only with the duties they have to perform. Under this system of insurance companies will employ their own men, who receive instructions from their own executive officers. Proper inspection, adequate protection, and prompt and intelligent adjustment of losses can thus be secured. All policies will be written for a period of one year subject to cancellation at any time for cause by either the member or the company.

With the organization committee enumerated heartily indorsing this form of insurance and giving their most liberal patronage and earnest efforts to its organization and operation and with the co-operation of other electric and traction companies, there is no doubt but that the success of the Electric Mutual Insurance Co. and the Traction Mutual Insurance Co. will be most eminent.

Convention Programs.

American Railway Mechanical and Electrical Association.

MONDAY, OCT. 10, 1904, 10 a. m.

Second Floor of the Transportation Building, World's Fair Grounds.

Opening Address, John I. Beggs.

President's Address.

Report of the Executive Committee.

Report of the Secretary-Treasurer.

Reading of Communications.

New Business.

"The Ideal Shop," by W. D. Wright, Superintendent of Equipment, The Rhode Island Co., Providence, R. I.

Monday Afternoon, 2 p. m.

"Wheel Matters," by J. Millar, Superintendent of Rolling Stock, International Railway Co., Buffalo, N. Y.

Question Box.

TUESDAY, OCT. 10, 1904, 9:30 a. m.

"Maintenance and Inspection of Electrical Equipment," by John Lindall, General Foreman of Shops, Elevated Division, Boston Elevated Railway Co.

Question Box.

Tuesday Afternoon, 2 p. m.

Special and Unfinished Business.

Election of Officers.

FRIDAY, OCT. 14, 1904, 9:30 a. m.

Joint Meeting with the Street Railway Accountants' Association for the discussion of reports on "Shop Records and Accounts," prepared by H. H. Adams, Superintendent of Shops, The United Railways & Electric Co., Baltimore, and H. E. Farrington, Master Mechanic of the Boston & Northern Street Railway Co., Chelsea, Mass., on behalf of the Mechanical and Electrical Association, and by H. M. Pease of the International Railway Co., Buffalo, and W. G. McDole, of the Cleveland Electric Railway Co., for the Accountants' Association.

American Street Railway Association.

TUESDAY, Oct. 11, 1904, 10 a. m.

Meeting of Executive Committee at Southern Hotel

WEDNESDAY, Oct. 12, 1904, 10 a. m.

Address of Welcome, Hon. D. R. Francis.

Welcome to St. Louis, Hon. Rolla Wells.

Address, Prof. W. E. Goldsborough.

President's Address.

Report of Executive Committee.

Report of Secretary and Treasurer.

Presentation of Papers.

Discussion.

Appointment of Committee to Nominate Officers and Select Next Place of Meeting.

THURSDAY, Oct. 13, 1904, 10 a. m.

Discussion Continued.

Reports of Committees.

Report of Nominating Committee.

Election of Officers.

The papers to be presented before the Association are as follows:

"Steam Turbines," E. L. Rice, General Electric Co.; J. R. Bibbins, Westinghouse Machine Co.

"Reciprocating Engines," by a representative of Allis Chalmers Co.

"Gas Engines."

"Transfers, Their Uses and Abuses," L. Jewell, Chicago City Ry.

"Signals."

The meetings of the A. S. R. A. will be held in the hall on the second floor of the Transportation Building.

Until Wednesday morning delegates will register at the Southern Hotel; beginning Wednesday morning they will register at the hall.

The Manufacturers' Committee has engaged a band to give concerts at the hall before the opening of each session and to give afternoon and evening concerts at points to be announced in the official program to be distributed at St. Louis.

Street Railway Accountants' Association.

THURSDAY, OCT. 13, 1904.

In parlor of the Inside Inn, World's Fair Grounds, 3 p. m. sharp.

Annual Address of the President, F. E. Smith, Chicago, Ill.

Annual Report of the Executive Committee.

Annual Report of the Secretary-Treasurer.

Report of the Committee to Make New Collections of Blanks and Forms. Elmer M. White, Hartford, Conn.

Appointment of Convention Committee on Nominations.

Appointment of Convention Committee on Resolutions.

FRIDAY, OCT. 14, 1904.

In Festival Hall, World's Fair Grounds, 9:30 a. m. sharp.

Joint meeting with the American Railway Mechanical and Electrical Association, to discuss "Shop Reports and Records," a report made by a joint committee, composed of Messrs. H. H. Adams, of Baltimore, and H. E. Farrington, of Chelsea, Mass., representing the Mechanical and Electrical Association, and Messrs. H. M. Pease, of Buffalo, and W. G. McDole, of Cleveland, representing the Accountants' Association.

SATURDAY, OCT. 15, 1904.

In Festival Hall, World's Fair Gronds, 9:30 a. m. sharp.

Annual Report of Committee on a Standard System of Accounting for Electric Railways. C. N. Duffy, Chairman, Chicago.

Reading and Discussion of Questions and Answers. This includes those published and others presented.

Report of Convention Committee on Nominations.

Report of Convention Committee on Resolutions.

Election and Installation of Officers.

Adjournment.

Manufacturers' Committee of the American Street Railway Association.

Daniel M. Brady, Chairman, president Brady Brass Co.

John A. Brill, vice-president J. G. Brill Co.

Calvert Townley, Westinghouse Electric & Manufacturing Co.

William B. Albright, director Sherwin-Williams Co.

Fred S. Kenfield, president "Street Railway Review."

George J. Kobusch, president St. Louis Car Co.

J. R. Lovejoy, manager railway department General Electric Co.

James H. McGraw, president Street Railway Journal.

W. J. Cooke, vice-president McGuire-Cummings Manufacturing Co.

Scott H. Blewett, general agent American Car & Foundry Co.

The meeting to effect a permanent organization has not yet been announced, but probably it will be held Monday, October 10th, in the forenoon.

Lehigh Valley Traction Co.

The plan of reorganization of the Lehigh Valley Traction Co. system, including the Philadelphia & Lehigh Valley Traction Co., the Allentown & Slatington Street Railway Co., and the Coplay, Egypt & Ironton Street Railway Co., has been mailed to the holders of bonds, stocks and claims against the companies named, which holders may become parties to the plan of reorganization and obtain the benefits thereof by depositing their bonds, stocks, etc., with the depositary of the reorganization committee. A new company is to be formed and will issue stocks and bonds as follows:

Three million dollars common stock and $5,000,000 five per cent preferred stock cumulative after five years. First mortgage bonds aggregating $5,000,000 will be issued and consolidated mortgage bonds aggregating $7,500,000. A portion of each issue will bear four per cent interest and a portion five per cent interest.

The stock of the new company is to be vested for a period of three years in seven voting trustees. George H. Frazier, Edward B. Smith, William F. Harrity, and Arthur E. Newbold of Philadelphia; Tom L. Johnson, of Cleveland, Ohio; and Harry C. Tretler and George O. Albright, of Allentown, Pa.

CHICAGO THE LONDON

STREET RAILWAY REVIEW

AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

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The publisher of the STREET RAILWAY REVIEW issues each year on the occasion of the meeting of the American Street Railway Association four or more numbers of the *Daily Street Railway Review*, which is published in the convention city and contains the convention reports. The *Daily Street Railway Review* is separate from the STREET RAILWAY REVIEW, but is in its nature supplementary thereto.

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We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

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If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

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SUMMARY OF CONTENTS.

REORGANIZATION OF THE ASSOCIATIONS.

It will be recalled that early in the present year there was considerable discussion as to the advisability of reorganizing the American Street Railway Association with a view to having a single association include the Accountants' and the Mechanical and Electrical associations, now organized, and further elaborate the scheme of organization by having a section of the association corresponding to each of the principal departments in an electric railway organization, each of these sections being administered by a vice-president and a secretary. The opinion expressed by the "Review" in this matter was that it would be to the disadvantage rather than the advantage of all concerned were it attempted to destroy the independence of the two allied associations, the Accountants' and the Mechanical and Electrical, and that if such a scheme were considered it would be better to experiment with the departments not already having well established associations of their own; thus, for the American Street Railway Association to establish sections for the consideration of matters affecting, say, the Claim Department and the Maintenance of Way Department.

Inasmuch as the Mechanical and Electrical association is already covering two departments, the power house, and rolling stock and shops, either of which might provide material for separate associations, it was also suggested that here was a good opportunity for determining the practicability of an association working in sections by organizing the proposed Maintenance of Way Association as a branch of the Mechanical and Electrical association.

It is gratifying to know that the executive committee of the Mechanical and Electrical association has considered this scheme favorably and that there are now before the membership of that association proposed amendments to its constitution and by-laws with a view to taking prompt action, should the maintenance of way men determine not to organize a separate association.

The embarrassment which would result from the indefinite multiplication of electric railway associations which will at all times look largely to the members of the American Street Railway Association for encouragement and financial support is apparent, especially in view of the variations in the organization of electric railways which bring about overlapping of departments. It is our belief that the happiest solution would be not to organize any new separate associations before giving the present plan of the Mechanical and Electrical association to reorganize with three departments a trial. This position is not taken with any thought of discriminating against the claims of the civil engineering department for separate recognition, but because it offers a means of providing an association to consider maintenance of way matters without encountering what really are serious difficulties.

SUPPLYMEN'S ASSOCIATION.

As a result of the meeting at Saratoga of the exhibitors attending the convention last year, an association of manufacturers and supplymen interested in the street railway field has been formed, with a membership of 10 representatives of leading houses and this year this association, or as it is called, the Manufacturers' Committee of the A. S. R. A., will have charge of the entertaining during the electric railway conventions at St. Louis in October. After consultation with the executive committee of the A. S. R. A. it was decided to place the matter of badges and registration in charge of the Manufacturers' Committee. The latter will furnish the badges and attend to the registration of all except delegates to the several associations, who will register with their respective secretaries as heretofore. The badges are to be issued to those supplymen only who represent members of the Manufacturers' Association.

Plans for elaborate entertainment of the delegates to the three conventions have been made and there is every reason to believe that the Manufacturers' Association will be a success in every respect. One very important matter in connection with this first convention after the organization of the new association is that of its permanent organization. We believe that, following the precedent set by the Supplymen's Association in connection with the railroad meetings, the meeting of the members for the election of officers and the adoption of a permanent organization will be held the first day of the convention week, that is, on Monday, October 10th. It is very important that this meeting be attended by all the concerns who are members or contemplate becoming such, and for the success of the

association every street railway supply house should have a properly accredited representative in St. Louis in time to attend this meeting. At this writing the date has not been definitely decided, but undoubtedly by the time this is in the hands of our readers, the program of the committee will have been published containing this announcement, or a call for the meeting issued in some other form. The important thing is to arrange for representation at this meeting.

RULES FOR THE GOVERNMENT OF EMPLOYES.

In 1901 a committee of four was appointed to provide a set of rules for the government of employes. The report was submitted at the 1902 convention, but was not adopted, the committee being continued for another year. At the 1903 convention the committee submitted a more comprehensive report, which was approved by the association and its adoption recommended to the member companies.

Of these rules adopted by the association, roughly speaking, three-fourths relate to the operation of street cars proper, and these rules are as complete and satisfactory as could well be expected of any compilation intended for general application. In nearly every city there are, of course, special conditions peculiar to the locality which will require that additions be made to the more generally applicable rules. The other fourth of the rules are those "to be observed by crews of interurban cars." This section of the rules is very incomplete in that, relying upon it alone, an interurban motorman could answer only about one-half of the questions for an examination based on the standard steam railroad rules. Inasmuch as the conditions of operation in so far as safety of trains is concerned are practically identical on high speed electric interurban lines and on the steam roads, the plan followed by some of the interurban companies of adopting the standard steam railroad rules, with such changes in definitions as are necessary because of motor cars being used instead of locomotives, is in every way commendable. The Scioto Valley Traction Co. requires that all men entering its service as motormen must have had experience in operating under the standard steam railroad rules and the men who enter the service as conductors are required within a short time (four months) to pass the same examination that is required of the motormen. Reference to this examination, which is printed on another page, will be found of interest, especially when compared with the interurban rules adopted by the A. S. R. A.

The principal respects in which the interurban rule book is inadequate or incomplete may be briefly indicated.

The rules on visible signals are badly arranged in that red and white are the only color signals included under this head, while the use of the green flag or lantern to indicate more than one section of a train, quite as important on electric roads as elsewhere, is provided for under the head of audible signals. Also the interurban rules make no mention of fusees.

The section on audible signals is incomplete in that no signal for flagman to go back to protect train when stopped is defined, nor are any instructions concerning the use of torpedoes given.

In the interurban rules the important section on movement of trains is included under the heading "Use of Signals," and is only partially covered there, no rule being given to cover the time of arrival and departure at stations, clearance when meeting opposing trains, identification of trains at meeting points, assuming schedule of train overtaken, flagging to next station, or the use of train register and bulletins. Another serious defect is the substitution of a distance interval instead of a time interval between trains proceeding in the same direction, as with a schedule requiring a maximum speed of 50 miles or over, the one mile interval recommended is manifestly inadequate to enable a flagman to protect his train by going back. Nothing is contained in the interurban rules to cover the movement of trains by train orders.

A standard code of rules has also been adopted by the Street Railway Association of the State of New York; as rearranged and renumbered by the rule committee, September, 1904, this code has been published in book form by that association. The interurban rules to be used in connection with the standard code are a great improvement over the old rules and show some very efficient work on the part of the rule committee. However, there are three points which do not seem to have been fully covered. There is no provision for the handling of trains by train orders; in protecting a train, the instruction to a conductor to go back a "sufficient distance" is not definite enough; and in the spacing of trains, one mile apart when running at speed is not sufficient. Also, there is no provision for the use of fusees and torpedoes, appliances which are in use on all steam roads and which have been used by a number of the interurban lines.

Standard forms of train orders have been found a necessity by the steam railroads of the country, and a great many of the larger interurban lines have adopted the standard forms of train orders as used on the steam lines. A "sufficient distance" for a conductor to go back to flag a following train or car should not be left to the judgment of the employe. It is dangerous to run cars only one mile apart at the high speeds at which interurban cars are run. For instance, train No. 11 meets with a slight accident while running at a speed of 30 miles an hour and the train is stopped; the second section of train No. 11 is only one mile behind it; it would be impossible for the conductor to get back a sufficient distance to flag the second section; the result is too well known, and the experience of steam roads has taught them that, unless block signals are used, five minutes apart is as close as safety will permit, and in a great many instances roads have found that ten minutes is as close as trains can be run with safety. This is a point that cannot be given too much consideration in the operation of interurban cars at high speed.

The Ohio Interurban Railway Association, which now has a membership of 132 companies, for the most part roads in Ohio, Pennsylvania and Indiana, has a committee at work formulating rules to govern the operation of interurban railways and general instruction to all employes, and copies of the draft of the proposed rules are now in the hands of the members of the association. The rules as submitted by this committee as a whole are very good. The grouping of the rules under the different heads, such as definitions, use of signals, train signals, whistle signals, movement of trains, etc., is exceptionally good and is quite an improvement over the others mentioned.

About the only unfavorable criticisms to be made on these rules are, as in the case of the other association's rules, the distance which a flagman must go back to protect his train, the method or manner of protecting his train as regards the use of fusees and torpedoes, and the distance or time between trains running in the same direction. Trains moving in the same direction at high speed should keep at least 5 and possibly 10 minutes apart, and the "sufficient" distance for a flagman to go back to protect his train is ¼ mile on straight track and ½ mile on curves.

In view of the very considerable number of members of the A. S. R. A. which are operating high speed interurban lines, it would seem very desirable that the association take up the matter of formulating standard rules for the government of employes on interurban roads and thus complete its work on this subject. In doing this the rules committee of the A. S. R. A. could with advantage act jointly with committees of the New York State and the Ohio Interurban associations.

VALUE AND COST OF PENSIONS.

There are four street railway companies in the United States which have adopted the policy of providing pensions for superannuated employes. These are the Rhode Island Co., of Providence, the Metropolitan Street Railway Co., of New York City, the Boston Elevated Railway Co. and the Denver City Tramway Co., which put pension orders into effect in November, 1901, July, 1902, January, 1903, and June, 1903, respectively. This action being in the nature of an experiment, and while the management in each case announced its intention to make very liberal provisions for employes, the orders stated that should experience indicate that the pension scheme as outlined would prove too great a burden the company reserved the right to rateably reduce the amount of pensions paid.

In this number of the "Review," we reprint a discussion of the "Value and Cost of Service Pensions," which is the second of a series of articles by Mr. Miles M. Dawson, published in the Railway Age. The figures given by Mr. Dawson should be of especial interest to our readers, as at the present time there are very few data available from the experience of electric railway companies as to the cost of pensions.

Mr. Dawson's computations show that considering only employes who enter the service at the age of 20 years and continue until the age of 65, and then receive pensions, amounting to one per cent of

the average salaries during the term of employment for each year of service, the charge for pensions is equivalent to an increase in the pay roll of all employes entering the service at the age of 20, including those who die before reaching the pension age, of only 1.46 per cent. Considering only those employes who live to secure the advantages of the pensions, the pension charge is equivalent to an increase on the pay roll of 2.62 per cent. From these figures it is quite apparent that if the pension charge be considered as an addition to the pay roll of all employes entering at the age of 20, including not only those who die but those who leave the service of their own accord or are discharged, will amount to much less than 1 per cent.

For other classes of employes entering the service at a more advanced age, the pension charge amounts to a greater proportion of the pay roll for the men of that class, being 4.63 per cent for the men entering at 50. Taking an average of all ages, it is probable that the pension charge would not exceed 1 per cent of the total pay roll.

The Rhode Island company, which bases its maximum pension on 2 per cent of the annual wages for each year of service and establishes the pension age at 70, would therefore probably have a pension charge equivalent to not more than 2 per cent of the total pay roll. The Metropolitan Street Railway Co., of New York, which has a less liberal provision, the maximum pension being 40 per cent of the annual wages to men who have been in service 35 years or more, will probably find the pension charge not to exceed 1 per cent of the total pay roll.

One of the special advantages in providing pensions for employes is that while the cost to the employer is small, under the conditions cited by Mr. Dawson, being from 1.46 per cent to 4.63 per cent, the benefit to the employe is very much greater, being for the corresponding conditions, from 9.11 per cent to 18.37 per cent. By this is meant that to insure an income equivalent to that of a pension the employe would have to save a larger portion of his wages than it costs the company to provide the pension. All things considered, Mr. Dawson states that every dollar of what is really increase of wages of each employe, which the employer gives in this way, is fully equal to ten dollars applied by a prudent and faithful employe to the same end.

As stated, the data available from experience of street railway companies are very meager. Inquiry was made recently of the four companies mentioned as having established pensions for superannuated employes in order to ascertain the financial burden so far imposed. The substance of the replies from three of them are as follows:

The Denver City Tramway Co. advises that up to July 22, 1904, none of its men had been placed upon the pension roll but that it is expected that some names will be entered in the near future.

The Boston Elevated Railway Co., in January, 1903, announced that in case of a blue-uniformed employe who, in the judgment of the management, was not able to perform any duty in the service of the company and who had been employed for 25 years, or who having been employed for a period of 15 years, had reached the age of 60 years, the company would contribute to the support of such employe a sum not exceeding $25 per month during the rest of his lifetime. Since this policy went into effect the allowance has been granted to 24 persons, two of whom have since died. In most cases the full amount of $25 per month was granted. The annual expenditure based on the number of persons now receiving allowances is $5,400.

The Boston Elevated Railway Co. in many cases also provides light work for aged or infirm employes, the idea being to encourage the men to remain self-supporting for as long a time as possible, but if they are deemed unable to do work to the value of $25 per month the pension allowance is usually granted.

Mr. Robert I. Todd, general manager of the Rhode Island Co., advises us that at the present time there are on the pension roll of the Rhode Island company seven beneficiaries, the average pension for each being $344.09, a total annual charge of $2,408.63. This company's pension scheme has been effective since November, 1901, and is according to the order issued at that time which was published in the "Review" for January, 1902.

ELECTRIC RAILWAY INSURANCE.

The question of insurance has been a rather serious one for several years and a very considerable number of street railway companies contend that the rates demanded by the underwriters for risks of this class are higher than they should be. Some companies have attacked the problem by carrying their own insurance, that is, by establishing a fund into which are paid amounts equivalent to insurance premiums with the idea that this will constitute a reserve to meet fire losses. Others are directing their attention to mutual insurance, believing that by increasing the number of companies and the amount of property involved they can with greater safety carry their own risks. The latest development in this direction is the organization of two mutual companies to carry respectively railway risks and power station risks. The general scheme of organization of these companies is given on page 600.

Closely allied with the matter of fire insurance is that of casualty insurance, except that while insurance companies are glad to get street railway fire risks, at a price, they are not willing to accept street railway casualty risks at all. The article by Dr. H. B. Rockwell, on page 590, is an interesting discussion of casualty insurance problem and will perhaps lead to important results in this line.

The matter of fire insurance of power stations can undoubtedly be handled more economically by mutual companies, although in well designed modern plants the fire risk is extremely small and we believe is accepted by the old line companies at very low rates. In the best stations there is practically nothing inflammable except the wood in the window casings and the doors. The floors and walls are of brick or concrete, the roofs are also of concrete supported on steel girders and, in fact, the contents of such stations is equally as noninflammable as the building itself so that if the building were isolated little risk would be incurred in leaving it uninsured. These considerations apply only to the very best designed structures, but many of the older power plants which were built before much experience had been gained in this line of insurance present considerable fire risk.

In the case of buildings for the storage of cars the risk must always be higher than in the case of power houses as the contents of the building are very liable to damage by fire no matter how nearly fireproof the structure may be. In the case of these buildings, however, the risk may be decidedly reduced by erecting a sufficient number of fire walls between different tracks so that but few cars are stored in any one section and a fire in one section cannot be communicated to any of the others. The risk is also decreased in well-designed car houses by laying the indoor tracks on a grade of about 1 per cent so that in case of fires even if the current is cut off from the overhead wires, the cars may be run down the grade and out of the building by simply releasing the brakes. There is no doubt, however, but that this class of buildings can also be most economically insured in a well organized mutual company, as the absence of all commissions and of a large number of high salaried officials would alone have considerable effect on the amount of the premiums.

If the mutual companies are found to be advantageous in the case of fire insurance they are certainly indispensable in the case of casualty insurance as the latter class of risks are absolutely refused by insurance companies. There is undoubtedly a broad field for a mutual company in connection with street railway accidents as there could be a large amount of fraudulent and excessive damages saved by a company organized to handle this class of work. This class of risks has always heretofore proved unfortunate to the companies that have undertaken them and it is evident that such insurance should not be undertaken until a sufficiently large number of companies have joined in the movement so that the aggregate premiums are ample to take care of any contingencies. One point brought out in Dr. Rockwell's article is worthy of careful consideration, that is, the term of insurance should be for a fair length of time, say five years, and the companies should not have the privilege of canceling their insurance. The business would be carried on somewhat after the manner of the claim departments of the large street railway systems and the saving in fraudulent claims would undoubtedly amount to a large figure. Such insurance should really appeal to the smaller rather than to the larger companies as the former are not in a position to maintain a well organized claim department. If the large street railway companies find it profitable to maintain a large and well organized claim department, a combination of companies would undoubtedly find it still more profitable to centralize the work of the individual claim departments in a well-organized and economically managed mutual casualty insurance company.

The Stone & Webster Properties on Puget Sound.—III.

The Puyallup River Water Power Development Near Tacoma, Wash.

The cities of Seattle and Tacoma, Wash., and their suburban towns have in five years increased in population from 130,000 to upwards of 225,000; the growth of manufacturing industries and construction of street and interurban electric railways has kept pace with the increase of population, and to supply the consequent demand for electric power an unusually large generating plant of the most modern type has been constructed on the Puyallup River.

General Plan of Development.

The Puget Sound Power Co., the owner of the plant, was organized in the year 1902, for the purpose of developing water power for use by the Stone & Webster properties in Seattle and Tacoma. Before beginning the construction of the plant a careful investigation was made of the variations in the flow of the several rivers in western Washington and the other features which would affect the reliability of the service obtainable from each, and a general plan was then adopted for the development of this power on the Puyallup River with an initial installation of 20,000-h.p., the plans being made and the greater portion of the work carried out on the basis of continuing the initial installation to an ultimate development of 40,000 h.p.

The design consists of diverting the Puyallup River just below the junction with the Mowich and carrying the water by means of a flume ten miles to a reservoir located on a high plateau, and thence discharging by means of steel pipes against wheels in the power house under a head of 872 ft.; the water wheels so driven to be direct connected to electric generators and the electric current so produced to be transmitted at a pressure of 55,000 volts 48 miles to Seattle and 32 miles to Tacoma.

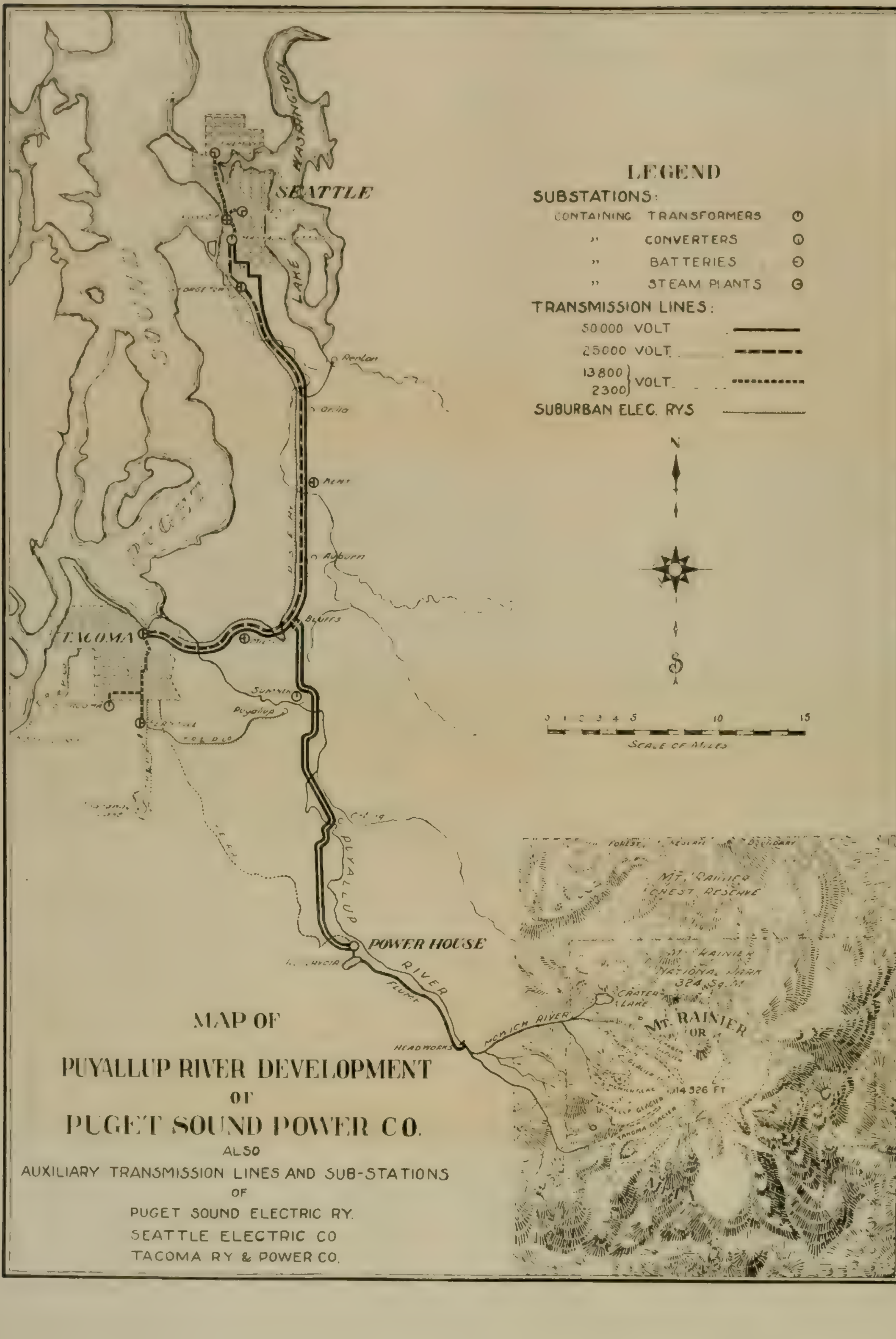
All water rights and the necessary land abutting on the river from the point of diversion to point of return were secured, also all land necessary for flume and other structures, and actual work of development was commenced Mar. 1st, 1903. To facilitate construction a spur track 2½ miles long was built from the Kapowsin Station of the Tacoma Eastern R. R. to a new station at Electron and continued a mile farther to the power house site. From Electron a standard gage cable incline was built to lift to an elevation of 950 ft. to the reservoir site above the power house, and a wagon road to the head works. The first generator unit of 5,000 h.p. was put into commercial operation delivering power to Seattle and Tacoma on April 14, 1904, less than fourteen months after work was commenced; the plant was put into complete operation for its initial installation of 20,000 h.p. on July 23, 1904.

Source of Supply.

The Puyallup River has its source in the glaciers of Mount Rainier, the highest mountain in the United States and one of the great mountain peaks of the world, covering 200 square miles and rising 14,500 ft. above the waters of Puget Sound. That part of the mountain higher than 5,000 ft. above sea level is covered with snow and ice, and the precipitation resulting from the moisture-laden air of the Puget Sound region coming in contact with the glacial cold of the mountain sides is estimated to average 140 in. per annum. The fields of ice and snow which result from this precipitation are constantly moving down the mountain sides to the valleys about its base in the form of slowly moving glaciers of many square miles in extent, which fill the valleys to the depth of hundreds of feet, and are constantly being added to from above and melting away below.

WEST VIEW OF POWER PLANT PUGET SOUND POWER CO.—FOUR GENERATORS IN OPERATION.

These great masses of ice increase in size and depth each winter and decrease by melting under the heat of summer, and the hottest and driest days of summer produce the greatest rate of melting. The Puyallup and Mowich Rivers drain a fan shaped section of the mountain and five of the glaciers described, and thence flow through mountain ranges which add greatly to their volume, each for a distance of about 12 miles from the glaciers, and then join, the combined rivers being then known as the Puyallup. The water shed of these rivers includes a rough and heavily timbered country not covered with ice or snow and below the very high mountain range. The streams of this lower timbered country are fed by the copious rains of the Puget Sound country which occur during the fall, winter and spring months concurrently with cool weather. During such cool weather the rain and the run-off in this timbered section is heavy and at the same time snow and ice accumulate on the mountain and the run-off from it is comparatively small. When the warm weather comes the rain and the run-off from the timbered section is at a minimum and the melting of the snow and ice on the mountain and the run-off from the same is at a maximum. This balance, or alteration of the heavy run-off from the timbered and ice sections, results in a


LEGEND
SUBSTATIONS:
CONTAINING TRANSFORMERS
" CONVERTERS
" BATTERIES
" STEAM PLANTS
TRANSMISSION LINES:
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25000 VOLT
13800 / 2300 VOLT
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Puyallup
PUYALLUP RIVER
POWER HOUSE
FLUME
HEADWORKS
MT. RAINIER FOREST RESERVE
MT. RAINIER NATIONAL PARK 324 Sq. M
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TACOMA GLACIER
MAP OF
PUYALLUP RIVER DEVELOPMENT
OF
PUGET SOUND POWER CO.
ALSO
AUXILIARY TRANSMISSION LINES AND SUB-STATIONS
OF
PUGET SOUND ELECTRIC RY.
SEATTLE ELECTRIC CO
TACOMA RY & POWER CO.

remarkably uniform flow in the river at the point from which the water is taken for power purposes and makes the operating conditions in using this water ideal.

Although the dam and intake are located within 10 miles of the nearest glacier the elevation at this point of diversion is only about 1,700 ft. above sea level and the climate at this elevation is so uniformly mild and the water flows so rapidly that no ice comes down the river nor is formed either in the flume or reservoir.

MT. RAINIER FROM FLUME NEAR SPILLWAY—THE "RESERVE SUPPLY."

Utilization of Current.

The power is used for all branches of service—light, power and railway. It supplies the electric railway systems in Seattle and Tacoma, aggregating 168 miles of trolley road, the multiple unit, [illegible] Seattle and Tacoma, two cable roads, one of Seattle and one of Tacoma, furnishes power for numerous [illegible] and the shops of the Northern Pacific Ry. and the [illegible] in the city of Tacoma, and supplies the greater [illegible] lighting and street lighting in [illegible] between Seattle and Tacoma.

Much of the power is distributed as alternating current, two phase for power and single phase for lighting, but there is also connected 10,000-kw. of converting capacity for producing direct current, 2,000 kw. of which is used for light and stationary motor supply. The bulk of the converting machinery (7,300 kw.) being of the synchronous type, it is not necessary for the water power plant to generate or transmit idle currents.

The distribution of the current to the various localities and the transformation and conversion for various uses takes place at 11 sub-stations containing 26,000 kw. of transformer capacity. Six of these are designed for transforming the 55,000-volt current to lower voltage and eight contain machinery converting to direct current for railway use.

INTAKE AND DAM, LOOKING EAST.

Dam and Intake.

At a point one-half mile below the confluence of the Puyallup and Mowich Rivers and about 1,700 ft. above sea level, is located the dam and intake of the Puget Sound Power Co. Here the water necessary for the operation of its plant is diverted by a low, solidly constructed dam, through a masonry intake to a flume which is con-

structed on the southwest side of the river for a distance of ten miles. The dam or diverting weir is 200 ft. long and 2 ft. high and covers the bed of the river longitudinally for a distance of [illegible] ft. exclusive of the down-stream apron. It is built down to an impervious bottom of clay hardpan and is made tight by three rows of triple lap sheet piling set into hardpan bottom and bedded in con-

FLUME LINE THROUGH ROCK CANYON OF PUYALLUP

crete; it is faced with 6 x 12-in. timber covered at the crest with ¼-in. boiler plates. While the whole dam is a spillway, there is a lower spillway 30 ft. wide to localize scour at the intake end. The intake is set at right angles to the dam and is constructed of concrete masonry. It is 62 ft. wide at the river bank and is protected by a screen grating made of iron bars ¼ in. x 4 in. x 6 ft., spaced 2½ in.

RESERVOIR PILING CONSTRUCTION, SHOWING POOL ARRANGEMENT FOR OPERATING WITHOUT FILLING RESERVOIR

Provision is also made for the insertion of flash boards in grooves in steel frames in such manner as to regulate or entirely shut off the intake at a point between the river and the grating. A radial gate of unique design is also installed at the junction of the masonry intake and the flume for the purpose of quickly controlling the amount of water delivered to the flume.

Flume.

From head works to reservoir, a distance of about ten miles, the water is carried in a flume which as now constructed is 8 ft. wide and 5 ft. high inside measurements, but is framed for the addition of plank to make it 8 ft. high. The flume is supported on a low trestle work which follows the contour of the land, this trestle work

WAGON ROAD TO HEADQUARTERS

is the same construction, and of equal strength to that usually used for railroads, and in fact during the construction heavy work trains were operated over its entire length. The flume proper is constructed of surfaced planks 2¼-in. in thickness and 12 in. wide, and the frames which surround it are placed 4 ft. between centers; the flume is built on a uniform grade of 7½ ft. to the mile. Sand boxes and automatic spillways are provided at various points along the flume and a number of gates are also provided for emergency use, while a light railroad track for hand cars of standard gage is laid along the top of the flume to facilitate inspection and repairs.

All danger timber along the line of the flume is being removed and the flume trestle is built on rock or hardpan foundation which protects it against trouble from slides. In constructing this flume the usual plan of building curves as a series of tangents was not followed, the bends in the flume are made with true curves presenting a uniform and smooth interior surface and thus facilitating the flow of water.

Reservoir.

The flume discharges its water into a reservoir located on a high plateau, nearly 900 ft. above the power house. This reservoir serves as a relay to maintain the plant in continuous operation, in case of interruption of water supply, and also serves the very useful purpose of supplying water for temporary overloads in excess of discharge capacity of flume, or in other words, for equalizing the daily fluctuations of load. The location of the reservoir is particularly well adapted for the purpose, the material excavated from the higher side of the site was used to form the embankment on the lower side of the reservoir. This material is a glacial boulder till of clayey consistency which required blasting before it could be handled with steam shovel; it puddled well and formed a water-tight fill which set hard in embankment almost like concrete.

The flume enters one end of the reservoir and, when the latter is drained, discharges into a concrete basin in front of the forebay. This arrangement permits the emptying of the reservoir for inspection or cleaning without interrupting the delivery of water to the

power house, and distributes the water quietly to the penstocks without danger of carrying air into the pipes.

The forebay is of concrete and is constructed inside of the reservoir, being divided into compartments forming separate gate chambers for the main penstocks. Each compartment is provided with iron racks or screens with stop boards to permit inspection or repairs without emptying the reservoir. The gates are arranged for connecting an electric motor drive to be controlled from the power house.

The depth of water in the reservoir is at all times shown at the power house switchboard by a Dibble automatic electrical indicating and recording water gage fitted with low water alarm. This gage is operated by three wires running from a float-actuated Dibble transmitter located in the reservoir.

Penstocks.

The penstocks, one for the two exciters, one for each of the four generating units now installed, and one for each of the remaining four units to be installed later, are carried through the reservoir embankment in the form of concrete protected wood stave pipes, joining the steel pipes just outside the reservoir embankment. Of the eight main pipes for the complete plant four, together with the exciter pipe, are now continued about 1,700 ft. down an incline of about 30 degrees to the power house on the river bank below. Each main pipe is of riveted steel 48 in. in diameter and ¼ in. thick at the upper end, tapering to 36 in. in diameter and ¾ in. thick at the lower end, and was furnished by the Risdon Iron & Locomotive Works. The penstocks are anchored by massive concrete abutments and all surface water is carefully drained away, and as a further security the pipes are protected with backfilling of earth on which is planted quick growing vegetation.

Power House.

The power house is built in the bank of the river on a foundation of piling and rock; it is of massive concrete, brick and steel construction; the building for eight units will be about 100 x 266 ft. divided longitudinally into two parts, a generator house and a transformer and switching house. The generating units are arranged parallel to and along the riverside of the building, the penstocks being brought to them under the main floor from the rear. The transformers are grouped in isolated rooms of concrete in the basement of the [illegible] house, the switching apparatus and wiring being [illegible].

VIEW OF PENSTOCK LINES, LOOKING SOUTH.

Water Wheels.

Each "unit" consists of two overhung Pelton water wheels, 10 ft. 6 in. in diameter, mounted on each end of the shaft of each five thousand horsepower two-bearing generator; the nozzles are of the needle type arranged for automatic deflection by Lombard "Type L" governor for speed control, the operation of the needles being only

INCLINE CABLE RAILWAY—MAXIMUM GRADE 68 PER CENT.

for economical adjustment of the discharge to the load of the machine; each nozzle is also provided with a motor operated gate valve for cutting off the water supply. The wheels have a maximum capacity of 7,500 h.p. for each unit.

The wheels are arranged to be started and stopped and adjusted for speed from the main operating switchboard at one end of the generator room; motor driven pumps provide oil supply for ordinary lubrication, pressure oil for forced lubrication in starting, and circulating water for cooling bearings.

The rotors and wheels of each unit are hydraulically forced onto a 24-in. hollow nickel steel fluid compressed shaft. The spray from the wheel discharges collecting in the water wheel housing enters this hollow shaft and automatically serves to cool the bearings. At the date of their installation these were the largest impulse wheel units in the world.

Electrical Equipment.

There are four General Electric revolving field generators of 3,500 kw. capacity each, with an overload capacity of 25 per cent for two hours, wound for three-phase current at 2,300 volts and a frequency of 60 cycles per second.

Two 150-kw. 125-volt 600 r.p.m. shunt wound exciters are provided, each direct connected to an overhung Pelton water wheel and to a 2,080-volt 200-h.p. three-phase induction motor. The wheels driving exciters are not provided with automatic governors, and the direct connected induction motors serve this purpose, operating either as motors or generators according as they run below or above synchronous speed. The motors also afford a relay source of power for excitation in case of failure of an exciter-water-wheel or its water supply. Each exciter is capable of exciting six generators under all conditions.

There are three banks of transformers installed at the power station, each bank consisting of three 2,333-kw. water cooled, oil insulated, General Electric transformers with 25 per cent overload capacity for two hours. Each bank has a capacity equivalent to two generators, the third bank being spare, so that the failure of even a complete bank would not diminish the capacity of the station. The transformers are connected delta on both the high and low tension

sides and the arrangement of the windings is such that with 2,300 volts on the low tension side, high tension voltages of 27,500, 45,000, and 55,000 may be derived. These transformers have been operated at 55,000 volts from the beginning.

Water for cooling is derived from a spring above the power house, supplemented by connection with the reservoir. The transformers are piped so that the oil can be removed from the case into large storage tanks, and an emergency blow-off valve is arranged to discharge the oil quickly into the river.

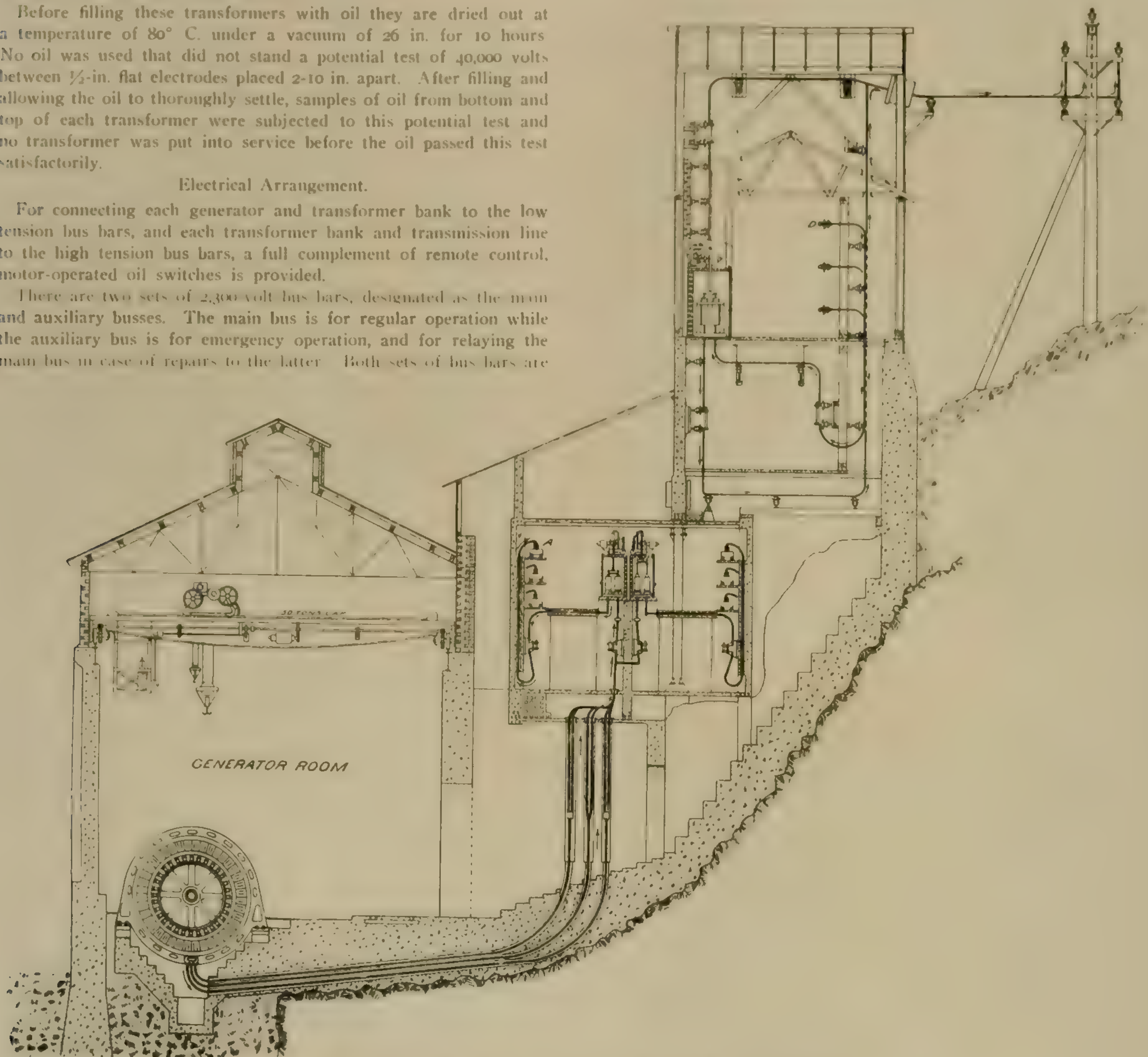
Before filling these transformers with oil they are dried out at a temperature of 80° C. under a vacuum of 26 in. for 10 hours. No oil was used that did not stand a potential test of 40,000 volts between ½-in. flat electrodes placed 2-10 in. apart. After filling and allowing the oil to thoroughly settle, samples of oil from bottom and top of each transformer were subjected to this potential test and no transformer was put into service before the oil passed this test satisfactorily.

Electrical Arrangement.

For connecting each generator and transformer bank to the low tension bus bars, and each transformer bank and transmission line to the high tension bus bars, a full complement of remote control, motor-operated oil switches is provided.

There are two sets of 2,300-volt bus bars, designated as the main and auxiliary busses. The main bus is for regular operation while the auxiliary bus is for emergency operation, and for relaying the main bus in case of repairs to the latter. Both sets of bus bars are identical and any generator and any transformer bank can be connected to either set.

Between each generator and each set of 2,300-volt bus bars there are two sets of disconnecting switches and a triple pole General Electric "Type H" 1,200-ampere, motor-operated oil switch, a set of disconnecting switches being on either side of the oil switch. Between each set of bus bars and each transformer bank there are two sets of disconnecting switches and a "Type H" 3,000-ampere motor-operated oil switch, the arrangement being similar to that of the generator switches. The purpose of the disconnecting switches is to remove the potential from the oil switches that inspection of or repair to the oil switches may be safely made. The disconnecting switches are not to be operated when carrying current except under emergency conditions. All ordinary switching is done by means of the oil switches which simultaneously open and close the three legs of the three phase circuit. In addition to the single pole double throw switches mounted on the operating panels, for opening and closing these switches, when cutting in or out a generator or transformer bank, there is for each oil switch a clock type time limit relay actuated by secondary current from current transformers in circuit with that switch, these relays operating the motor connected to the oil switch in case of an overload or short circuit lasting the period for which the relay is set. These relays can be set for overload periods of 4 seconds down to a small fraction of a second, it thus being possible to automatically localize short circuits on the system, and in apparatus, without completely shutting down the system. The electrical arrangement of the motors driving the exciters is the same as that of the generators.



CROSS SECTION LOOKING EAST, SHOWING CIRCUITS NOS. 1 AND 4
Circuit No. 1 From Generator to Low Tension Bus Bars A-B.
Circuit No. 4 From High Tension Bus Bars C-D to Line.
Main Low-Tension Bus in Use, Auxiliary Bus Disconnected.

There is one set of high tension bus bars, divided into three sections by sectionalizing switches, each transformer bank being connected to a corresponding section, and one line to each of the end sections.

Between the high tension bus and each bank of transformers there are two sets of disconnecting switches and one triple pole

General Electric 60,000-volt, 400-ampere, motor-operated oil switch, a set of disconnecting switches being on either side of the oil switch. There are two outgoing high tension lines and each line is controlled as just described for the transformer banks. All the high tension oil switches possess the automatic features as described for the low tension oil switches.

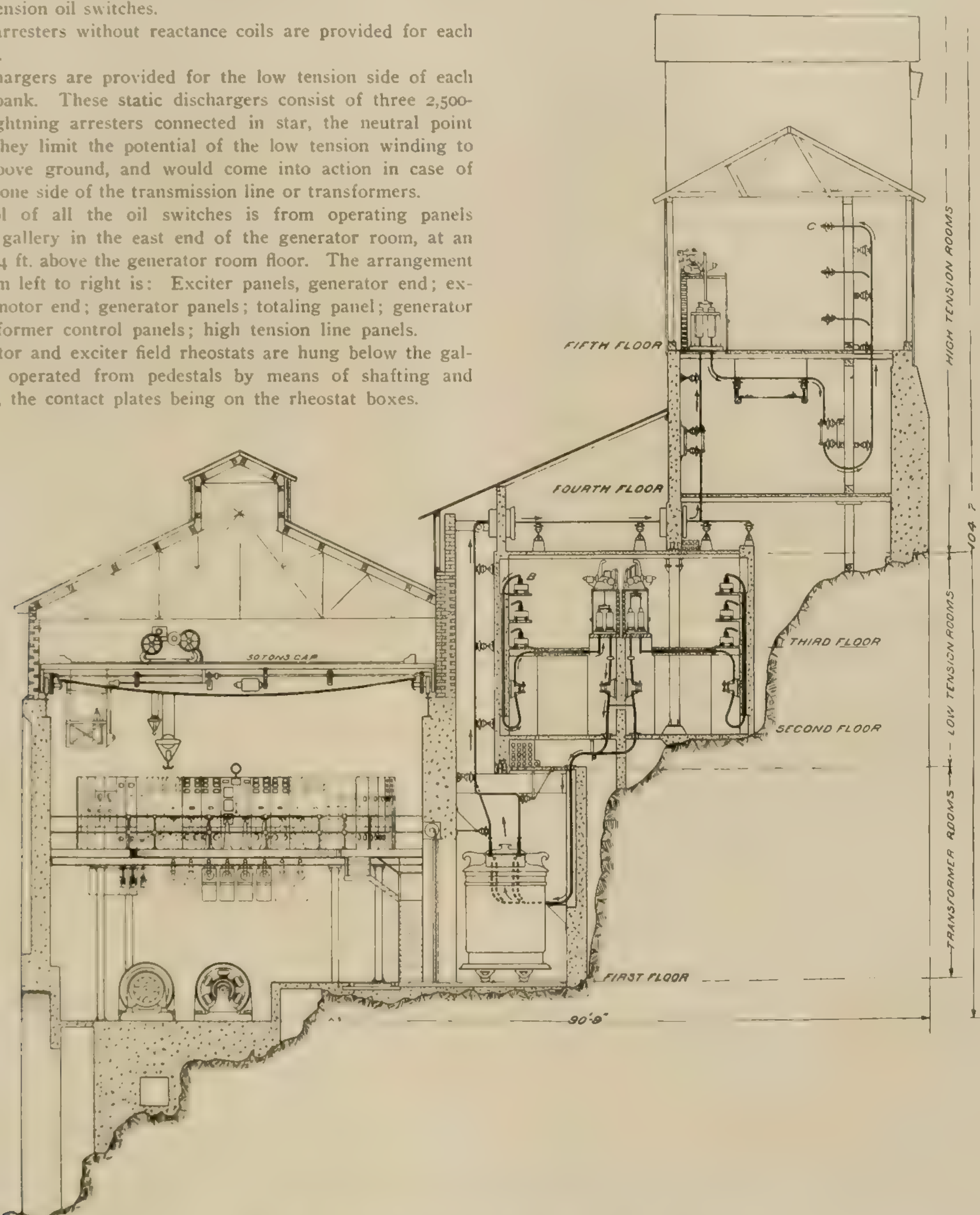
Lightning arresters without reactance coils are provided for each outgoing line.

Static dischargers are provided for the low tension side of each transformer bank. These static dischargers consist of three 2,500-volt S. P. lightning arresters connected in star, the neutral point grounded. They limit the potential of the low tension winding to 2,500 volts above ground, and would come into action in case of grounding of one side of the transmission line or transformers.

The control of all the oil switches is from operating panels erected on a gallery in the east end of the generator room, at an elevation of 14 ft. above the generator room floor. The arrangement of panels from left to right is: Exciter panels, generator end; exciter panels, motor end; generator panels; totaling panel; generator panels; transformer control panels; high tension line panels.

The generator and exciter field rheostats are hung below the gallery and are operated from pedestals by means of shafting and bevel gearing, the contact plates being on the rheostat boxes.

lery, a water wheel may be started or stopped, a generator brought up to voltage, synchronized with other generators on either bus, a transformer bank cut in on either bus and a transmission line connected in circuit without the presence of a person in the room where



CROSS SECTION LOOKING EAST, SHOWING CIRCUITS NOS. 2 AND 3
Circuit No. 2 From Low Tension Bus Bars A-B to Transformers.
Circuit No 3 From Transformers to High Tension Bus Bars C-D.
Main Low Tension Bus in Use, Auxiliary Bus Disconnected.

The highest alternating current potential on the switchboard panels is 115 volts derived from potential transformers and the highest direct current potential is 125 volts derived from the exciters.

Each generator panel contains three ammeters, one voltmeter, a polyphase indicating wattmeter, a polyphase intrograting wattmeter, and a field ammeter.

Each outgoing line panel contains three ammeters, and the totalizing panel contains a power factor indicator, a frequency indicator, a curve drawing voltmeter and three curve drawing ammeters. The curve drawing instruments belong to a type lately developed by the General Electric Co., giving a record of 3 in. long per hour.

The control of the plant is completely from the switchboard gallery ... the actual switching is done, the lighting of a red lamp indicating the closing of a switch and a green lamp the opening of a switch.

Switch House Arrangement.

Two of the illustrations show sections through the generator room and switch house. The transformer rooms are at the same level as the generator room but isolated from the latter by rolling steel doors. On floor No. 2 are the low tension disconnecting switches, the generator and transformer cables going to the sets of disconnecting switches installed between the oil switches and the bus, being on the outer walls and immediately below the bus bar compartments which are above on floor No. 3. In the center of floor No. 3 are the low tension oil switches corresponding to a generator or

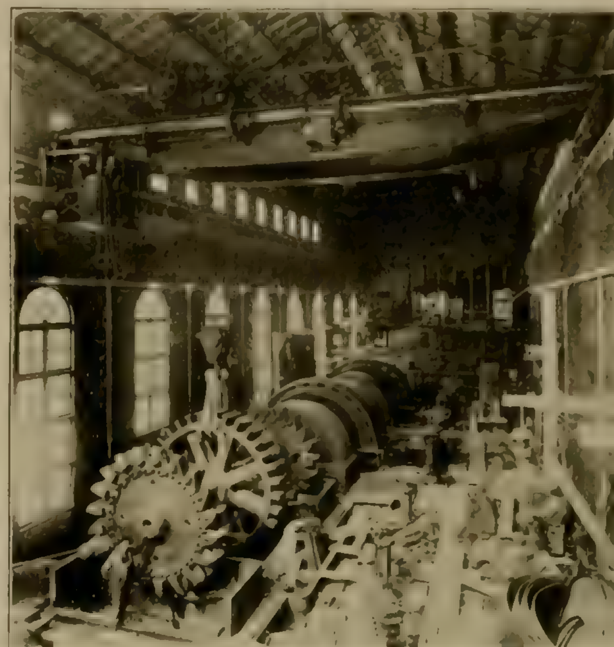
SWITCH HOUSE.

5th Floor—H. T. Bus Bar at Left, Transformers at Right.
4th Floor—Instrument Transformers—H. T. Disconnecting Switches.
3d Floor—2300-volt Bus Bar—2,300-volt Oil Switches.
2nd Floor—Disconnecting Switches.

transformer bank being arranged back to back and facing their corresponding set of bus bars. The bus bars are of the laminated type consisting of flat copper bars with expansion joints and supported on marble slabs set on edge which in turn rest on concrete slabs forming barriers between adjacent bus bars. The compartments formed by the concrete slabs are to be covered by insulated fireproof doors.

The oil switches are installed in brick cells with soapstone bottom and top slabs and doors. Each pole of a switch is separated from the other poles by brick barriers.

The same general scheme is used for both the low and high tension disconnecting switches and oil switches, except that only one set of high tension bus bars is at present installed, provision being made for the later installation of the second set. The high tension disconnecting switches and current transformers are on floor No. 5, while the high tension oil switches are on floor No. 6. Above floor



INTERIOR OF POWER HOUSE, JUNE 8, 1904.

No. 6 are the two outgoing high tension line towers, in the north end of which are the high tension lightning arresters, each pole being separated from its adjacent pole by brick barriers extending the full length of the arrester. The lines emerge from the wire tower centrally through an extra heavy 30-in. sewer tile covered by a glass plate.

Transmission Line

From the power house two parallel transmission lines run a distance of 22 miles to Bluffs, a station on the line of the Puget Sound Electric Ry., 9 miles from Tacoma and 25 miles from Seattle. From Bluffs one line runs for a great part parallel to the transmission line of the Puget Sound Electric Ry. to Seattle and one to Tacoma, also parallel to the transmission line of the Puget Sound Electric Ry.

The transmission line of the Puget Sound Electric Ry. is at present operating at 27,000 volts but the line is designed for operating at double this potential, so that when this line is changed over to a 55,000-volt basis there will be two complete and independent pole lines from the power house to Seattle and Tacoma. At Bluffs there are erected junction pole switches by which the two transmission lines may be cut through independently, one to Seattle and one to Tacoma, or both lines put in multiple, or any section isolated without interfering with the operation of the other sections.

From the power house to Bluffs a private right of way has been secured, the two pole lines being from 50 to 80 ft. apart. When passing through wooded sections all dangerous timber has been cleared well back on the land adjacent to the right of way on both sides, so as to completely protect the transmission line.

The minimum length of poles used was 45 ft. with a minimum top diameter of 10½ in. The standard spacing is 125 ft. on straight line and 90 to 100 ft. on curves.

The main cross arm is 5 in. x 7 in. x 7 ft. 4 in. Washington fir, boiled in raw linseed oil, giving it a much longer life than an untreated arm. This arm is bolted to the pole by two galvanized iron bolts and braced by a combination wood and galvanized iron brace. At the top of the pole is an arm 5 in. x 7 in. x 18 in. supported by an angle iron frame bolted to the pole by two galvanized iron bolts.

The main arm supports two insulators and the top arm one insulator giving an equilateral triangular spacing of 72 in. between wires.

The pins on one line from the power house to Bluffs and from Bluffs to Seattle and Tacoma are galvanized malleable iron, cast hollow and circular in cross-section and having a shank diameter of 2½ in. The pins on the other line are of the same general exterior form and dimensions but turned from eucalyptus wood and treated with linseed oil. The iron pins and eucalyptus pins are entirely interchangeable in all parts of the construction.

The insulators are of dark brown glazed porcelain, a small portion being furnished by the Locke Manufacturing Co. and the greater portion by R. Thomas & Sons, East Liverpool, O. The insulators are a special design adopted after tests on a number of samples of varying design. The insulator consists of a broad umbrella shaped top 14 in. in diameter and three inner shells cemented together and to the iron pins by neat portland cement. They weigh about 22 lb. and stand a potential of 90,000 to 100,000 volts before arcing over under an artificial rain test. The separate parts of the insulators were given a dry potential test at the factory before shipment, and after assembly in Tacoma and before shipping out on the line they were again tested to a potential corresponding to the dry arcing over voltage. So far the behavior of these insulators under the weather conditions that have existed since the plant was put into operation and under a line potential of 55,000 volts, has been entirely satisfactory.

The line wire on both lines from the power house to Bluffs and from Bluffs to Seattle is 19-strand No. 0000 semi-hard drawn copper cable, and from Bluffs to Tacoma is solid No. 0 semi-hard drawn copper wire.

The wires are transposed, making a third of a turn about every four miles.

The telephone line is supported on cross arms 7 ft. below the main arm and consists of two No. 10 hard drawn copper wires, transposed every tenth pole, the glass insulators being double petticoat deep groove on locust pins. The operation of the telephone line with this construction has been entirely satisfactory. The company also has an independent telephone line leased from the Sunset Telephone Co. and constructed over another route.

Sumner and Puyallup.

Eighteen miles from the power house and along the transmission line from the power house to Bluffs is the town of Sumner. In Sumner has been built a sub-station to accommodate two 100-kw. [illegible] to 2,300-volt transformers for local power and lighting. At present only one transformer has been installed, furnishing current for lighting Sumner.

A pole line has been built from Sumner to Puyallup, a distance of three miles, for supplying the city of Puyallup with current for lighting and power, taking the place of the steam plant at present in operation.

Massachusetts St. Sub-Station.

The receiving station in Seattle is built on Massachusetts St. near the southerly city limits. Here the high tension current is stepped down to 2,300 volts for local distribution to the stations of the Seattle Electric Ry. Co.

WIRE TOWERS—HIGH TENSION LINES LEAVING POWER HOUSE.

Control is provided for the two incoming high tension lines by means of high tension motor-operated oil switches, and for two 4,000 kw. banks of transformers and for three outgoing 2,300-volt feeders. The control of the transformers consists of a motor-operated 60,000-volt 400-ampere oil switch on the high tension side of each bank of transformers and a motor-operated 2,500-volt 4-pole oil switch on the low-tension side of each bank. The control of the 2,300-volt outgoing feeders is by motor-operated 4-pole oil switches similar to the transformer low tension switches, differing only in capacity, the former being 800-ampere and the latter 1,200-ampere capacity. All of the oil switches have time limit relays for automatically opening the switches in case of overload or short circuits. There are installed four 2,000 kw. transformers in two banks of

RIGHT ANGLE TURN IN TRANSMISSION LINE AT ORTING.

two each, transforming from 50,000 volts three phase to 2,300 volts two phase. The arrangement of the winding is such that 50,000, 40,000 and 25,000 volts can be used on the high tension side and low tension voltages of 13,800, 6,900 and 2,300 volts may be obtained. The two transformers constituting a bank are connected T but using the full winding in the teaser transformer rather than 87

SHOWING CURVE CONSTRUCTION—NEAR SEATTLE.

per cent as in the usual Scott three-phase-two-phase connection. This produces only 1,990 volts on the low tension side of the teaser transformer with 2,300 volts on the main transformer, and in order to boost this to normal a 200-kw. transformer called a compensator having the full ampere capacity, in the boosting coil, of the 2,000 kw. transformer and ratio of transformation of 1,990 to 310, is installed. This makes it possible to admit all 87 per cent taps on the high tension winding of which there would be a number, for the three primary voltages above stated, and simplifies the transformer construction.

All the transformers, including the compensators, are water cooled, the water for cooling being primarily derived from the city service, but recooled by a cooling tower to effect economy by the reuse of water.

There are in addition to this apparatus two 500-kw. transformers in this station with a ratio of transformation of 25,000 to 2,200 volts installed for connection to the transmission line of the Puget Sound Electric Ry.

For measuring the input of power into the 2,300-volt busses a graphic recording voltmeter, ammeter and wattmeter are provided in addition to the integrating wattmeter.

Lightning arresters identical with those at the power house are provided for each of the incoming lines. Marble barriers between adjacent poles of the arresters are installed to prevent the travelling of an arc from one leg to another.

Four-pole static dischargers are installed on the low tension side of each transformer bank, their purpose being the same as those at the power house.

For controlling the voltage of the 2,300-volt outgoing feeders there is installed in each feeder a motor-operated induction regulator each of a capacity of 340 kw. These regulators boost or lower equally each leg of each phase.

Seattle Electric Co's. Distribution.

The power is transmitted at 2,200 volts, two phase, from Massachusetts St. sub-station to Post St. station and from there also at 2,200 volts two phase, to James St. station and Fremont sub-station.

Post. St. station contains nine 500-kw. rotary converters each with two 300-kw. transformers, five giving 500-volt current for railway and four 250-volt current for lighting, also six 50-kw. tub transformers for street lighting. This station is a steam relay station and contains two 2,500-kw. overload capacity, 60 cycle, 2,200-volt, two phase, alternators, each driven by a vertical compound engine, also a 1,000-kw. lighting and a 500-kw. railway battery. The station contains the general switchboard for controlling the whole distribution in Seattle.

James St. station contains two 300-kw. induction motor generator sets giving 500-volt railway current. It is also a steam relay station with three 150-kw. railway generators driven by a double corliss engine. When operated on a water power basis the railway generators are used as motors to operate the James St. cable road.

Fremont sub-station contains two 300-kw. motor generator sets, one induction and one synchronous, the motor end of each being 2,200-volt, two phase and the generator end 500-volt direct current. There is also installed a 300-kw. railway battery.

The Seattle Electric Co. has in addition to these, two steam relay stations not used as sub-stations. These are equipped with direct current machinery for railway and light and have a combined capacity of 1,500-kw.

Tacoma Sub-Station.

The receiving station in Tacoma is a new brick building, built as an addition to the steam station of the Tacoma Railway & Power Co. Control for two incoming high tension lines is provided as described for Massachusetts St. sub-station. One 4,000-kw. 50,000 to 2,300 volts transformer bank is installed with automatic oil switch control on high and low tension sides.

There are also installed two 500-kw. step-up transformers, transforming from 2,300 volts two-phase to 13,800 volts three-phase for supplying power to Fern Hill sub-station, the Northern Pacific Railway Co's. shops and other local consumption not within the range of economical distribution at 2,300 volts. Automatic control of this bank is provided on the low tension side only by means of a "Type

HIGH TENSION WIRING AND DISCONNECTING SWITCHES—MASSACHUSETTS ST. SUB-STATION, SEATTLE.

H" 4-pole motor-operated oil switch. Spare transformers for each of these banks are provided.

For receiving power from the 25,000-volt transmission line of the Puget Sound Electric Ry. four 200-kw. oil cooled transformers, wound for 25,000 to 50,000 volts, stepping down from 25,000 to 2,300 volts, are installed.

The high tension oil switches are installed on a steel concrete gallery 20 ft. above the transformer room floor, the two line oil switches on a gallery at right angles to the length of the building and the transformer switch on a gallery parallel to the length and along the north wall of the building. Directly under the transformer oil switch are the transformers themselves. On the opposite side of the room and parallel to its length and four feet above the floor are the transformer 2,300-volt oil switches.

One 400-kw. induction regulator similar to those installed in Massachusetts St. sub-station, controls the potential of the supply bus, being installed between the transformer bus and the supply bus. Apparatus for cooling the transformer circulating water is being installed somewhat similar to that at Massachusetts St. sub-station.

The 2,300-volt power is used for lighting and power service in the city of Tacoma partly, and partly converted into 600-volt direct current for railway and commercial motor service. This conversion is effected by two 500-kw. induction motor-generator sets, by one 850-kw. synchronous motor set and by 800-kw. in belted machines driven by a 1,000-kw. synchronous motor. Either this synchronous motor or the 1,000-kw. motor driving the 850-kw. direct current generator can be driven by the steam engines which drive onto a line shaft in which these motors are set, being connected at either end by jaw clutches, thus furnishing a supplementary source of supply and reserve for any of the alternating current distribution, and for the induction motor generator sets supplying current for the railway. A 100-h. p. induction motor furnishes power for driving a cable road accommodating the hill district of the city.

The Tacoma Railway & Power Co. operates about 84 miles of track in the city of Tacoma and between Tacoma and the neighboring towns of Puyallup, Spanaway and Steilacoom, and also furnishes power for the operation of the trains of the Puget Sound Electric Ry. within the Tacoma city limits.

At the Fern Hill junction of the Puyallup and Spanaway lines is a steam station of 500 kw. capacity. There is being installed in this station a 500-kw. synchronous motor generator set, supplied from the sub-station above described by a 13,800-volt transmission line. This same transmission line supplies current for the operation of motors and lights at the shops of the Northern Pacific Ry. at South Tacoma and for the operation of the induction motors driving air compressors working a Pohle air lift system pumping water for the Tacoma city water supply, near South Tacoma, and for operating a large number of other stationary motors used by various manufacturing concerns.

System of Puget Sound Electric Railway.

The Puget Sound Electric Ry. operates an interurban third rail system between Seattle and Tacoma traversing the White River Valley, a distance of 36 miles, and also a branch line reaching the town of Renton. The third rail is supplied with 600-volt direct current through three sub-stations located at Georgetown, Kent and Milton.

Each sub-station contains a bank of transformers stepping down from 25,000 volts three-phase to 2,300 volts two-phase; also a 300-kw. induction motor generator set; and a storage battery having a rating of 384 kw. on the hour basis. Oil switch control is provided on both the high and low tension sides.

From Kent sub-station is operated the city lighting systems of Kent and Auburn, a transformer, separate from those feeding the motor generator set, being provided for supplying this 2,300 volt service.

These sub-stations are supplied from the 25,000-volt transmission line, previously mentioned, this line having the 25,000-volt transformer relay at both the Seattle and Tacoma ends. When this line is operated at 50,000 volts, transformers for this voltage will be installed in all the sub-stations.

Auxiliary and Relay Apparatus.

The electrical development has been designed primarily to insure uniform and uninterrupted service. Continuity of service has been insured by the greatest solidity of construction in every part; by duplicate busses and switches at the power house, duplicate transmission lines and spare transformers at each end of transmission line so that all repairs can be made without discontinuing service and by having in all the electrical machinery an overload capacity of from 25 per cent to 50 per cent.

In addition to this there are in reserve in Seattle and Tacoma six steam plants of 10,000 kw. aggregate capacity and six storage batteries of 2,700 kw. aggregate capacity, all electrically interconnected with each other and with the water power plant, and ready for supplementary and relay service.

How Can the Claim Department Co-operate with the Operating Department in the Prevention of Accidents.

BY F. W. JOHNSON, CLAIM AGENT, CONNECTICUT RAILWAY & LIGHTING CO.

A statement of the aggregate sums expended by the electric railways of this country, in the adjusting or defending of claims and suits for damages arising from accidents during the past few years, would, indeed, make a very interesting article. But with what infinitely greater interest would be received facts showing what proportion of this vast sum would have been saved to the companies interested, had sufficient measures been taken to have avoided many of these accidents.

Never has the old axiom of "an ounce of prevention is worth a pound of cure" applied more forcibly than does it to the question of accidents.

Between the Claim Department and the Transportation or Operating Department of the average electric railway company of the present day there rarely exists that spirit of mutual co-operation so vitally essential to this very question of the prevention of accidents. Just what causes may be responsible for this absence of concerted action oftentimes depends upon local conditions. But, in a majority of cases it is due, I believe, to a lack of proper appreciation of the duties and of the possibilities of the work, on the part of the Claim Department.

To better illustrate my point: The Transportation Department of the modern railway company finds a broader field for work than in being content to calmly await such patronage as chance or circumstances may throw in its way. By various methods this department keeps the many advantages of the road before the public, and increased traffic is the natural and logical result of its enterprise.

Why, then, should the Claim Department of that same railway company be content to devote all its efforts toward the successful defense or adjustment of the results of accidents already on hand, and, beyond an occasional letter to the general manager or superintendent, regarding some particular accident, do little or nothing toward entering upon the vast possibilities in the work of preventing accidents. But, you say, we do attempt to prevent accidents; we make a practice of reprimanding and of dismissing employes for various infractions of the rules governing accidents, etc. Very true, but is not that merely "locking the door after the horse has been stolen"? Would it not have been more advantageous, from the company's standpoint, to have done something toward preventing that accident?

Some months ago, at my suggestion, the Connecticut Railway & Lighting Co. inaugurated a series of experiments to determine whether it were not possible to materially decrease the frequency with which certain classes of accidents occurred, as well as to improve the general handling of accidents by employes. The work was assigned to the department to which it properly belonged, the Claim Department. From the beginning there appeared to be but one solution of the problem—to give to the men proper instruction in this important branch of their work. Accordingly we started in on a campaign of education covering the prevention and proper handling of the more common classes of accidents, among the employes of the system throughout the state of Connecticut.

Among other things, we learned that it was the custom on the

various divisions to place a new employe on the platforms of cars for a certain length of time. In other words, he put in a certain number of days, under competent instruction, learning the operation and construction of his car, as well as the [illegible] fares, tickets, etc. At the expiration of ten, twelve or fourteen days, if he had shown the adaptability, he was adjudged competent to become a full-fledged conductor or motorman. [illegible] his instructions regarding accidents, consisting of such hurried directions as could be given him by a busy superintendent upon whom had devolved the duties shirked by the Claim Department. Is it to be wondered at, then, in view of the necessarily limited instructions given the employe in this way, that he should oftentimes fall an easy victim of the shrewd games of "sharks" and "fakers"? That entanglements in some of our most serious cases, due apparently to stupidity on the part of an employe, are in reality but our just deserts in failing to provide that employe with proper instructions for such an emergency.

We began our campaign, first of all, by rewriting and revising our rule book. The rules were brought right up to date, dead wood was discarded, and the rules were couched in language that was short, sharp and to the point. Next, we took the entire system, a division at a time, and personally met all the employes of that division, in classes ranging from twenty to fifty. For one hour and a half we talked accidents, straight from the shoulder. Every effort was made to make the talks interesting to the men. The importance of the prevention and of the proper handling of accidents was brought home to them as never before. The men were encouraged to ask questions freely, and part of each session was devoted to an informal discussion of points brought up by them.

The zeal and enthusiasm with which the men entered into the project was far beyond our fondest expectations. They were as eager to receive the information as were we to impart it. But, if we were surprised at the manner in which the men received the idea, we were, indeed, astonished at the manner in which they put it into effect. An immediate and permanent decrease was shown in certain classes of accidents. A decided improvement in the making out of accident reports was at once noticeable. A former annoyance, the failure of crews to report accidents, has been reduced to a minimum, now averaging scarcely one a month. And the average number of witnesses secured, per accident, always one of our chief concerns, has increased from 30 to 45 per cent.

Having aroused the interest of the men, we are now at work devising methods by which we intend to keep alive that interest, and are at present experimenting with one which gives every indication of accomplishing that purpose. In seeking to prevent accidents, bear in mind that prevention and education are synonymous terms.

Value and Cost of Service Pensions.

[One of a series of articles on this subject by Mr. Miles M. Dawson, published in the Railway Age for Sept. 2, 1904.]

The form which service pensions usually take, is that of an income for the lifetime of the employe beyond a certain age, the amount of the income being a percentage of the wages last received, of the average wages throughout the last five or ten years, or the average wages throughout the employment. The wages last received might be much greater than the average, because of promotions, and might also be lower because of failing capacity. Even when the pension is a percentage of the average wages throughout the employment, this is not equivalent for all purposes to a percentage of the wages, being what mathematicians call "constant," i. e., the same from beginning of the employment until the end. There are many perplexing actuarial questions which arise from the variations, and some of these must be considered when we look into pension funds; but the problems relating to service pensions may be solved approximately without regard to these refinements.

These problems may be stated as follows:

1. To find the average value of the pension to the recipient at the time when the pension begins. In other words, the fair value of the final donation to the employe at the close of his service.

2. To find the value to the recipient, measured by the proportion of his wages which he would have been required to save and invest in order to accumulate, by the time he reaches the pension age, a sum equal to the then value of his pension. In other words, the value of his pension, considered as a percentage addition to his wages throughout the term of his employment.

3. To find the value of the pension, considered as a percentage addition to the wages of those employes only, who, entering at the same age, either continue in the employment until they reach the pension age, or die before reaching that age. In other words, the value of the pension, considered as an increase of wages of faithful and persistent employes only.

4. To find the value of the pension, considered as a percentage addition to the wages of all employes who enter the employment, whether surviving and continuing to the pension age or dying, retiring from the service or being discharged before attaining that age. In other words, the value of the pension, considered as an addition to the entire payroll.

For simplicity let us assume that the pension is to be 1 per cent of the average salary paid during the employment, for each year of service; and let us further assume for this purpose that the salaries paid have been precisely equivalent to a salary fixed at the amount of the average salary.

First, considering pensions to begin at age of sixty-five, we find, for each $100 average monthly salary, the pension is:

Employment beginning at age 20—45 per cent of $100	$45
Employment beginning at age 30—35 per cent of $100	35
Employment beginning at age 40—25 per cent of $100	25
Employment beginning at age 50—15 per cent of $100	15

Valued at the time of its commencement, taking interest at 4 per cent and mortality as per the British government annuity experience, these pensions are worth:

Employment beginning at age 20	$368.73
Employment beginning at age 30	280.79
Employment beginning at age 40	194.37
Employment beginning at age 50	122.91

These values are the fair average values of the pensions at the moment they are entered upon; but they are considerably less than it would cost a man, aged sixty-five, to purchase annuities for these amounts from insurance companies, for the reason that they do not count upon 4 per cent interest in fixing their rates, but on 3 per cent. Moreover, if one were to attempt to provide these incomes, certain to be paid for life, it would be necessary to invest principal sums sufficient to produce such an amount of interest, unless life annuities are bought. To earn these sums in interest at 4 per cent per annum, it would be necessary to invest the following respective sums:

Employment beginning at age 20	$1,125
Employment beginning at age 30	875
Employment beginning at age 40	625
Employment beginning at age 50	375

In other words, the actual cash value, at the retirement age, of the benefits given would range from $122.91 for each $100 of salary for employes who commence at fifty to $368.73 for those who commenced at twenty; but the pensions would do as much to assure an income for the life of the retired employe as would a sum of from $375 to $1,125.

Second, considered purely as an addition to the wages of the employe who receives the pension, we find that if one dollar were set aside each year to accumulate to the value of the pension, by age sixty-five, the amount of the accumulation would be about as follows:

Employment beginning at age 20	$123.45
Employment beginning at age 30	75.13
Employment beginning at age 40	42.48
Employment beginning at age 50	20.42

To accumulate amounts equal to the value of the pensions, therefore, would require the following percentages of each $100 yearly salary:

Employment beginning at age 20	2.68 per cent
Employment beginning at age 30	3.82 per cent
Employment beginning at age 40	4.58 per cent
Employment beginning at age 50	6.02 per cent

The employe, however, could not actually purchase an income for life at its actual net value; and, unless he were to buy a life annuity,

which is not probable, he would need to accumulate capital to yield interest equal to this income. This would require setting aside the following percentage of the salaries:

Employment beginning at age 20	9.11 per cent
Employment beginning at age 30	11.65 per cent
Employment beginning at age 40	14.71 per cent
Employment beginning at age 50	18.37 per cent

By means of an addition to the salaries of these employes only, then, who survive and continue in the employment until the pension age is reached, of only from 2.68 per cent to 6.02 per cent there is conferred upon every such employe a benefit which, so far as assuring his support is concerned, is equal to his saving from three times to four times as much each year out of his salary.

Third, it is almost equally instructive to consider what is the cost to the employer as an addition to the wages of those employes only who either survive and continue in the employment, until they reach the retirement age, or die in the service before that time; because the employer's purpose is to reward faithful and continuous service, and no more can be asked of any man than that he be "faithful unto death." If this reward could be given each year in increased wages, he would no more regret the payment of it to employes who died in the harness than to those who lived and served to sixty-five. Therefore, it is not improper to affirm, that as a reward for fidelity, the pension should be considered to arise from additions to the wages of all faithful employes, though accruing only to the survivors of them.

Assuming mortality before the pension attaches, according to the American Experience Table and assuming 4 per cent interest, the pensions named are equivalent to percentage additions to the wages of all faithful employes, whether attaining the pension age or sooner dying, as follows:

Employment beginning at age 20	1.46 per cent
Employment beginning at age 30	2.36 per cent
Employment beginning at age 40	3.12 per cent
Employment beginning at age 50	4.63 per cent

To recapitulate then, the employer will by what is equivalent to a percentage increase of the wages of all employes, beginning at age twenty, who survive or die in the service, of 1.46 per cent, give an old age income, which the employe could secure, by the means usually adopted by men, only by saving 9.11 per cent of his income; for various beginning ages the comparison stands as follows:

	Cost to employer.	Benefit to employe.
Age 20	1.46 per cent	9.11 per cent
Age 30	2.36 per cent	11.65 per cent
Age 40	3.12 per cent	14.71 per cent
Age 50	4.63 per cent	18.37 per cent

The value of the benefits, therefore, under existing conditions ranges from four times to more than six times the cost.

Fourth, there is another view of the cost which in practice has perhaps more significance to the employer than even the foregoing, and that is: To what percentage addition to the entire payroll is it equivalent? This involves calculations based upon rates of withdrawals and dismissals from the service, and these rates would differ so widely in different employments that it would be useless to undertake to estimate this cost. It is, however, a matter of common observation that in most employments, withdrawals and dismissals greatly outnumber the deaths. Since the percentage of increase of the pensioner's own salary was, beginning at the age of 20, 2.63, while the percentage of increase of salaries of all faithful employes from that age (including all who died) was 1.46, it is clear that the cost, as a percentage of increase of the entire payroll, would be for that age much less than 1 per cent. In many employments, no doubt, the average for all ages would not exceed 1 per cent. In other words, the pension would not be more than equivalent to an increase of the payroll by 1 per cent.

The last paragraph has reference not to the percentage of increase of the payroll because of pensions paid in the current year, but merely to what percentage of increase of all the salaries to employes of the respective current ages, the pensions to the survivors is equivalent. The other percentage can be approximated with reasonable accuracy in a particular case, sometimes, but as it involves questions as to increase or decrease of the payroll, etc., it cannot here be attempted.

It must be manifest from these considerations that by what is equivalent to a very small increase in the wages an employer can, by a reward of merit system, provide for faithful employes a livelihood in old age which few of them would or indeed could provide for themselves and which involves an enormously heavier annual burden upon those who do succeed in making the provision. It is not too much to say that every dollar of what is really increase of wages of each employe, which the employer gives in this way, is fully equal to $10 applied by a prudent and faithful employe to the same end.

It will have been observed that even the moderate and altogether insufficient pension of 15 per cent of the salary, for employes beginning at the age of 50, costs a much larger percentage than the 45 per cent pension for employes beginning at 20. This indicates what a lodestone to hold employes in the service the system can be made, especially when the percentage for each year's service is increased when the service is very long. Thus suppose the pensions were 2 per cent for each year of service from 36 years to 45, 1½ per cent for 16 to 35 and 1 per cent for up to 15; the cost for the younger commencing ages would still be much less than for the older, though the pension would be so much larger.

Thomas Farmer, Inspecting Engineer.

Mr. Thomas Farmer, who for the past year has been superintendent of the G. C. Kuhlman Car Co., has resigned his position and opened an office in the Electric Bldg., Cleveland. It is his intention to make a specialty of inspecting cars in the process of construction at different car building plants and, if desired, to furnish specifications from which cars are to be built. This is a branch of engineering that has never been specialized before and Mr. Farmer is especially fitted to perform this work as previous to his connection with the Kuhlman company he was superintendent of motive power and car shops of the Detroit United Ry. for nine years and has therefore had a wide experience both in car building and in the practical operation of rolling stock.

THOMAS FARMER.

Mr. Farmer has already been retained by several large railroads which have abandoned their old method of inspection in favor of the method he presents. A feature of Mr. Farmer's method will be a daily report to the purchaser as to the progress of his work.

Mr. Farmer was the founder of the American Railway Mechanical & Electrical Association and was its first president. He is also a member of the American Society of Mechanical engineers and the Detroit Engineering Society.

Nine of the 21 electric railway companies in Maine have forwarded their annual reports to the railroad commissioners for the year ending June 30, 1904. The combined reports show a decrease in net earnings of $7,667. All but one of the roads report a surplus, however. As a result of accidents two persons were killed and four injured during the year. The loss in earnings was due to decrease in the number of passengers carried.

The Street Railways of St. Louis.*

A Brief History of the Development of Urban Transportation in St. Louis Data on the St. Louis Transit Co. and the St. Louis & Suburban Railway Co.

The history of urban transportation in St Louis may be conveniently divided into four periods: That of the omnibus, 1843 to 1850; that of the horse car, 1850 to 1885; that of reconstruction, 1885 to 1894; that of electricity, 1894 to the present.

Although an omnibus was put in service in 1838 by a Mr. Welcher (at least as early as March 30th of that year), the venture was not a success and the first omnibus line to be permanently established was that of Capt. Calvin Case and Erastus Wells, started Nov. 2, 1843. At first there was one bus, driven by Mr. Wells, running on Broadway, between 3rd and Washington Sts. and the O. K. Coffee House at 2nd and Montgomery Sts. The fare of "one bit" was considered by the Missouri Republican in 1843 to be a very reasonable one for the distance. Later this was reduced

MURRAY CARLETON,
President St. Louis Transit Co.

to a "picayune" or half bit ($6\frac{1}{4}$ cents); afterwards 5 cents became the standard fare.

The Missouri Republican in 1858 published a review of the omnibus business, from which we gather that a vehicle cost from $650 for eastern built buses to $725 for the home-made article; that horses cost from $80 to $125 and even $150 per head; that the use of the fare box invented by J. B. Slawson, of New Orleans, and sold for $25 each, enabled owners to pay drivers $16 to $20 per month and board, instead of only $12 per month and board, the wages on less progressive lines; that the license fee was $30 per year, and the net earnings $2 per day.

The second bus line was started in 1844 by a Mr. Kunz; the third by John C. Vogel in 1845 or 1846. Other lines were operated by three Siegers brothers and by Mr. Sutter. In July, 1848, Case & Wells sold their business to O'Blenis & Mathews and 18 months later repurchased a half interest, the new firm being known as Case & Co. July, 1850, Case & Co. owned all the bus lines in the city except that on Seventh St., which was operated by Mr. Case's brother, Luther. Dec. 15, 1855, the firm was dissolved by reason of the death of Calvin Case, who was a victim of the Gasconade disaster, and the various interests divided the several lines among them.

Weismann, Scheele & Co. and Scheele & Hackman, rival firms, later consolidated as Scheele, Hackman & Fath, Dermon & Co., F. & W. Meyer (Geo. S.), Case & King, and John Kampeter were other omnibus operators.

ROBERT McCULLOCH,
Vice-President and General Manager St. Louis Transit Co.

In 1858 there were owned by the St Louis lines 145 omnibi (to use the plural preferred by General Scott); 87 of these were run regularly; there were 681 horses and 218 men in the service; the average income was placed at $8 per bus per day; the total passengers were 13,920 per day; the traffic on fair Sundays was estimated at 15,000 persons.

In 1858 there were 11 regular omnibus lines as follows: Broadway, from 3rd to Bremen (now Salisbury); Broadway from Bremen to Bissell's Ferry; Market, from Main to 18th; Franklin Ave., from 4th to 27th; Second St., from Market to Arsenal (now Arsenal St.); Olive, from 4th to 18th; Seventh, from 3rd and Lucas Ave. to about 7th and Geyer Ave.; Broadway, north to the Rolling mill at Bissell's Ferry; Chouteau Ave., from 4th and Market to La Fayette Park; 17th St., from 4th and Morgan to Reservoir Garden at St. Louis Ave.; Arsenal St. to Carondelet.

A single repair shop at Broadway and Montgomery was used by all lines.

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*The data prior to 1898 are very largely taken from a compilation made by Mr Richard McCulloch, and used by courtesy of the St. Louis Transit Co.

HORSE CARS.

From 1850 to 1860 the city grew so rapidly that the omnibus lines could not properly care for the traffic, and Jan. 3, 1859, a meeting of citizens was held at which resolutions favoring the establishment of a horse railway were passed. Feb. 7, 1856, an ordinance had been passed granting the Laclede Railroad Co. a franchise for a double track north and south line through the city, but this road was never built.

In 1859 several companies were granted franchises: St. Louis R. R., Mar. 10; Citizens Ry., May 6; Missouri R. R., May 6; People's Ry., June 22; Gravois Ry., Dec. 6; Union Ry., Dec. 20. The Missouri Railroad Co. was the first to operate cars, its line being opened on Olive St., between 4th and 17th, July 4, 1859; the St. Louis, the Citizens and the Peoples companies began operating the same year.

While the Civil War gave a severe check to street railway enterprise in St. Louis, by 1870 the settled territory within the city had been well covered with street car lines.

CABLE ROADS.

The cable, successfully installed in San Francisco in 1873 and in Chicago in 1882, was first installed by the St. Louis Cable & Western Ry. In 1884 a company, with Indianapolis capital, was chartered to build a cable road from 6th and Locust Sts. to Vandeventer and Morgan, connecting with a narrow-gage steam line through Normandy to Florissant, and the road was opened to traffic in 1886. The line was poorly constructed and had too many sharp curves for successful cable operation. Double-deck cars, much patronized by pleasure riders, were used on this line.

The Citizens company reconstructed one of its lines and opened for traffic with cable power Nov. 23, 1887. Jan. 22, 1888, the horse cars were again put on, but after overhauling the cable construction, the cables were again started May 1, 1888.

The Missouri R. R. opened its first cable line, from 4th to Sarah St., on Olive, Apr. 1, 1888, and to Forest Park June 1, 1889.

The Peoples Ry. converted its line to cable in 1889 and began operating Apr. 1, 1890.

The St. Louis R. R. changed its Broadway line in 1890 and at that time it was the longest cable road yet built. It was opened for traffic February, 1891.

ELECTRIC RAILWAYS.

The first electric car to be operated in St. Louis was on the Lindell Ry. in 1887; the power was a storage battery furnished by the Edison Co. of New York. The experiment was unsuccessful and after a short time was discontinued.

In 1888 the Short Electric Railway Co. installed an experimental electric line on So. Broadway for the St. Louis R. R. This was unsuccessful and the St. Louis R. R. was rebuilt for cable operation in 1890.

Apr. 4, 1889, the city authorized the Lindell Ry. and the Union Depot R. R. to install the overhead trolley on portions of their respective roads. Apr. 4, 1890, permission was given to equip the entire systems electrically. The Union Depot R. R. first operated electric cars in March, 1890, and the Lindell Ry. in September, 1890.

The start having been made in electric construction progress was very rapid. The Mound City Ry., the Market St. and Laclede Ave. divisions of the Missouri R. R., and the South St. Louis Ry., began electrical operations the winter of 1890-91; the Bellefontaine Ry. in April, 1892; the Cass Avenue, Northern Central and the Union roads in the summer of 1893, and the Baden & St. Louis road in June, 1894.

The original cable road was converted for electricity in 1891 and at the same time the name was changed to the St. Louis & Suburban Ry. This company built an electric power station at De Hodiamont and made several important extensions.

The last horse car line to be reconstructed was the Jefferson Ave. line, which began operation as an electric line Jan. 1, 1896, marking the end of the reconstruction period.

TORNADO OF 1896.

May 27, 1896, about 5.30 p. m., St. Louis was struck by a particularly severe tornado, which inflicted severe damage upon the street railways operating in the southern part of the city. The power house of the Union Depot R. R. was wrecked by the brick stack falling into the engine room; the Park and St. Ange Ave station of the Peoples Ry. was wrecked by the front wall being blown in and falling on the machinery; two iron smoke stacks at the Lindell power house No. 1 were blown down. On other roads many trolley and feeder wires were blown down. The only roads not stopped by the storm were the Bellefontaine, the Mound City and the Olive St. line of the Missouri R. R. The suspensions were about as follows: Cass Avenue & Fair Grounds, two hours; South Broadway line, five hours; St. Louis & Suburban, five hours because of loss of two smoke stacks at power house; Southwestern, five days; Peoples Ry., three days; Market St. and Laclede Ave. lines of Missouri R. R., three days. The Union Depot R. R. got some of its lines in operation after five days, but required several weeks for complete repairs; the 100-ft. brick stack was rebuilt in 13 days, a remarkably short time.

STRIKES.

The first general street railway strike in St. Louis was in April, 1881, and on April 24th, 25th, 26th and 27th the principal lines were not able to operate cars. A second, and perhaps the greatest strike in the history of street railways, was in 1885; all cars were turned in on the afternoon of October 6th, the day of the Veiled Prophet's Parade. Nearly all the roads contrived to keep a few cars running, but for two weeks following October 8th, when rioting developed, all cars carried police officers on board. A third strike which tied up all the cars in the city, was called May 8, 1900, the primary cause being the refusal of a union gripman to break in a non-union man. After 56 days, during which much rioting occurred, an agreement was reached and the men went back to work July 2nd. On July 9th, however, the strike was renewed and several weeks more elapsed before the cars were running under normal conditions.

TRACK CONSTRUCTION.

The first track in St. Louis was laid with wrought iron flat tram rails, with the wagon tram out. The wheel flanges were on the outside also. Operation for a few months showed that it was impossible to keep cars on the track, and the rails were taken up and again laid with the wagon tread facing in, and the wheels also reversed, which remedied the trouble. The difficulty lay with the wheels rather than the rails, as the St. Louis R. R. on Broadway, which placed the wagon tread of the rails out but the wheel flanges inside operated successfully for years without changing its rails.

As an explanation of the 4 ft. 10 in. gage of St. Louis street railways it has been suggested that the track as first laid was 4 ft. 8½ in., but that the rails had spread to an average of 4 ft. 10 in. by the time the necessity for adopting a uniform gage arose. Another and more reasonable explanation is that the odd gage was deliberately adopted in order to impose a physical obstacle should steam lines attempt to operate over the horse tracks. The 4 ft. 10 in. gage was made standard for the street railways of St. Louis by act of the Missouri Legislature Jan. 16, 1860. By city ordinance Mar. 22, 1884, the section of head was defined, and the rail required to be laid with the lower flange on the inside.

The first Bessemer steel rails (45 lb. per yd.) were laid by the Bellefontaine Ry. in 1878. In 1885 the South St. Louis R. R. put down some 52-lb. Johnson girder rails, which afterwards became the standard section adopted by all the St. Louis companies.

The first 60-ft. rails were put down by the Citizens company in 1895, when it converted its cable line to electricity; these rails were of girder section 7-in. deep and weighed 85 lb. per yard. In 1886 and 1887 a great deal of 4½-in. girder rails, 52 to 63-lb., was laid by the Citizens and Missouri roads for cable track.

In 1890, when the Peoples and St. Louis roads were reconstructed, the rail used was a 78-lb. 6-in. girder, and this was standard for several years.

Electric welding was tried in 1893 by the Baden & St. Louis company, and 2,200 joints were electrically welded. In the fall of 1893 the St. Louis R. R. put in 800 cast-welded joints, the first ever made commercially.

ROLLING STOCK.

The earlier cars in St. Louis were built by John Stephenson, J. M. Jones, of Troy; Brownell & Wright, of St. Louis; the St. Louis Car Co. and the Laclede Car Co. These cars were for the most part bodies 14 ft. or 16 ft. long and were double enders; but a later car very popular with the management was the "bobtail," a 10 ft. or

12-ft. body with a driver's platform on one end and a rear step on the other. The bobtail required no conductor and was drawn by one horse or two small mules.

In 1874, the Northwestern St. Louis R. R. (later the Mound City Ry.) operated a double deck car.

In 1864 steam dummies were put in service by the Fair Grounds Ry., but these were so disconcerting to horses that their use was prohibited by the city.

The first cable rolling stock comprised open grip cars with seven seats on each side, drawing closed cars. In 1896 the Missouri company bought new equipment, with grip cars having cross seats of cane and the sides protected by wire netting.

JAMES ADKINS, Secretary and Treasurer. FRANK R. HENRY, Auditor.
St. Louis Transit Co.

The early electric cars in St. Louis had bodies 16 ft. in length and were operated through double reduction motors made by the Thomson-Houston Co. In 1892 the Bellefontaine company put on cars with 20-ft. bodies.

The St. Louis & Suburban lost its original car equipment by fire in 1891, and when getting new cars chose 28-ft. bodies mounted on double trucks, the forerunner of the present suburban standard car, which has also been widely used on city lines.

In 1892 the Lindell Ry. spliced some of its short car bodies, leaving a vestibule in the center.

St. Louis Transit Co.

In 1899 all the street railways of St. Louis except the St. Louis & Suburban were consolidated as the United Railways Co., and Sept. 1, 1899, passed under the management of the St. Louis Transit Co., as the operating company. At that time there were several groups of companies, the roads in each of which were under single ownership if not in fact consolidated. The relations of these groups, and some interesting data as to the separate companies are shown in the following statement:

NATIONAL RAILWAY CO. LINES.

St. Louis Railroad Co.; organized Feb. 1, 1859; capital, $300,000. Franchise granted Mar. 10, 1859, to Hudson E. Bridge, D. A. January, John How, Christian Crone, Alexander Peterson, Robert A. Barnes, James H. Lucas, Antoine Wiseman, William M. McPherson, Frederick Meyer and George R. Taylor. Cars first ran August, 1859. Presidents in order of time: D. H. Armstrong, D. A. January, H. E. Bridge, William Tecumseh Sherman, D. H. Armstrong, H. E. Bridge, J. O. F. Farrar, James H. Blood, Benjamin Farrar, John F. Madison, R. A. Barnes, Christian Peper. Purchased in 1888 by a Chicago syndicate, and C. B. Holmes chosen president; he was succeeded by D. G. Hamilton. Converted to cable 1891.

Baden & St. Louis Railway Co., chartered Mar. 11, 1870; capital $100,000. President, Dr. George S. Case. Sold to St. Louis Railroad Co. in 1892. Converted for electricity in 1894.

Southwestern Railway Co. Franchise granted Apr. 1, 1893, for a line to make running arrangements with other roads. Line on Chippewa St. built in 1894 and other tracks leased. Cars operated in August, 1895. Company controlled by St. Louis Railroad Co.

Citizens Railway Co.; organized Apr. 26, 1859. Capital, $300,000. Franchise granted May 6, 1859, to Henry T. Blow, B. Gratz Brown, James B. Eads, George S. Case, John Doyle, Cary Gratz, William J. King and B. Crickard. Road reconstructed for cable in 1887, and electric operation begun Jan. 1, 1895. Presidents: B. Gratz Brown, James B. Eads, A. B. Easton, Julius S. Walsh. Purchased in 1889 by Chicago syndicate and C. B. Holmes chosen president; he was succeeded by D. G. Hamilton.

Cass Avenue & Fair Grounds Railway Co. Franchise granted Jan. 1, 1871. Road begun operating June 25, 1875. In 1888 the property was purchased by the Chicago syndicate and C. B. Holmes elected president; he was succeeded by D. G. Hamilton.

Union Railway Co. Franchise granted Dec. 20, 1859. Road built in 1865, extended to Fair Grounds in 1875. Presidents: B. Gratz Brown, John Brown, Julius Walsh. Purchased by the Chicago syndicate in 1888 and C. B. Holmes chosen president. Property transferred to Cass Avenue & Fair Grounds Railway Co. Apr. 11, 1892. Road was constructed as an electric line and began operating August, 1893.

Northern Central Railway Co. Franchise granted May 11, 1881. Road built in 1885 and opened March, 1886. Purchased by the Chicago syndicate in 1888. Property transferred to Cass Avenue & Fair Grounds Railway Co. Apr. 11, 1892. Began operating by electric power July, 1892.

Southern Electric Railway Co.—Carondelet Railway Co.; organized 1874. Franchise granted July 2, 1874, to build a railway to Carondelet, beginning at Chippewa St. and Carondelet road. Incorporators: John G. Kelly, Fred L. Garesche, M. J. Brennan, Michael Hannuel, O. M. Dean, Peter Murray, Bartholomew Guion, A. McHose, William L. Swing, Jr., R. R. Southward and J. R. McDonough. Road first operated May 30, 1875. By ordinance of July 13, 1876, the rights of this road were transferred to the—

South St. Louis Railway Co. July 11, 1884, the name of this company was changed to—

Southern Railway Co. July 21, 1894, the name was again changed to—

Southern Electric Railway Co. Presidents: I. C. Terry, Pierre Chouteau, Thomas Fleet, William C. Lange, T. J. Meteary, E. R. Coleman, W. L. Johnson, Chase Kilpatrick. Acquired by the Chicago syndicate.

Jefferson Avenue Railway Co. Franchise granted Feb. 6, 1882, began operation Sept. 22, 1882; electric cars operated Jan. 1, 1896. Presidents: John M. Gilkeson, P. C. Maffitt, Robert McCulloch.

LINDELL RAILWAY LINES.

Lindell Railway Co., organized Jan. 26, 1864, capital, $600,000. Cars first operated, Mar. 15, 1867; electric cars first operated September, 1890. Presidents: Dwight Durkee, John D. Maxon, Robert McCulloch, J. R. Lightner, George D. Capen, Edwards Whitaker. This company operated:

Taylor Avenue Ry., built in 1893.

Compton Heights, Union Depot & Merchants Terminal Ry., built in 1893.

Clayton & Forest Park Ry., purchased in 1895;

Midland Ry., purchased in 1897.

MISSOURI RAILROAD CO.

Missouri Railroad Co., organized May 10, 1859, capital, $500,000. Franchise granted to William M. Morrison, Marshall Brotherton, Dr. William Vanzandt, James H. Parker, A. W. Henry and Erastus Wells. Converted to cable in 1887 and 1881 Market St. line connected for electric operation in 1891. Presidents: Erastus Wells, P. Choteau Maffit, Edwards Whitaker.

UNION DEPOT OR SCULLIN LINES.

Union Depot Railroad Co.—Gravois Railroad Co.; organized 1859. Franchise granted to John T. Douglas, James F. Small, Samuel D. Warren, John G. Prather, Dr. M. McDonnel and William D'Oensh. Road built in 1862 and soon sold under foreclosure to Green Erskine and Thatcher S. Johnson, who sold it in 1876 to the Union Depot Railroad Co. This company acquired: Bellefontaine Ry.; incorporated Feb. 8, 1864; sold in 1876, again in 1890, and finally to the Union Depot R. R. in 1893.

Northwestern St. Louis Railway Co. Franchise granted June 30, 1874. Road built in 1874. By ordinance of July 13, 1876, property was sold to the—

Mound City Street Railway Co. Motive power changed to electricity in 1890. Apr. 17, 1894, property was authorized transferred to Union Depot Railroad Co. Presidents: William F. Wernse, John Scullin.

Grand Avenue Ry., built in 1895.

Presidents of Union Depot R. R.: C. C. Rainwater, John Scullin.

OTHER LINES.

Peoples Railway Co. Franchise granted June 22, 1859. Began operation in 1859; reconstructed for cable and began operation April, 1890. Charles Green appointed receiver in 1897.

FOURTH STREET & ARSENAL RAILWAY CO.

Tower Grove & LaFayette Railroad Co. Franchise granted Mar. 20, 1866. Under ordinance of Apr. 15, 1888, the property was transferred to the—

Fourth Street & Arsenal Railway Co. Presidents: S. W. Dreyer, J. H. Lightner, J. H. Britton, J. T. Lionberger, D. E. Walsh, Julius S. Walsh, Charles Green, Francis X. Green.

The first president of the consolidated company was Edwards Whitaker, who had been president of the Lindell and the Missouri companies. Mr. Whitaker was succeeded by Murray Carleton, formerly vice-president.

The officers and heads of departments of the St. Louis Transit Co. are: President, Murray Carleton; vice-president and general manager, Robert McCulloch; secretary and treasurer, James Adkins; auditor, Frank R. Henry; assistant general manager, Richard McCulloch; master mechanic, M. O'Brien; chief engineer of track, C. A. Moreno; assistant superintendent of power, Edward Smith; chief electrician, Lawrence Crecelius.

The company now operates 345 miles of track, measured as single track. The earnings of the St. Louis Transit Co. for the eight months of the current year were:

Months.	1904.	Increase.	Percentage of increase over 1903. 1904.	over 1902 1903
January	$557,881.15	$30,180.70	6.04	14.59
February	555,728.50	85,140.20	18.09	13.64
March	638,070.60	75,378.45	13.39	13.73
April	702,850.95	102,024.80	16.98	19.19
May	820,559.80	195,060.20	30.74	12.96
June	916,322.05	280,049.00	44.01	15.69
July	976,008.70	343,453.35	54.20	11.21
August	1,006,570.85	354,626.00	54.39	13.72
Total	$6,182,998.60	$1,471,921.70	31.24	14.29

St. Louis & Suburban Ry.

The St. Louis & Suburban Railway Co. has the distinction of being the successor to the first company in St. Louis that operated its line by other than animal power. The beginning of the system was in the Central Railway Co., organized in July, 1872, to build a road five miles long, extending from a point 100 ft. north of Olive St. at Grand Ave. In August of the same year the name was changed to the St. Louis & Florissant Railroad Co., and the line built so far as Kienlan Ave. A year later it was extended 15 miles to St. Ferdinand (now Florissant). This road was a narrow gage line and was operated by steam power until 1882, when it was sold to the St. Louis, Creve Cœur & St. Charles Railroad Co., which company operated the line till 1884, when it was sold to the St. Louis, Cable & Western Railway Co. This company had a franchise for a cable road and in March, 1886, the cable line was put in operation. As stated in connection with the early history of St. Louis street railways, this line was not well designed nor well built and the operation of cable cars was irregular.

The St. Louis, Cable & Western property was acquired by the St. Louis & Suburban Railway Co. Feb. 6, 1891, and the road converted and put in operation as an electric line January, 1892. Since then the St. Louis & Suburban has included in its system the Brentwood, Clayton & St. Louis Railroad Co., the St. Louis & Kirkwood Railroad Co. and the St. Louis & Meremac River Railroad Co.

JULIUS S. WALSH, JR.,
Second Vice-President.

JOHN MAHONEY,
General Superintendent,
St. Louis & Suburban Ry.

J. A. KRIES, JR.,
Master Mechanic and Superintendent of Power.

The St. Louis & Kirkwood Railway Co. built its line in 1895-6 from Forest Park to Meremac Highlands; it was reorganized as the St. L. & K. Railroad Co. and was acquired by the St. Louis & Suburban Ry. in 1897.

The Manchester Road Electric Railway Co. received a franchise Dec. 31, 1892, for Manchester Road, and Dec. 28, 1895, for Sarah St. to connect with the St. Louis & Suburban, and built in 1896; it extended to Kirkwood in 1897. The property was acquired in 1896 by the St. Louis & Meremac River Railroad Co.

The original company of the Suburban system owned its right of way and operated under a steam railroad charter, and now for the most part cars are operated over private right of way. There is but one line to the business portion of the city and all other branches connect with this at various junctions west of Vandeventer Ave. The company operates 95 miles, measured as single track; of this [illegible] miles is on private right of way.

The original track on the cable line was laid with 65-lb. 5-in girder rail, and on the narrow-gage line the rails were of T-section, 35 lb. and 40 lb. per yd. On rebuilding in 1891, 5-in. girders of the cable track were cast welded, and wooden ties with rail-chairs placed between the joints.

Within the last two years all tracks in city streets laid with 5-in. rails have been reconstructed with 9-in. Some of the 6-in. girder rails have also been replaced and on the private right of way within the city 80-lb. T-rails have been substituted for lighter sections; in the country 60-lb. T rails are used except on one division of ten miles, where the old 35-lb. rails are in service.

The power plant at which all current for the railway is generated is at [illegible] on the Wabash Railroad. This station generates both direct and alternating current. The equipment comprises:

Two 32 x 60-in. simple Hamilton Corliss engines direct connected to 800-kw. direct current generators, operating at 80 r. p. m.

One 31 x 72-in. engine of the same type and make, running at 68 r. p. m. and belted to two 300-kw. direct current generators.

One 30 x 48-in. simple Allis-Chalmers engine direct connected to an 800-kw. direct current generator.

Two 30 and 50 by 60 in. compound Allis-Chalmers engines, operating at 75 r. p. m., direct connected to 1,200-kw., 6,600-volt, 25-cycle alternators.

One 30 and 56 by 60 in. Fulton Iron Works engine direct connected to an alternator of the same size.

The entire station is operated non-condensing.

The alternating current is distributed to two sub-stations at 6,600 volts, and there converted to 550-volt direct current. One substation is at 16th St. and has three 600-kw. rotary converters; the other is at Brentwood with two 600 kw. converters.

But two types of cars are used, all of the St. Louis Car Co. make, and mounted on St. Louis Car Co. No. 47 double trucks, known as the large and small cars. The large cars are 46 ft. 8 in. long, 9 ft. 2 in. wide and weigh 48,000 lb., and are equipped with four G. E. No. 67 or four Westinghouse No. 49 motors per car. The small cars are 38 ft. long, 9 ft. 1½ in. wide and weigh 34,000 lb., and are equipped with four G. E. No. 57 or two Westinghouse No. 49 motors per car. The large cars seat 52 and the small cars seat 40 passengers each.

During the year ending Dec. 31, 1903, the gross earnings from operation were $963,806.96; the number of passengers carried, 19,931,178; number of car-miles run, 5,515,536.

The officers and heads of departments of the company are: President, Julius S. Walsh; 1st vice-president, Breckenridge Jones; 2nd vice-president, Julius S. Walsh, jr.; secretary and treasurer, E. P. Sommers; general manager, John Mahoney; master mechanic and superintendent of power, John A. Kreis, jr.; engineer of maintenance of way, J. Y. Johnson; superintendent of lines, Nathaniel Smith.

Schenectady Railway Benefit Association.

A little over a year ago a meeting of the employes of the Schenectady Railway Co. in forming an organization was called. The meeting was addressed by Hinsdale Parsons, president of the company, who stated the company would provide club rooms and furnish them for the employes and also donate $1,000 towards the benefit fund, and an organization was formed shortly afterwards with a membership of 30. The present membership is nearly 100 and is steadily increasing.

The company added a second story to the car barns and on Oct. 1, 1903, the club was opened. A large reading room, supplied with all the latest papers, magazines, etc., a bowling alley and a billiard room are provided for the amusement of the men. There is also a locker room, bath room, and two small rooms used for smoking. The largest room is used during the winter for a series of lectures on technical subjects pertaining to operating motor cars, etc. The dues of the association are 50 cents a month.

Notes on the Power Stations of the St. Louis Transit Co.

BY RICHARD McCULLOCH, ASSISTANT GENERAL MANAGER

The St. Louis Transit Co. now has four generating stations, at three of which the output is entirely direct current and at one of which the output is partially direct and partially alternating current, at a potential of 6,600 volts, 25 cycles. These stations are known respectively as the Cass Ave. Station, the Central Station, the Union Depot Station and the Northern Station.

The Central Station is located at Park and Vandeventer Aves., and was built by the Lindell Ry. in 1894. The equipment originally installed comprised Westinghouse 500-kw. generators belted to Porter-Allen engines, and a Stirling boiler equipment with Hawley down draft furnaces. In 1900 and 1901 this station was almost completely rebuilt, practically the only part of the equipment remaining unchanged being the Stirling boilers. A new boiler room was added in which were erected O'Brien water tube boilers equipped with Green chain grate furnaces, and new engines and generators were also installed. The new equipment for this station comprises four 2,250-kw. and two 1,500-kw. Westinghouse generators direct connected to cross compound condensing engines built by the Fulton Iron Works. As at the other direct current stations of this company, the potential at which current is generated is normally 550 volts, being increased to 600 volts on the peaks of the load. When this station was remodeled Worthington elevated jet condensers were installed and also Worthington cooling towers, the entire station now being operated condensing.

Three of the Porter-Allen engines originally installed in the plant have been direct connected to the generators and these are so arranged that they may be used as boosters by placing them in series with the bus bars. It is at this station that on pleasant Sunday afternoons the current is boosted up to 1,200 or 1,400 volts in order to get a potential of 500 volts on one of the outlying lines.

The Cass Avenue station is located at Prairie Ave. and North Market St. and now contains three 800-kw. generators driven by simple non-condensing Allis engines and one 200-kw. G. E. generator direct connected to an engine of similar make and type. The engine last mentioned is interesting in that it has valve gear of the corliss type and operates at 150 r. p. m., and has worked satisfactorily ever since it was installed. The boiler equipment comprises 16 fire tube boilers of 200 h. p. each. These are all equipped with Hawley down draft furnaces. This station is interesting in that

CENTRAL POWER STATION

it was built just as it now stands in 1893 and was the first power plant in which direct connected generator units were used in railway service. Before starting this station there were grave doubts as to the practicability of the design and for some time it was regarded as one of the great curiosities in the traction field.

The Union Depot station is at Jefferson and Geyer Aves., and occupies the site of the first electric railway power house in St. Louis. The station was built in 1890, the original equipment consisting of a large number of D-62 generators belted to Hamilton-Corliss simple non-condensing engines. The boilers installed were the Heine water tube.

This station has had many vicissitudes. In May, 1896, the tornado which did so much damage in St. Louis blew down the largest brick stack, wrecking about one-half of the engine room, killing the chief engineer and several other men. The station was rebuilt and the reconstruction of the stack was one of the interesting engineering feats, it having been put in anew in the extraordinarily

short time of 13 days. In December, 1903, one of the most severe boiler explosions that ever occurred resulted in the destruction of seven boilers of this plant and the wrecking of almost exactly the same portion of the engine room which had suffered because of the storm seven years before, the break in the exterior wall being almost exactly along the line of the former break.

During the last five years the D-62 machines, constituting the first equipment, have been removed and replaced by direct connected units, some of these latter being first installed in this plant and others being removed from the Southern electric power plant formerly operated at Broadway and Osage St., and installed here.

The present equipment of the Union Depot station consists of one 800-kw. G. E. generator direct connected to an Allis engine; one 500-kw. Westinghouse generator belted to a Hamilton-Corliss engine; one 1,500-kw. G. E. generator direct connected to twin Allis engines; two 400-kw. G. E. generators, each direct connected to a Porter-Allen engine; one 1,050-kw. G. E. generator direct connected to an Allis engine and one 800-kw. G. E. generator direct connected to a Rankin-Fritch engine. All of the engines are simple non-condensing. In addition to the generator equipment enumerated, there

[illegible]

is at this station one 600-kw. Western Electric booster driven by twin Allis engines. This booster is of unusually large capacity, 1,000 amperes at 200 volts.

For boilers, there are two 500-h.p. Heine, four 250-h.p. Babcock & Wilcox, two 250-h.p. O'Brien water tube and four 250-h.p. Heine boilers, all hand fired, and four 250-h.p. Heine boilers with Hawley down draft furnaces.

The Northern station is at Broadway and Salisbury St., and here are generated both direct and alternating current. The direct current equipment consists of two 2,250-kw. G. E. generators direct connected to 36 and 70 by 60-in. cross-compound, Fulton Iron Works engines, operated at 75 r. p. m. The alternating current units are two 1,200-kw., 6,600-volt, 25 cycle, 3-phase G. E. machines, each direct connected to a 28 and 56 by 60-in. cross compound condensing Fulton Iron Works engine, operated at 75 r. p. m. In the boiler room are sixteen 400-h.p. O'Brien water tube boilers equipped with Green chain grates. Wheeler surface condensers are used, the condensing water being cooled by means of four Barnard cooling towers located on the roof of the building. This plant was designed by W. D. Boyce & Co., of St. Louis, and put in operation in 1901, and was illustrated and described in the "Review" for November of that year.

The Transit company now has two rotary converter substations. One of these, known as the Delmar substation, is located at Delmar and DeBaliviere Aves. This station uses the entire alternating current output of the Northern power station, which is some six miles distant. The current is transmitted at 6,600 volts over two 3-phase overhead lines, each constructed of three No. 0000 copper wires. At the Delmar station are installed four 600-kw. G. E. rotary converters with the necessary step-down transformers. There has also been placed here one 1,000-kw. rotary converter for use temporarily during the Fair. Current for this last machine is supplied from the Tenth and St. Charles Sts. station of the Union Electric Light & Power Co. The Delmar station is near the Fair Grounds and has to supply the feeders for the western portion of all the Transit company World's Fair lines on the north side of the grounds.

The Central substation is at 1711 Locust St., which is in the heart of the business district and is connected with the new station which the Union Electric Light & Power Co. is now building at the foot of Ashley St., by four No. 0000 copper 3-phase transmission circuits. These cables are all laid underground in tile ducts, the transmission distance being about four miles.

It was intended to have this substation in full operation by June 1, 1904, thus relieving the Central station of the down-town load, but by reason of the Union company's inability to furnish current from its Ashley St. station, only a portion of the substation has been operated, current for this being obtained from other sources. The equipment consists of seven 1,000-kw. G. E. rotary converters with necessary transformers for stepping the alternating current down from 6,600 volts to 375 volts. There is also at this station a storage battery of 3,000-kw.h., installed by the Electrical Storage Battery Co. This has done heroic work ever since it was put in place. For regulating the charge and discharge of the battery, there are two 250-kw. G. E. boosters.

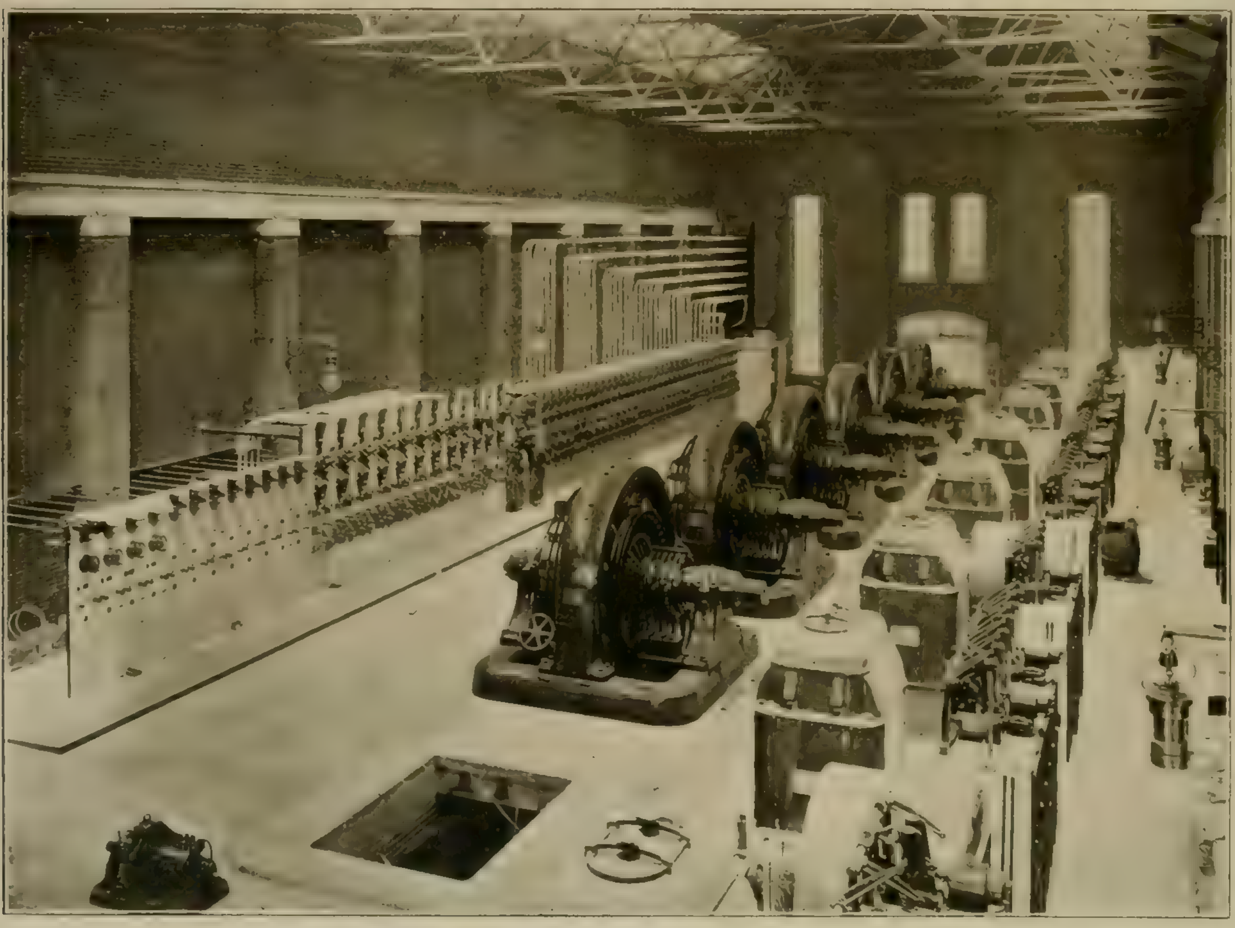
The plans of the St. Louis Transit Co. for taking care of the World's Fair traffic were based on the assumption that the Union Electric Light & Power Co. would furnish it with 2,000 kw. for 24

RICHARD M'CULLOCH,
Assistant General Manager, St. Louis Transit Co.

hours per day beginning with May 1st, with 4,000 kw. after June 1st, and 9,000 kw. after July 1st. Owing to the fact that the Light & Power company's plant is not completed this could not be done but the lighting company has been able to furnish sufficient current for the operation of the 1,000-kw. rotary at the Delmar station, but this supply comes from another plant of the Light & Power company by means of an inverted converter, that is, direct current generated at the lighting plant is supplied to a rotary and the converted current transmitted to the Delmar station, where it is reconverted for supply to the trolley feeders.

EXTERIOR CENTRAL SUB-STATION—ST. LOUIS TRANSIT CO.

Grave doubts were entertained by the management of the St. Louis Transit Co. as to its ability to properly care for the World's Fair traffic under the conditions mentioned and when it was demonstrated that the lighting company could not deliver current, arrangements were made for getting current from the Louisiana Purchase Exposition Co. for use during the hours of maximum loads. Fortunately there were several underground transmission circuits, each



INTERIOR CENTRAL SUB-STATION—ST. LOUIS TRANSIT CO.

with wire of No. 0000 copper, connecting the Fair grounds with the new Ashley St. plant of the Union Electric Light & Power Co., and not yet in use. The use of one of these was secured and connection with the high potential underground feeders made at the Ashley St. plant and also connection made at the World's Fair grounds with the exhibitors' switchboard in Machinery Hall; thus it is possible to operate two 1,000-kw. rotary converters at the Central substation with current either from the 5,000-h.p. Allis-Chalmers unit or the 2,000-kw. Curtis turbine unit. The transmission line is a roundabout one, being about ten miles in length.

The plan of the Transit company for the future when the alternating current for the full operation of the Central sub-station is secured, contemplates the construction of several additional sub-stations. One of these will probably be built at Broadway and Osage St. at the South Broadway car house, which is near the old Southern Electric plant, and another will be installed in the Cass Avenue power station. When these two substations are in operation it is hoped that the company will be able to discontinue the operation of the Union Depot and Cass Avenue power houses, leaving only the Central and the Northern stations as generating plants. Both of these have modern equipments of boilers and coal handling apparatus, large direct connected generation and condensing plants.

West Baden, Ind., as a Convention Place.

The West Baden Springs Hotel, of West Baden, Ind., which has now an invitation before the American Street Railway Association to hold its 1905 convention at the Springs, has only this year entered the convention field. The campaign undertaken, however, has met with success and the advantages offered by the hotel as a meeting place already have been demonstrated in a number of instances, and several association meetings are scheduled for the coming year. The principal associations that have held conventions at West Baden this year are the National Molding Manufacturers of the United States, which met there in May last; the Commercial Law League of America, with 500 persons in attendance, which met in July, 1903; the "Indians," who held their sixth annual "pow-wow" and tournament in August, and the $200,000 Club of the New York Life Insurance Co., with a membership of 500, which held a three days' meeting beginning Sept. 20th.

SOUTH TERRACE, WEST BADEN SPRINGS HOTEL.

For 1905 the associations which have decided to hold their conventions at West Baden and the estimated attendance as based on the records of former meetings, are:

Indiana State Medical Association, 600 people; the Travelers' Protective Association, 800 people; the National Association of Water Works of America, 450 people; and the American Association of Nurserymen, 500 people.

As many of these associations bring as large an attendance at meetings as the A. S. R. A., the hotel can accommodate 1,500 persons in a most satisfactory manner, the building being strictly modern in all appointments.

Too much cannot be said as to the excellent facilities for the display of exhibits. As described in the "Review" for August, the court of the West Baden Springs Hotel, which is known as the "Grand Atrium," is a circular court 200 ft. in diameter, covered by a glass dome, the base of which is 80 ft. above the floor. Excluding a small fountain, the floor space available is 32,938 sq. ft., and is absolutely unobstructed. The floor of the "Atrium" is cement concrete laid on solid rock, so that the foundation is sufficiently strong for heavy exhibits. The "Atrium" has been placed at the disposal of the association for its exhibit hall, and 125-volt electric current is available for operating exhibits which it is desirable to show in motion.

Aside from the Casino where the Goddess of Chance is domiciled, there are in the immediate vicinity numerous national attractions offering opportunity for excursions. Among these may be mentioned Buerk's Observatory, Cross' Mammoth Cave, Dillon Cave, Rise of Lost River, Paoli Mineral Springs, the celebrated Archer Cave, Flat Lick Springs and Six Mile Circle, easily accessible by drives over pike roads, the livery service and facilities being of the highest order.

St. Louis Day Traffic.

Thursday, September 15th, was St. Louis Day at the World's Fair, when all the business houses of the city were closed and more than 400,000 persons visited the Exposition. It was expected that the electric railway facilities would be severely taxed to handle the traffic, but such precautions had been taken by both the Transit and Suburban companies that the service was more than equal to the requirements. Captain McCulloch, vice-president and general manager of the Transit company, issued a special notice to conductors and motormen, calling upon each to exercise extreme care and watchfulness, especially at intersection and junction points. No accident worthy of mention occurred during the day or evening.

The St. Louis Transit Co. operated 1,100 cars on St. Louis Day and carried 1,151,785 passengers, of whom 788,536 were revenue passengers and 363,249 were transfer passengers. The cash receipts for the day amounted to $38,478.12. The Suburban carried 141,091 passengers.

According to estimates, Fair visitors were taken away from the grounds by the Transit and Suburban companies on the night of St. Louis Day at the rate of about 1,000 per minute, and this was done without accident, crowding or confusion. The heaviest travel to the Fair was from 9 to 11 a. m. and from noon to 3:30 p. m. The rush from the grounds set in about 6 p. m. The gates at the Pike entrance could not accommodate the rush in the forenoon, so part of the cars were run direct to the Administration Building. At night from 10 to 15 Transit cars were loaded at one time at the main entrance and dispatched under short headway. Captain McCulloch personally superintended the loading of the Transit cars, and General Superintendent Mahoney had charge of the Suburban cars.

In addition to extra cars and methods for handling them, special switchmen and watchmen were stationed at congested intersecting points in the city and at curves, and a force of men from the mechanical department was in readiness to respond to emergency calls.

Incidentally, it may be mentioned that there were special attractions at the Fair on St. Louis Day, which included military and other parades, picnics, celebrations and ceremonies by secret and other societies.

Lansing and Suburban Bond Issue.

The Lansing (Mich.) & Suburban Traction Co., which was incorporated in March, 1904, to take over the Lansing City Electric Railway Co. and the Lansing, St. Johns & St. Louis Railway Co., has authorized a bond issue of $750,000 to take up the bonds of the underlying companies and to provide for further extension. The Detroit Trust Co. is trustee under the mortgage.

McKinley Syndicate Properties of Central Illinois.—I.

Including City and Suburban Lines, Which Will Eventually Reach from Danville to St. Louis.

While the development of electric interurbans in the state of Illinois has been considerably slower than in several of the neighboring states, a large amount of work in this direction has been carried on during the last three years by syndicates of which Mr. W. B. McKinley, of Champaign, is at the head, and the roads either purchased or built, together with those which are under construction or are projected by the same interests will, within the next two years, increase the interurban railway mileage in the state of Illinois by several hundred miles. In addition to the central Illinois properties, which we shall describe in detail, the interests with whom Mr. McKinley is associated control electric railway properties in Ft. Wayne, Ind., and northern Illinois, including the Illinois Valley Railway Co., running from Marseilles through Ottawa to Utica, La Salle, Peru, Spring Valley to Ladd, which line will soon be extended west to Princeton; also the local street railways in La Salle and Peru, the Galesburg Railway & Light Co., and the local railway properties in Galesburg, besides the Galesburg, Monmouth & Rock Island interurban, now under construction, and the Quincy Horse

MAP OF ILLINOIS CENTRAL TRACTION SYSTEM

Railway & Carrying Co. The management of the properties in northern Illinois, however, is entirely distinct from that of the properties in the central part of the state. The latter properties include the Illinois Traction Co., the Illinois Central Traction Co. and the St. Louis & Springfield Railway Co. The Illinois Traction Co. has been in complete operation for nearly a year and the Illinois Central Traction Co. and the St. Louis & Springfield Railway Co. have been in partial operation since June and are now nearing completion.

In acquiring and constructing these various properties the operations of the McKinley syndicate have been quite different to those of most of the other electric railway syndicates in the country. Instead of building interurban lines exclusively, the McKinley syndicate has acquired a number of city railway systems in the towns through which its interurban lines are being extended and in several cases it has combined with the railway system the electric lighting, the gas lighting, electric power and steam heating systems of these cities. This control of the public utilities in several cities is not only a valuable one in point of earning capacity, but it also largely reduces the operating expenses and to some extent considerably modifies the engineering designs of the different plants. As an example of this, simple engines using relatively large quantities of steam are run non-condensing in the plants from which the steam heating is supplied and in this way the exhaust steam yields considerable revenue through several months of the year.

These railways also extend through a continuous line of coal fields from which the power houses obtain their coal supply at a far lower figure than is available to the average interurban line.

The Illinois Traction System.

The Illinois Traction System includes the local street railway systems at Danville, Champaign, Urbana and Decatur, including the gas and electric lighting and steam heating in those cities and 56 miles of interurban railway extending from Danville to Champaign and with branches from Danville to Georgetown and Catlin, and from Ogden to Homer. The location of these lines is shown in the accompanying map.

The Urbana & Champaign Street Railway Co. was organized in 1859 and in the same year received a perpetual charter from the legislature. The road which first extended from the railroad depot in Champaign to the court house in Urbana, was built in 1862, and it is interesting to note that the rails for this road were imported from England at a cost of $135 per ton. These rails were still in the track in 1890, when the line was converted to electricity, and are still in good condition. In 1890 additional franchises were obtained in Champaign and Urbana and the road was entirely rebuilt and new mileage added, making the total length of track 9 miles. The gas and electric light companies which were previously in operation were merged with the street railway in Champaign in 1893. An electric light plant was started by Mr. McKinley in 1886 at Champaign and in 1890 he purchased the railway property, which he held for two years, and then sold to other interests, by whom the present power house was built in 1893. This property was bought back again by Mr. McKinley and the following year a steam heating plant was added to the business.

In March, 1903, the entire business of the company in Champaign was merged with similar properties in Danville and the Decatur properties were merged in January, 1904, with the other properties of the syndicate. The Decatur gas and electric light properties were bought by the syndicate in the fall of 1899, and this was followed by the purchase of the street railway properties in Decatur in July, 1903. The Danville railway system was started in 1882 as a horse car system under the name of the Citizens Street Ry. and was changed to an electric railway in 1901, the name of the company being changed to the Danville Street Railway & Light Co. This property was bought by the McKinley syndicate in July, 1900, and in the summer of 1901 the interurban line from Danville to Westville was built. In the following summer the Westville line was extended to Georgetown and a branch was built to Catlin. In 1902 the Danville city lines were extended to Roselawn and in the fall of the same year 12 miles of interurban line were built from Champaign east to St. Joseph. The Danville, Urbana & Champaign line was completed in 1903 and in 1904 the branch from Ogden south to Homer was built.

City Systems—Danville.

Danville and its suburbs contain a population of 35,000 inhabitants. The street railway lines in the city of Danville cover nine miles of streets, of which about five miles are double track in the central part of the city, making in all about 14 miles of single track in operation. These lines are divided into seven routes, or divisions, over which the cars operate under either 10 or 20-minute headway, so that in the central part of the city where the lines are double track the cars are passing every three or four minutes.

Heretofore the common transfer point has been at one of the company's car barns on North Vermilion St., but within a short time the transfer point is to be changed to the Public Square, where the general offices of the company are located. A commodious building has recently been acquired for a waiting room and general offices of the company, on one side of the public square, and this building is to be remodeled as soon as possession can be obtained, the lower floor being retained for a large waiting room and the upper floors being used for the offices of the street railway as well as the electric lighting, gas and steam heating departments of the company.

Twelve cars are in daily service on the regular schedule and the company owns 15 closed and 13 open cars, which gives a large reserve equipment for special occasions. The city cars start at 6 a. m. and run until 11 p. m., except on Saturdays, when they run until midnight. The company has two car barns in use, one of which is, as previously stated, to be abandoned and the other is a barn used merely for storage purposes, which is located on the Soldiers' Home line. A large plat of ground has been purchased alongside of the company's gas plant which is but a short distance from the public square and the power house, and a large new car barn is to be erected upon this site. The power house supplies current for the city railway system and part of the current for the Danville & Champaign interurban and will be described in connection with the latter.

Considerable pleasure traffic has been created on the city lines by means of a park established by the company this year, known as Wayside Park, and the outdoor concerts given at the Soldiers' Home. The government maintains an excellent band, which gives outdoor concerts throughout the summer on Sunday afternoons and two evenings each week. The grounds being free to the public, causes the concerts to be largely patronized by the residents of Danville and on Sunday afternoons the company finds it necessary to run trains of two and three cars to accommodate the traffic to this point.

Wayside Park, which has just completed its first season, is situated on the Georgetown line. This park was started in a small way as an experiment and has proved so successful during its first season that its area and the scope of its entertainments will be considerably enlarged in the near future. A small tract of land, about two acres, was fenced in and a building formerly used as a car barn was altered into a summer theater. The admission to the park was made free to patrons of the street car line and admission to the gallery of the theater is also free. The seats on the main floor of the theater are reserved at 10 cents each and entertainments of various kinds have been given nightly during the season.

The concessions for the theater and refreshment stand have been leased to a theatrical manager who furnishes all the attractions and does the advertising for a certain percentage of the receipts from the park traffic; the railway company merely maintains and polices the grounds. The management of the theater at this park has a circuit of about a dozen railway parks and maintains a number of theatrical companies which it moves around the circuit from week to week, so that fresh attractions are offered at the park each week. The attendance this summer has run from 600 to 1,000 people per night, which has taxed the seating capacity of the theater to its utmost.

Champaign and Urbana.

The street railway systems of Champaign and Urbana may be considered as a single system as the two cities are built up to each other, the dividing line between them being a city street. The street railway in these cities consists of nine miles of track built of Shanghai rails in the paved streets and 60-lb. T-rails in the suburbs. The schedules are arranged to give a 10-minute service in the business portions of the city and a 20-minute service on the outlying branches.

The company owns 14 motor and 13 trailer cars and there are 6 open and 12 closed car bodies which are changed on the trucks according to the season. The power house and car barns for this system, as well as the interurban system, are located on Tremont St. at the end of one of the city divisions. The car barns are well equipped with machinery and paint shops in which all the repairs of the company's rolling stock are made excepting the foundry work. The power house of this system will be described in connection with the interurban line.

The University of Illinois is located in Urbana, on the dividing line between the two cities, and the road enjoys a large patronage from the university students. The County Fair Ground is located on the company's lines which gives rise to considerable extra traffic at certain seasons. The company has also established a park known as West End Park, in which are located a theater, a casino and refreshment booth and other minor attractions. The theater is operated by the same lessee who operates the theater in Danville and a similar class of theatricals is given. The company's experience in the operation of West End Park has extended over a number of years and the park has been operated at different times directly by the company and by lessees. The experience of the company has been that it is much more profitable to lease the theater and other concessions than it is to operate them itself. It has been found that the details of hiring performers, attending to the advertising, etc., involve a large amount of work for the railway manager, and the failure of many of the performers at different times to fulfill their engagements has caused an endless amount of trouble. It was also found that the same class of performers could, as a rule, be engaged for considerably less money by a regular theatrical manager, who could move them from place to place and give them steady work throughout the summer season, than they could be hired for by the street railway management for an engagement of one or two weeks. These considerations convinced the management that it is far more profitable to give the use of the theater and a percentage of the street car receipts to a theatrical manager than it is to operate the amusement features itself. The park is well patronized and 5 trains of three or four cars are usually necessary to accommodate the traffic.

Decatur.

The Decatur street railway lines are the most recently acquired city system of the McKinley syndicate, and comprise 13½ miles of road, most all of which is single track. The public square in this city lies about in the center of the business district and all the lines radiate out to different sections of the city from this central point. There is a loop around the public square over which all the city cars pass and in the center of this loop is located a waiting room and transfer station which constitutes the main transfer point between all the city lines. The company operates 17 closed cars, three open motor cars and nine trailer cars, and its rolling stock also includes one McGuire sweeper, one work car and one flat car. The majority of the cars are equipped with General Electric No. 62 motors and there are also some Westinghouse equipments. The street railway was formerly owned by separate interests from the gas and electric light companies, and was operated from a separate power house, but since the consolidation of all of these interests the old street railway power house has been dismantled and power for the electric lighting and electric railway is generated in one station which is now being re-equipped. This station, which was formerly the electric light plant, is situated on the outskirts of the city alongside the tracks of the Wabash and C., H. & D. railroads. This location offers exceptional facilities for obtaining the coal supply for the station.

The boiler room is adjacent to the siding and contains two 350-h. p. new Stirling boilers which have just been erected, two 350-h. p. old boilers of the same make and two 125-h. p. horizontal tubular boilers. All of these boilers are hand fired. The engine room equipment, part of which is now being newly installed, contains two simple Bates engines with 20 x 40 in. cylinders and one 24 x 48 in. and one 20 x 42 in. simple engines of the St. Louis corliss type. The railway is operated by two 200-kw. General Electric, 550-volt generators, one of which is belted to one of the Bates engines and the other to the 20 x 42 in. St. Louis corliss engine. In addition to the railway apparatus, the station contains three 150-kw. General Electric, 2,300-volt alternators and one 65-light Ft. Wayne series arc machine, and two 90-kw., 550-volt generators are about to be installed for reserve power for the railway system. The company has two car barns situated on East North St. on opposite sides of the street, one of which is used merely for storage purposes and the other is kept as a general repair shop. The latter includes an equipment of lathes, drills and other machine tools necessary for making all repairs to the company's cars, with sufficient facilities for practically rebuilding the old cars.

There is a city park on one division of the company's lines which gives rise to considerable pleasure traffic in the summer and on certain evenings during the summer the city gives band concerts at the public square which always call out a large attendance. The

transfer station which is in the center of the public square is surmounted by the band stand and on the evenings when concerts are given the public square is often so crowded with people that there is barely space for the company's cars to operate around the loop.

The Interurban Lines

The route of the interurban lines between Danville and East St. Louis, including those which are in operation and those under construction, is shown in the accompanying map. The line between Danville and Champaign, known as the Danville, Urbana & Champaign Ry., parallels the Big Four route between these termini and is 34 1-3 miles long. From Ogden to Homer there is a short branch six miles in length and from Danville two branch lines are run, one 12 miles long, passing through Westville to Georgetown, and the other 6 miles in length running southwest from Danville to Catlin. These roads are single track with turnouts and are laid with 70-lb. T-rails and ballasted with gravel. Outside the city limits the curves are slight and can be operated over at high speeds. The grades are very slight except at two points. One of these points is at the crossing of a stream where the grades are 3½ and 4 per cent on the approaches and the other is near the city of Danville, where there is a short 7 per cent grade. The overhead work on this line is principally span work. The high tension lines and a continuous No. 0000 direct current feeder are run on one line of poles and two sets of telephone wires are run on the opposite poles. The trolley wire consists of hard drawn copper of Figure 8 section and the continuous feeder is tapped into this trolley line at intervals of about 1,000 ft. In addition to this there are two short direct current feeders, one extending about 5 miles out from Danville and the other a similar distance out from Champaign.

There are eight cars in regular service on the Champaign-Danville line and three extras. One car is operated as a shuttle car on the Ogden-Homer branch, which makes connections with all of the cars on the main line. There are also seven cars in operation on the Georgetown and Catlin division, giving a half-hourly service on the former division and an hourly service on the latter. On the Danville and Champaign division there is an hourly service each way, the first car leaving Danville and Champaign at 5:15 a. m. The last car arrives at Danville and Champaign at 12:30 a. m., although when there are theatrical or other performances at either Danville or Champaign the last car waits until the end of the performance.

In addition to the local trains there are six limited trains daily from Champaign to Danville and six limited trains from Danville to Champaign. These trains make only six or seven stops between the termini and an extra fare of five cents is charged on these trains between any two towns. The local trains make the run between Danville and Champaign in one hour and 45 minutes, and the limited trains in an hour and twenty-five minutes under the present schedule.

There is but one sub-station on the line, this being situated near Fithian, which is about midway between Danville and Champaign. There are also two storage batteries floating on the line, one of which is situated in St. Joseph and the other at Georgetown. The sub-station contains three 110-kw. Stanley oil-cooled transformers stepping down from 15,000 to 370 volts, a 300-kw. Stanley rotary converter and a two-panel switchboard. The arrangements for supplying power to this line are rather unusual. Part of the current is supplied from the Danville end of the line and part from the station at Champaign. In Champaign there is a double current generator giving alternating current on one side and direct current on the other, and the alternating current is stepped up to 15,000 volts, at which pressure it is carried to the sub-station at Fithian. The direct current end of the machine supplies 600-volt current to the Champaign end of the line and the sub-station rotary converter supplies direct current to the middle portion of the system. At Danville there is a rotary converter of 300-kw. capacity which is driven by means of a pulley on an extended shaft by a corliss engine. This is used in either or both of two ways. The direct current from the rotary is led directly to the direct current feeders and the alternating current is stepped up to 15,000 volts by means of three Stanley transformers and this current fed into the high tension lines. The high tension lines pass through the Fithian sub-station and may be connected through direct from one end of the road to the other, or the section either side of the sub-station may be cut out. The Fithian sub-station may, therefore, either be supplied through the high tension lines from the double current generator at Champaign or from the engine-driven rotary at Danville, or from both, running in parallel, and the ends of the road nearest these cities may also be supplied with direct current from the same two machines. In using the rotary converter in this way it has been found practicable to generate 50 per cent of its rated capacity as direct current and 50 per cent as alternating current, or if used exclusively for generating alternating or direct current 80 per cent of its rated capacity may be generated.

The power house in Danville is an old structure containing generating machinery for the local and interurban lines and the electric lighting. The building is about to be reconstructed by removing the present roof, erecting rows of steel columns set on concrete piers and building a new cinder and gravel roof which will be 27 ft. high in the clear. The boiler room contains nine boilers, aggregating 3,600-h. p., of which 1,800 h. p. are Stirling boilers, 800-h. p. Gary boilers, made by the Oil City Boiler Works and 1,000-h. p. Abendroth & Root boilers. All of the boilers are equipped with Green Engineering Co. chain grate stokers and provided with ash shoots, by means of which the ashes are discharged into cars. The generating units in this station used in connection with the railway lines consist of a 1,000 h. p. Hamilton-Corliss engine to which are equipped a 300-kw. General Electric direct current generator and a 300-kw. Stanley rotary transformer, one Russell tandem compound engine belted to a 100-kw. direct current generator and two 80-kw. multipolar Thomson-Houston generators which are held in reserve.

At a short distance from this station is located the company's principal repair shop, paint and carpenter shop and freight house. All of the interurban cars are housed and repaired at this place.

The power house at Champaign, like that at Danville, contains a rather varied assortment of machinery, which has been installed from time to time to keep pace with the growth of the business. The boiler room contains two 320 h. p. Stirling boilers, one 275 h. p. and two 250 h. p. Babcock & Wilcox boilers and one 275 h. p. Aultman & Taylor boiler. The draft is obtained by means of two stacks, one of brick 137 ft. high and the other of steel 150 ft. high.

The fuel used in this power house is known as duff coal, which is really fine coal dust which does not contain even the smallest lumps. It is obtained by passing ordinary screenings through a very fine screen, and the use of this coal requires an unusually large grate area and a very strong draft. When burned on the grate this coal fuses into large cakes which, after being broken up, makes a very intense fire and burns with a very small percentage of ash.

The engine room contains a 1,000 h. p. Russell engine 30 x 30 in., direct connected to a 500-kw. General Electric double current generator, giving 600 volts direct current on one side and 370 volts alternating current on the other side. This alternating current is stepped up by transformers to 15,000 volts for use on high tension lines. There is also one Rankin & Fritsch 225-h. p. corliss engine belted to a 150-kw. direct current generator and a Porter and Allen 200-h. p. engine belted to a 120-kw., 600-volt, 4-pole Westinghouse generator. These units are all used in connection with the railway systems. The station also contains three 50-light Western Electric arc machines belted to a Russell engine, an 80-kw. Westinghouse 1,100-volt alternator belted to an 85-h. p. Clyde engine, a 300-h. p. Ideal engine belted to a 150-kw. Ft. Wayne, 1,100-volt alternator and a 50-light direct current arc machine. During the day when the lighting load is very light it is carried by a motor-generator set operated from the direct current railway circuit. This consists of a 600-volt motor of 100 amperes capacity belted to a 45-kw., 1,100-volt Westinghouse generator. The water supply for this station is secured from two wells 175 ft. deep by means of two pumps made by the Cook Well Co., of St. Louis.

The cleaning of the machinery in this station is done entirely by compressed air, for which purpose an air tank is installed which is supplied by a motor-driven air compressor. The equipment of the power houses both at Danville and Champaign is run entirely noncondensing, due partly to the fact that the present plant was made up of comparatively small units which have been added from time to time and partly to the fact that in both places the exhaust steam is used for the city steam heating system and in this way brings in considerable revenue during part of the year when steam heating is required. The greater part of the interurban system has been in opration but a comparatively short time, and the power plant has been arranged in the most readily available way without making very radical changes in existing stations. As soon as time permits,

which of the present station equipment will be replaced by one or more large sized direct connected units and the plants will be modernized in engineering details. The company has quite extensive car barns and repair shops in Champaign, adjacent to the power house. There are a woodworking shop, machine shop, blacksmith shop, and winding room which are equipped to take care of all the repairs required for the city cars excepting the foundry work.

The company has two private telephone lines connecting all the points on the interurban systems just described, one of which is used for general business purposes and the other exclusively for the dispatcher, whose office is located at Danville, within a few doors of the public square. The method of dispatching is similar to that employed on most interurban railways, the car crews reporting their arrival at each meeting point. The motorman and conductor of the car taking the siding at the meeting point make their report to the dispatcher and also report the number of the train which they have met. Some changes in the dispatching system are to be inaugurated by Mr. Hoagland, the general superintendent at Danville. Two telephones are to be installed in each car, one at either end, which will be readily accessible to both the motorman and conductor of the car at the same time. The jack boxes are to be installed on the posts between the tracks at the sidings so as to be accessible from the car and on taking the siding the car will stop opposite one of these boxes and the lead to the telephone plugged into it. The dispatcher's orders will be taken down by the motorman and repeated back by the conductor, each at his own telephone, which it is believed will save considerable time and at the same time secure greater accuracy by having both of the crew talk to the dispatcher separately.

INTERURBAN CAR, ILLINOIS CENTRAL TRACTION SYSTEM.

Express and Freight.

The company is developing an express and freight business and has three cars in regular service. The express car leaves Danville at 11 o'clock each morning and collects and delivers express matter at all points, reaching Champaign at 2 o'clock in the afternoon. The car leaves Champaign at 2:30 p. m. and makes the trip back to Danville, arriving there at 5:40 p. m. Express cars are also operated on the Georgetown division, upon which an exceptionally good express business has developed.

With the exception of the coal carrying trade which has been undertaken on these lines all other shipments of goods, express matter and where they are small enough are carried in the baggage and smoking compartments of the regular cars. Express agents are established at all the principal points and packages are also received by conductors of cars at way stations and are delivered to the agent nearest their destination, but no delivery system beyond the agent's headquarters is undertaken. Packages will be put off the cars at cross roads, or any point desired, but the company assumes no responsibility for the goods thus delivered. Everything, however, as far as possible, is being done to accommodate shippers on these lines, and the long distance company's telephone is always open to the business community to order goods by this means, which will be forwarded by the express.

As we have previously stated, these lines are in the heart of a coal mining region and recently the same interests which control the electric lines have organized a coal company with the object of hauling coal in car-load lots and delivering it at all points reached by the interurbans. To handle this trade the company has built in its own shops six coal cars and has bought six others. These cars are to be hauled by an electric locomotive which is also being built in the Danville shops. The locomotive will be of 300 h. p. capacity, each of the four axles being equipped with a 75-h. p. General Electric motor.

The type of cars used on the interurban lines are 51-ft combination passenger, smoker and baggage cars, built by the American Car Co. The interior finish is inlaid mahogany and the main compartment contains 22 cross seats, 11 on each side, capable of seating 44 passengers. The cars switch around Ys at both ends of the line so that the same end of the car always runs forward. For this reason the seats are not made with reversible backs. They are of the Hale & Kilburn type and are leather covered and the backs are high, affording a head rest, making them much more comfortable than the ordinary low back seat. The smoking and baggage compartment is arranged in a somewhat unusual manner. The motorman's compartment is in the left-hand corner of the smoking room and forms a room by itself with doors on either side, one leading into the smoking room and the other outside of the car. Opposite the motorman's compartment is a longitudinal seat seating five passengers and three upholstered wicker chairs are placed in the baggage room, making a seating capacity for eight people. Two sliding side doors are placed in the sides of the smoking compartment for loading and unloading express packages. The cars are equipped with four General Electric No. 73 motors and type M control. They have Westinghouse air brakes and are heated by Western Car Heating Co. hot water heaters. Each car is lighted by 30 incandescent lamps and carries a Wagenhalls arc head light. The latter have been wired up with two resistances in parallel instead of using a single one as is customary, and while this arrangement uses nearly double the amount of current it results in an unusually powerful light.

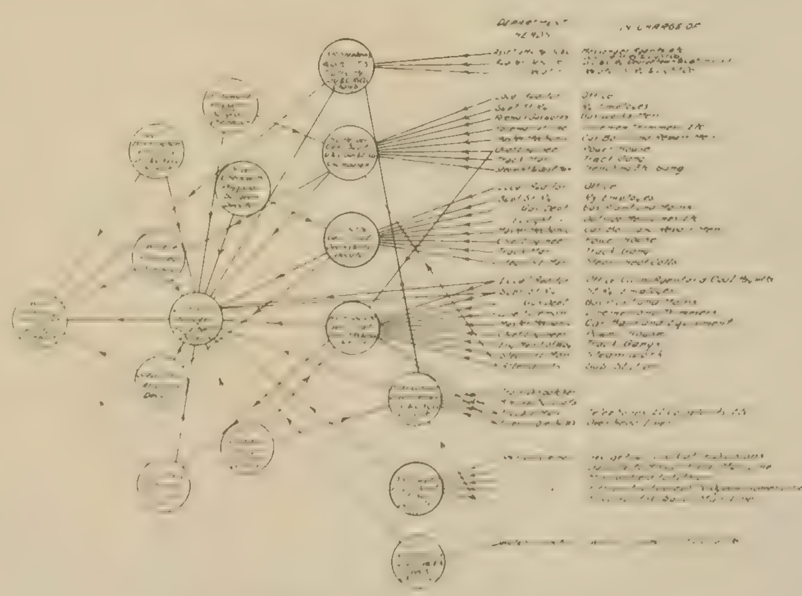


DIAGRAM OF ORGANIZATION, ILLINOIS CENTRAL TRACTION SYSTEM.

Financial

The Illinois Traction Co. is doing an excellent business on all of its street and interurban lines, and has a monopoly of the gas, electric light and steam heating business in the cities in which it operates. The following tables cover the properties in Decatur, Danville, Champaign and 56 miles of interurban lines and show the comparative statement of earnings and expenses for the month of

Ry. for the last five years and also for the seven months ending July 31 for the same period.

Month of July.

	1904	1903	1902	1901	1900
Total gross earnings	$83,003.83	$67,194.64	$51,139.41	$38,890.12	$32,132.57
Expenses ...	45,808.31	40,232.50	27,481.62	20,980.58	22,468.31
Net over expenses and taxes	37,195.52	27,962.14	23,657.79	17,849.54	9,964.26

Seven months ending July 31.

	1904	1903	1902.	1901	1900
Total gross earnings .	$538,721	$428,347	$329,066	$250,373	$219,635
Expenses	314,313	257,763	176,977	144,654	148,621
Net over expenses and taxes .	224,407	170,583	152,089	105,718	71,014

The organization of the officers and operating forces is somewhat complex and is best shown by the accompanying diagram. Mr. W. B. McKinley is president and general manager of the whole system and Mr. L. E. Fisher is manager of all the properties in Danville, Champaign and Decatur, including the interurban systems. In each of the cities there is a general superintendent in charge of all the departments who reports directly to Mr. Fisher, and there are also superintendents of most of the departments who report to the general superintendent. While the line of authority is generally direct from the superintendent to the general superintendent, the manager and the general manager, there are a few exceptions to this that will be noted by reference to the diagram. Mr. B. R. Stephens as private secretary to Mr. McKinley, reports primarily to him and to the manager only as auditor and traffic manager of the D., U. & C. Ry. Mr. Connor, as superintendent of the D., U. & C. Ry., reports to Mr. Stephens, traffic manager, on subjects pertaining to the movement of freight, express and special cars. Sub-station employes report to Mr. Hoagland, general superintendent of the Danville Street Railway & Light Co., except the attendant at the St. Joseph storage battery, who reports to Mr. Pepper, general superintendent of the Urbana & Champaign Railway, Gas & Electric Co. The chief engineer of the Champaign power house reports to Mr. Hoagland only on matters pertaining to the high tension system of the D., U. & C. Ry. The trouble man and the foreman of overhead work report to Mr. Hoagland, but are subject to call by Mr. Connor in case of trouble on the lines under his charge. The local auditor in Danville and Mr. Connor report to either the manager or the general superintendent, as may be desirable. With these exceptions all the employes report along the lines indicated.

(To be continued.)

The operation of through cars from Uniontown, Pa., to Greensburg, Pa., via Connellsville, Scottdale and Youngwood, was begun September 6th, the distance being 38 miles, the running time 2 hr. 25 min., giving hourly service. Between Scottdale and Uniontown, a distance of 20 miles, thirty minute service is being maintained. Cars are operated by the Pittsburg, McKeesport & Connellsville Railway Co. over the tracks of that company from Uniontown to Hunker, a distance of 29 miles, at which point they pass on to the tracks of the Pittsburg, McKeesport & Greensburg road, the cars remaining in charge of the Pittsburg, McKeesport & Connellsville crews through to the terminal.

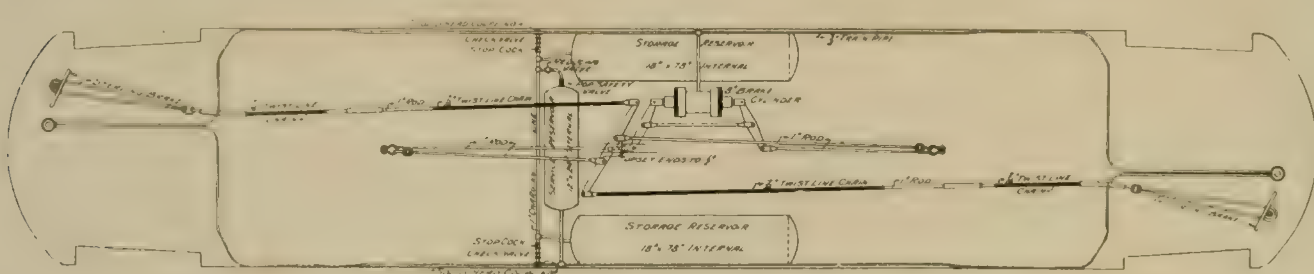
Storage Air Brakes on System of Public Service Corporation of New Jersey.

The management of the Public Service Corporation has decided to make extensive use of the storage air brake system on its cars. At present 276 of its double truck cars are being equipped with storage air brakes. For charging these equipments with air, six stationary motor-driven compressing plants are to be located at convenient points on those lines over which the storage air brake cars are to be operated. Two of these compressing plants are completed, one at the Montclair car house and one at the South Orange

AIR COMPRESSING PLANT AT MONTCLAIR, N. J.

car house. Other plants will be located at Greenville, Harrison, Maplewood and the sixth at some point not yet decided upon. All of these compressing plants together with all the brake equipments on the cars have been furnished and installed by the National Electric Co., of New York and Milwaukee.

The system involves the application to each car of two storage tanks, each 18 in. x 78 in., which are designed to receive the air from the stationary compressing stations at about 300 lb. pressure. From the car storage tanks the air passes to an auxiliary service reservoir through a reducing valve for obtaining the working pressure of 50 lb. From the service reservoir, the air passes at the low pressure direct to the brake cylinder. Aside from the addition of the storage tanks and reducing valve, the brake equipment on each car is of the standard Christensen straight air type.



BRAKE EQUIPMENT ON PUBLIC SERVICE CORPORATION CARS.

Each compressing plant for furnishing compressed air at 300 lb. consists of two belt driven air compressors, each having a capacity of 100 cu. ft. of free air per minute. Each compressor is driven by a railway type motor, taking trolley current through a regulation car controller. In conjunction with the two belt driven compressors, there are three cooling storage tanks at each plant, each tank being 18 ft. long x 3 ft. in diameter. The tanks are set on end and are connected in series, this arrangement providing for cooling the air and also for reducing condensation to the minimum. The air passes from these storage tanks to the street boxes through a 3-in. pipe line. The street boxes are provided with flexible hose for filling the storage reservoirs on the cars. When a car is charging at the street boxes, the high pressure air passes through a check valve in the charging line and thence through a ground stop cock to the storage reservoir.

The Montclair compressing plant will for the present supply air

to about 20 double truck cars, while that at South Orange will serve about 38 cars. In considering the size of the storage tanks which were to be used upon the cars for carrying the high pressure compressed air supply, Mr. D. F. Carver, chief engineer of the street railway department, made a number of tests to determine the amount of air used by an ordinary car in ordinary service. It was found that the maximum number of brake applications for a full round trip would never exceed 300 and that the number for maximum service would be about 280. This number is far in excess of the average number. It was determined that the average consumption of compressed air per 40-lb. application would be but slightly over 1 cu. ft., and an average was assumed of 1.2 cu. ft. per application. It will thus be understood that the total maximum consumption of air, assuming 280 applications using 1.2 cu. ft. each will be 336 cu. ft. of free air to be supplied from the storage tanks. The combined volume of the two storage tanks per car is 21.95 cu. ft., giving at 300 lb. pressure a total capacity of 439 cu. ft. of free air. But as the air passes from the storage tanks into the auxiliary or service reservoir at 300 lb. down to 50 lb., there is available in the storage tanks for braking purposes an amount of air corresponding to that volume at 250 lb. pressure or 368 cu. ft. of free air, which is sufficient for the total of 280 applications. The storage tanks under the cars have a factor of safety of approximately six. The piping and fittings are extra heavy for high pressure.

The National Electric Co. has also equipped 150 cars of the Public Service Corporation with standard Christensen independent motor driven straight air brake equipments.

The W. S. Jackson Automatic Block Signal System.

The signal system herewith described was designed by Mr. W. S. Jackson, who is connected with the Jersey City, Hoboken & Paterson Street Railway Co., one of the roads now controlled by The Public Service Corporation of New Jersey. He claims to have a simple as well as an efficient block signal system that will meet all the requirements of electric railway service.

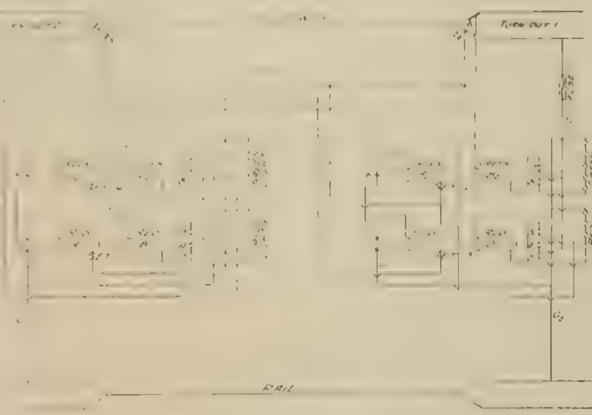
The system described is designed to be operated on roads using single track and turn-outs, but with slight modifications of the wiring plan, it may also be used on double track roads.

At each end of a piece of single track, there are placed on a pole supporting the span wire, two machines, enclosed in wooden boxes, one operating a red semaphore and red light, and the other operating a green semaphore and green light.

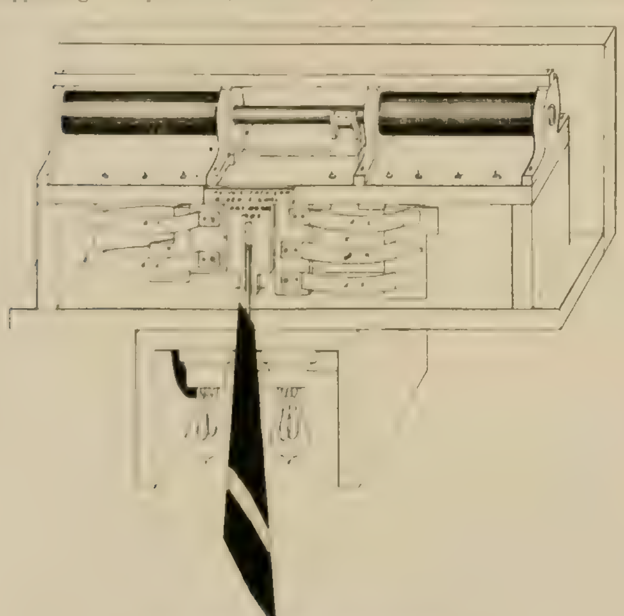
The machine is made up of two electro-magnets connected together by a plunger [illegible] in the corresponding coil. To the plunger is fastened a rod, at the end of which are fastened pieces of fibre [illegible] which enter and recede from the switch points. The electro-magnets are mounted, in a horizontal position, on a wooden bench, under which are fastened switches, which are opened and closed by the action of the magnets on the plunger and cam. The semaphores are operated by means of the plunger and cam. The red and green machines are similar in construction, the only difference being that the red machine has two more switches than the green machine.

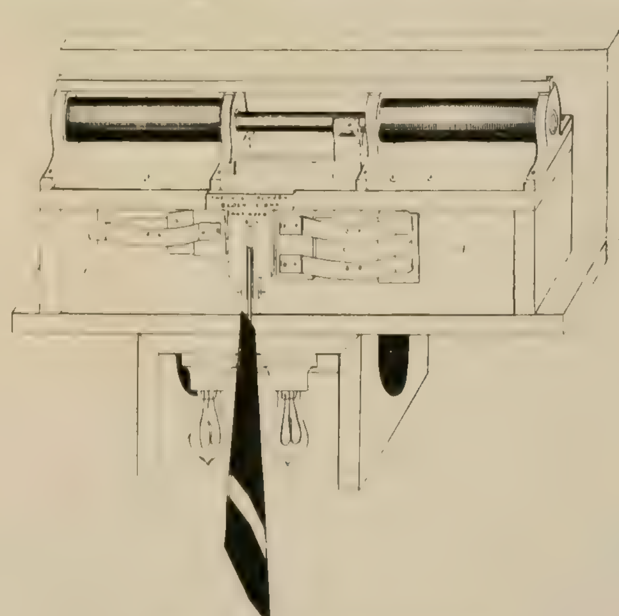
In the wiring plan, as shown herewith, the signals are in the normal or "no signal" position, that is, the semaphores are in inclined positions, and the lamps are out. Now let us suppose a car to enter the block, coming from turn-out No. 1, and going to turn-out No. 2. The trolley wheel makes contact with a contact device, which is placed just outside of the turn-out as shown in the wiring plan, thus sending a current through line wire b_1; this current energizes magnet A_1, causing it to draw the plunger in, and means of the cam, raising the semaphore to the horizontal or danger position. After the current has passed through magnet A_1 it passes through switch No. 1 to the ground, through wire G_1. Now the switches No. 1 and No. 2 are opened, and switches Nos. 3, 4, and 5 are closed, and current coming from feed wire F, passes partly through switch No. 5, and so through the lights to the ground, and partly through switch No. 4, and over the line wire c to magnet A_2, energizing it, thus causing it to bring the semaphore into a horizontal position, opening switch No. 6 and closing switches Nos. 7 and 8, which allows current to pass through switch No. 8 and so through the lights to the ground.

The red semaphore, now at danger, stops the car which is, let us



WIRING DIAGRAM.


RED SEMAPHORE AND SWITCH BOX.


GREEN SEMAPHORE AND SWITCH BOX.

supposed about to enter block from turn-out No. 1 and the green semaphore protects the car which is closely behind that car that has just entered the block.

Now when the car in the block has reached the other end it again makes contact with overhead contact device and causes current to pass through line wire b_2; this current divides itself, as will be seen, part of it going to magnet B_1, causing the plunger and cam to come back to the normal position, and part of it going to magnet B_2, causing the plunger and cam of the green machine to come back to the normal position. The switches Nos. 3, 4 and 5 of the red machine are now opened, as well as switches No. 7 and 8 on the green machine; the light circuits are not cut and the lights are out. For a car going from turn-out No. 2 to turn-out No. 1, the action is precisely the same. It will be noticed that the red machine is operated first, and that the operation of the green machine is dependent upon the operation of the red machine, thus assuring the motorman that he has signalled the car approaching from the opposite direction to stop.

DEVICE FOR OPENING AND CLOSING SWITCHES.

In this system the signals are always at danger, for should the trolley wheel pass over the contact, and the green semaphore fail to go up, this would show that the red semaphore at the other end of the block had failed to operate, and therefore that the signals were out of order. In this system the lights are entirely independent of the semaphores, and should the lamps not burn for some reason or other, this would not interfere in any way with the operation of the semaphores.

The designer has also perfected a three and four-wire plan for connecting the signals, not shown here, by means of which if two cars approaching from opposite directions should strike the overhead contacts simultaneously but one car could operate the signals, thus insuring that car the right of way.

This system of signals has been in successful operation for the past two years on the Bergen Turnpike Road, running from Hoboken to Hackensack; also for the past year, on the Orange and Passaic Valley Road, which runs through Orange, East Orange, and Bloomfield; also for the past year on the Valley Road of the North Jersey system which runs from Montclair to Montclair Heights.

Krupp Specialties in America.

Thomas Prosser & Son, of 15 Gold St., New York City, are the American representatives of Fried. Krupp & Co., of Germany. They are making a specialty of Krupp steel tired wheels with any style of tire fastening and with steel casting, wrought iron or cast-iron centers, either plate or spoke type; or steel casting wheels (plate or spoke type) with tire and center cast in one piece.

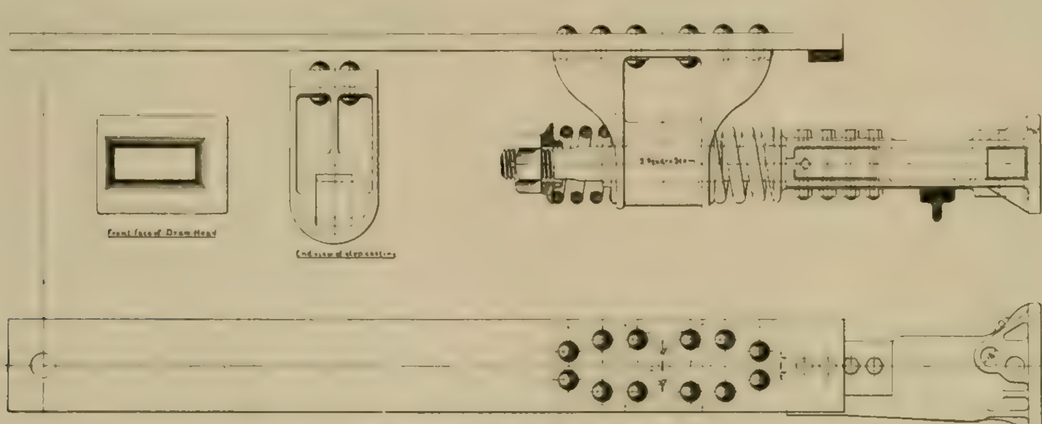
Thomas Prosser & Son also handle Krupp resistance wire for electrical purposes, as well as rheostats, arc lamps, heating apparatus, electric headlights, etc. This wire possesses a specific resistance only about 10 per cent lower than mercury. Krupp resistance material can be loaded permanently up to a temperature of 112 degrees Fahrenheit, without undergoing any alteration of structure.

This firm is also prepared to take orders for Krupp shafts and other forgings up to 70 tons for power house engines, etc.

Van Dorn Heavy Draw Bars and Couplings.

For the use of heavy electric cars operating at high speeds the W. T. Van Dorn Co. has designed a specially heavy draw bar and coupling which are shown in the accompanying illustration. This company has made a special study of the requirements of electric railway couplings and draft gearing for the past ten years and most of the important electric roads in this country have been equipped with the Van Dorn couplings. The company, therefore, feels it is in a position to furnish couplings to meet any condition on any class of railways.

There are perhaps but few men in the railway field who appreciate how much heavier couplings should be constructed for electric railways than for steam railroads. The reason for this is that a very much higher acceleration of the electric cars makes the demands on the couplings almost twice as severe as they would be with the same weight of car on steam roads. Managers of different roads have frequently stated that they wanted couplings of light capacity as their service would be comparatively easy on cars equipped with multiple unit system, but the Van Dorn company has found by experience that the heaviest type is none too strong for this service. It is therefore recommended that managers of electric railways or elevated railroads who wish to order couplings for their cars write direct to the company, giving full information as to the weight of the cars, length of body and the curvatures of the road, so that the maker can recommend a type of coupling that will be adequate for the purposes. All couplings built by the Van Dorn company are machine fitted and no couplings of any class are supplied in which the play exceeds 1-16 in. when the couplings are new. This makes a very compact train, and when coupled up as closely and rigidly as possible there is a very material increase in the life of the cars.



THE VAN DORN NO. 10 COUPLING.

The Albany & Syracuse Electric Railway Co. has adopted, in addition to commutation tickets which are sold between all regular stations, a money ticket book, which is practically a mileage book, containing 200 5-cent coupons, at $8 per book, a discount of 20 per cent from the regular rate of fare.

Proceedings of the Twenty-Second Annual Meeting, Street Railway Association of the State of New York.

The 1904 meeting of the Street Railway Association of the State of New York was held in Utica September 13th and 14th. The reputation of the New York State Association for business-like conventions was well sustained and the Utica meeting will go on the records as one of the most successful, as well as one of the most enjoyable conventions in the history of the association. Approximately 250 members and guests were in attendance. The supplymen's exhibit was interesting. The large attendance of ladies added to the success of the meeting and made it a memorable one from a social standpoint. The entertainment features provided by the ladies of Utica and by the Utica & Mohawk Valley Railway Co. were perfect in every detail. Mr. Allen and his associates made ideal hosts. President Connette left nothing to be desired as a presiding officer. Mr. Cole, the genial secretary of the association, deserves a great deal of credit for the success of the meeting.

The sessions of the association were held in the New Century Club Auditorium.

President E. G. Connette, of Syracuse, called the first session to order at 10:45 Tuesday morning. The convention was welcomed to Utica by the mayor, Hon. Charles A. Talcott, who in his address spoke of the great influence which the electric railway has had on our national growth and commercial greatness, and expressed the belief that in the true record of the progress and enlightenment of the Twentieth century the labors of the New York State Association would have a conspicuous place.

The report of the executive committee was then read and approved. The committee recommended, in view of the increasing number of delegates and guests attending the annual conventions of the association, that in the future some prominent hotel resort be selected as the meeting place, where better hotel conveniences and greater accommodations for the supplymen's exhibit could be had.

The report of the secretary and treasurer was then presented and approved. The report shows an increase in membership and a satisfactory financial condition.

The president's annual address which followed was an able presentation of electric railway development in the state of New York.

President Connette's Address.

We meet in annual session in the city of Utica for the first time since the organization of the Association; it is a propitious time for the Association to meet in the beautiful and historic Mohawk Valley, because the construction and operation of the Utica & Mohawk Valley Railway is an exhibit of the best methods in the building and operation of interurban railroads. Within two years the villages and cities from Rome to Little Falls have been linked together, so that they are now almost a continuous population. The high speed and frequent service which is now enjoyed by these people is certainly a great contrast to the transportation facilities enjoyed by their forefathers.

A little over one hundred years ago the Mohawk River supplied the only means of transportation for the few people who lived in the hamlet of Old Fort Schuyler. Small boats—similar to canal scows—propelled by hand were used for the carrying of passengers and freight.

In 1811 stage boats were run between Utica and Schenectady for the accommodation of passengers, which left Utica twice a week at 5 a. m., and arrived in Schenectady the following morning in time for breakfast. About this time a highway was built, so that stage lines were being operated from Utica to Albany; in January, 1811, Parker Howe advertised that the mail stage now leaves Baggs, Utica, every morning at four o'clock; passengers will breakfast at Maynard's, Herkimer, dine at Josiah Shephard's, Palestine, and sup at Thos. Powell's, Tontine Coffee House, Schenectady.

In 1820 a large part of the Erie Canal was open for freight and passengers, and the Erie Canal Navigation Co. advertised that they sailed every Monday and Thursday morning from Utica at 9 o'clock and arrived at Canastota at 7 p. m.

In 1836 the Utica & Schenectady Railroad was opened for traffic, and the newspapers throughout the state announced the opening with a grand flourish, and boasted that the company had six locomotives, 50 cars and 50 emigrant wagons, and that each car would carry 24 passengers.

These antique methods of transportation compared with facilities for handling passengers and freight, as provided by the only four track steam railroad in the world, and by an electric service second to none, shows indeed a rapid evolution in the development of transportation facilities.

Within the past three years new life was infused into the old Utica & Belt Line company, out of which grew the Utica & Mohawk Valley Railway Co., running from Little Falls to Rome, and which now operates cars at a speed which almost equals the fast trains of the steam roads. This road has been substantially constructed and it is worth the while of the members of this Association, while in Utica, to ride over its lines and observe the substantial roadbed and bridges of modern, up-to-date construction.

While the year past has not witnessed such prosperity as the preceding year or two, still the gross earnings of the street railroads of this state for the last fiscal year show a healthy increase over the previous fiscal year. The increase in the operative mileage of street surface railroads during the past year was 111.9, by far the greater portion of which increase is interurban mileage.

The building of electric roads through hitherto unexplored territory, connecting villages and hamlets with the centers of commerce and industry and providing quick and frequent transportation for passengers and produce, establishes the electric railroad as a great missionary function in converting the isolated and antiquated methods of living and doing business into the up-to-date and progressive ideas of living. The disposition of persons or municipalities to retard the building and growth of electric roads by opposition, imposing serious restrictions and impracticable or burdensome conditions, resulting in the abandonment of the project, is a menace to the general public good and deprives that particular community of valuable and substantial benefits.

According to the last annual report of the Board of Railroad Commissioners, the casualties on street surface railroads are less than they were during the preceding fiscal year, which is encouraging, and shows that the roads are being operated with more care and improved methods. Defects in methods of train dispatching on electric railroads has resulted in more serious accidents during the last year than from any other cause. Head-on collisions have occurred on two roads using the most approved systems of train dispatching. A more perfect method of operating cars by train signals should be devised, if possible, to prevent collisions, or some other means adopted by which such accidents can be avoided.

The increase in the freight and express business on electric railroads during the past five years is shown by the following table:

1899	120,940 tons
1900	153,343 tons
1901	287,311 tons
1902	394,641 tons
1903	516,470 tons

This indicates that the package or parcel business is increasing rapidly, but there is yet a large field for development in this line. The running of express service on electric roads creates a convenience which can scarcely be appreciated until it has been tried. It connects the jobbing house in the city with the hamlet and village stores, so that the latter can replenish their stocks of goods from time to time with promptness and with much less expense than under the old methods, and furnishes the farmer a quick and easy market for his produce; the future of this class of business and the advantages to the public thereby can scarcely be estimated.

Interesting papers have been prepared and will be read before this convention upon the subject of freight and express business on elec-

the roads and I trust that the convention will give particular attention to this as one of the livest subjects to be developed by the street and interurban roads.

There was no legislation enacted during the past year which adversely affected the street railway interests of this state; while there was some legislation which more or less benefited some of the roads.

We note with especial interest the development of electricity as a motive power to supplant the use of steam locomotives, as illustrated by the recent arrangements of the New York Central railroad to install an electrical system for the movement of all its trains on the Hudson Division as far as Croton—34.42 miles, and on the Harlem Division as far as White Plains—34.27 miles. The local service will be handled by trains of from four to six cars; each car will probably be equipped with two motors of about 200 h. p., while the large trains will be handled by electric locomotives. Thirty electric locomotives have been ordered which will weigh about 90 tons each, and will be equipped with four gearless motors of about 550 h. p. each, giving a total of 2,200 h. p. per locomotive. Each of these locomotives operating on a 600-volt circuit can haul a 500-ton train at a speed of 60 miles per hour. The locomotives will be equipped with multiple unit type of controller so that two or more locomotives can be coupled together for the handling of the heaviest trains.

The power station to handle this immense plant will contain eight steam turbines with generator of 5,000-kw. capacity each, installed in two stations—one at Yonkers and the other at Port Morris.

The development by the electrical companies of the compensated alternating current railway motor is a long step forward, as the advantages of this system are the lesser cost of conversion and distributing and reduced operating expenses in sub-stations. Its application is especially desirable where the density of traffic is low—that is, where a more or less infrequent service is maintained over reasonable distances, or where a more frequent or heavy service is maintained over distances greater than are now customary in direct current work. It is also particularly applicable where trains are run in such large numbers that the current drawn from the line at a given point is very large and would necessitate converter substations at frequent intervals if direct current was used. Where large loads are concentrated at a few points on the line as against the load uniformly distributed over the whole system, or where the cost of motor car equipment is small compared with the cost of transmitting and distributing, the alternating system is most suitable.

These motors have a decided advantage from the fact that they can be used either with alternating or direct current.

Special arrangements have been made for a car equipped with this type of motors to run between Utica and Rome during this convention. The car will be run between Utica and Oriskany with direct current and between Oriskany and Rome with alternating current at 2,200 volts; a special line having been erected for the purpose for the benefit of persons attending this convention. Announcements will be made as to the hours that this car will be run.

As a matter of statistics, it is doubtless interesting to know that the average number of persons employed on all street surface railroads during the past fiscal year was 30,028, and that the amount paid out in salaries and wages during that time was $17,841,895.49. It is not only interesting from a statistical standpoint, but it gives an idea of the large number of men and the immense amount which is paid out in wages, which should in itself accentuate the importance of the State Association in representing an industry of such large proportions.

The committee appointed at the last meeting of the Association at the instance of the State Board of Railroad Commissioners, to act jointly with the American Institute of Electrical Engineers and the National Board of Underwriters for the purpose of making high voltage tests, to determine the danger of transmission lines under present methods of construction, have performed their duty in a zealous and commendable manner. I especially call the attention of the association to their report, which will be submitted at this meeting.

The Standard Rules Committee have done excellent work in connection with their duties. Their report has been printed in pamphlet form, showing the rules as now recommended, together with reports of the minutes of the committee showing why certain changes have been made. The work on the system of interurban rules has not reached a point yet which is entirely satisfactory to the members of the Rules Committee, but they have incorporated in their report certain recommendations in regard to interurban rules. This committee should be continued in order that the work of standardization may be perfected, especially so far as interurban rules are concerned, and I would suggest that this committee especially consider the question of train dispatching.

The cordial relations existing between employes and the street railroad companies of the state is a pleasing condition, and is doubtless due to the up-to-date methods in the management and control of men. No concern which employs men can reach the maximum of success and attain the best results without a thorough co-operation of its employes. All men are human and the position they occupy in life should not affect their self-respect. The golden rule applied to the management of employes is one which will always bring good results.

There is a common interest among the street railroads which can only be fostered and protected by united action. This association was organized for the purpose of attaining the end suggested; that is, to provide the avenue for unifying the work, and caring for and looking after the interests of the street railroad companies of this state, and every street railroad company in the state should, therefore, become a member. Nearly all of them are, but there are yet a few roads which have, for some reason, never joined the association, and I, therefore, respectfully suggest that every effort be made to have every street railroad company in the state become a member of this association. It is not only beneficial from the standpoint of looking after the common interests of its members, but the annual meetings are becoming more and more popular and interesting. The papers submitted and the subjects discussed are of such a nature as will harmonize the ideas of management and develop up-to-date plans for the proper operation of the different departments. A "Question Box" has been introduced as a new feature of the program at this meeting and an interested discussion of the various topics contained therein is desired.

One of the pleasant features of our annual meeting is to meet the supplymen and greet them in a social way, and the large number which are in attendance at this meeting is a reassurance of their unflagging interest in and good will for this association.

In closing I do not forget to express my hearty thanks and appreciation for the loyal and active support of the executive committee, and for the live and active interest of the members and friends of the association, and especially the street railway press in the effort to make this meeting an interesting and pleasant occasion.

The association has shown its usefulness and importance in the past several years, and its importance and usefulness can yet be increased and broadened and I, therefore, bespeak for the association the same hearty support and co-operation of its members, officials and executive committee as has been contributed during my incumbency as president of the association.

After the routine preliminary business had been disposed of, the meeting proceeded to the reading and discussion of papers.

The first paper presented was, "Power Production and Distribution on the Metropolitan Street Railway System," prepared by Mr. M. G. Starrett, chief engineer of the New York City Railway Co. In the absence of Mr. Starrett, the paper was read by Mr. W. B. Reed, of the same company.

The president asked Mr. C. E. Roehl, of the Brooklyn Heights Railway Co., to lead the discussion.

Mr. Roehl said in part:

"The Metropolitan company marked a new era when it started in with a large alternating current station and distributing by high tension feeders to sub-stations. We in Brooklyn have not quite as large a plant as the Metropolitan system, but we will approach it gradually. In four years we have doubled our power output, and if the plan of our operating department this winter is carried out, we will have trebled it; in other words, we will have it developed 300 per cent over what it was four years ago. Brooklyn began in the early days with electric traction, and we have, therefore, a number of small direct current stations. Four years ago we started a 32,000-h. p. combined alternating and direct current power station. This station is now in operation and has been for about six months, and we are able to get some results from it. Since that time, last summer, we started with a new station, entirely alternating current. This station when completed will be about 100,000 h. p. This, I think, is one of the largest stations yet planned. Like the

Metropolitan, we have the 6,600-volt three-phase alternating current, with six sub-stations. We have storage batteries in two of them. These batteries were fallen heir to, and we did not feel disposed to throw them out, and so we are still using them. We are not, however, using storage batteries in any of our new sub-stations. A careful study of the Brooklyn situation shows that we cannot build the same kind of sub-stations that the Metropolitan system did. I think [illegible] sub-stations of [illegible] kw. in rotary capacity. Our largest station is 6,000 kw.; most of them are 5,000 kw. Our standard unit is 1,000-kw. rotary. Where the territory requires beyond 5,000 kw. we find it is cheaper to revise the boundaries of the sub-station district and build another sub-station, finding that it is cheaper than the expense of maintaining one station with longer low tension feeders.

"[illegible] new power station we have decided to change to [illegible]. We find that we will make a saving of about $300,000 in our high tension feeders alone after changing our present alternators from 6,600 to 11,000 volts. We propose to re-wind them so that they can be operated either at 6,600 volts, or 11,000 on the star connection with neutral grounding.

"Our high tension feeders are not insulated as heavily as on the Metropolitan. Whereas it uses 7-32 in. paper insulation around each conductor, we use 11-64 around each conductor. We have also adopted as a standard feeder 250,000 cm. That is uniform throughout; we carry about 2,500 kw. per feeder.

"[illegible] back to the size of the sub-stations. We have now six sub-stations, and we are planning to have fourteen.

"I was very much interested in the statement of Mr. Starrett that they were able to save $1,650,000 in their alternating current distribution as compared with a number of direct current stations. That figure compares very closely with our own estimate that we [illegible] years ago on our Brooklyn station. We found that we were able to save about a million and a half dollars by using alternating current distribution with sub-stations as compared with direct current. Our station, as compared with the Metropolitan station, has smaller units. We have 4,000-h. p. engines and 2,700-kw. generators as against the 3,500-kw. generators in the Metropolitan system.

"Our cost of coal is somewhat less. I note that Mr. Starrett states that 67 per cent represents the coal cost. Ours is 65. That is explained by the fact that we use a very low grade of hard coal—No. [illegible] buckwheat, paying about $1.45 a ton for it. On the other hand, our labor cost is somewhat higher. We have 24 per cent as against 19 for the Metropolitan. This is probably due to the fact that we have entirely hand-fired boilers, it being impossible to burn so low a grade of coal with the automatic stoker.

"Having both direct current stations and alternating current distribution, we have an opportunity to compare the old method with the new. It is cheaper for us to generate the alternating current and send it out over high tension feeders and distribute it from the rotary sub-stations than it is to generate the current at our direct current stations.

"[illegible] reference [illegible] of an article which I read in the "Street Railway Review," or rather an editorial, questioning the advisability of using the alternating current, and citing the case of the Boston Elevated. There, I think, the lowest cost of the direct current system [illegible] cent per kw. hour. We are able to beat that at our sub-stations thus far, so that I think that the Boston Elevated can probably beat its figure by going into the alternating current distribution."

Mr. H. H. Vreeland, of New York, spoke a few words on the importance of the younger men in the electric railway business keeping abreast of the times in view of the marked changes during the [illegible] in methods of generating and distributing power.

Mr. W. Caryl Ely, of Buffalo, spoke along the same line, and related the following incident illustrating the rapidity of advancement [illegible]:

"At Niagara Falls, when the plans were being matured for powerhouse No. 1 of the Niagara Falls Power Co., Mr. George Westinghouse, of Pittsburg, visited the Falls and talked with the people who were promoting that power enterprise, and suggested that it was a great mistake to think of distributing that power by means [illegible]. He suggested as the result of their experience that compressed air be considered for the purpose [illegible] years after [illegible] the first current was turned out of the powerhouse, and the 5,000-h. p. generators that turned out the alternating current were manufactured by the Westinghouse company."

In reply to a question by Mr. Ely, Mr. Vreeland stated that the distance between the sub-stations of the Metropolitan at 120th St. and 140th St. was something less than a mile. Mr. Ely then asked Mr. Vreeland if experience in New York City had demonstrated it to be more economical to maintain two sub-stations at distances of less than two miles apart than it would be to consolidate those two sub-stations into one, of course leaving out of the calculation the question of cost of real estate and other indirect considerations.

Mr. Vreeland replied that the two sub-stations mentioned were placed where they were for local reasons. There is a very heavy grade both ways on Amsterdam Ave. from 128th St. and very heavy service, the line being one of the heaviest on the system, and cars on holidays and Sundays are run on about 20-second intervals. A very long hill runs nearly two-thirds of the distance to the next power station. It is more economical to distribute from this point. Probably had the present company had the arrangement originally of the old distribution, there might have been some changes. When the Metropolitan company built the 96th St. station its operation was confined entirely to Manhattan Island and the lower sections. The Third Avenue Railroad, to which the Metropolitan succeeded, had its station and sub-stations under contract and partially constructed when the Metropolitan took the road, and it was more a question of getting them completed and in operation at as early a day as possible, as the Third Avenue road did not have sufficient power for its operation, so that less consideration was given to these points. But in direct answer to the question, it would have been done in that way, owing to the peculiar conditions.

Mr. McNamara, of Albany, called attention to the important point that Mr. Starrett in his paper advocated storage batteries in connection with sub-stations, while Mr. Roehl, of Brooklyn, stated that in new work the Brooklyn Rapid Transit Co. would not install batteries. The gentleman wanted to know why storage batteries would not be used in Brooklyn.

Mr. Roehl: "It would take a very large battery to smooth out the fluctuations in the load of an elevated railroad—an excessively large and excessively expensive storage battery. It will do it, as we know it does it in the Metropolitan; but we do not find it to be satisfactory with an elevated road."

Mr. Vreeland, in further explanation of the use of storage batteries in New York, said: "The chief thing that led us to consider the storage battery in connection with our sub-stations was the enormous loads that we carry, and a drop in our voltage slows down our speed. We have to keep up to the maximum on our speed to conform to any schedule at all. The loss in time on our schedule is a very serious matter with us, and causes a congestion of cars in many localities. We found that we must keep a voltage of 550 to meet that condition, and that was one reason why we went so largely into the storage battery question. And another reason was that our service is very heavy 18 hours a day on our principal lines. We have a peculiar condition in New York with the theater section and the club section. Take first the theaters from 23d St. to 46th St. on and adjacent to Broadway, with the new theaters; they have seating capacity for 68,000 people, and this crowd is thrown out on Broadway at night inside of 10 minutes. Taking this in connection with the club service our traffic is extremely heavy at such time, and in order to do the work we had to have the relief of a storage battery. We have in many of our stations, on some of the east side lines, carried our load on the battery from 1 o'clock to 4 o'clock in the morning, and shut down the power station completely to do necessary repair work, and this was another factor in favor of batteries. Those were the principal reasons; but, as I say, an important one and a very important one, was that the drop in voltage affected our service in the central lines and all of our more important heavy lines."

Mr. T. E. Mitten, of Buffalo, explained the use of storage batteries in Buffalo as follows: "We are rather dissimilar in conditions from almost any other system, in that we use a very large proportion of power generated at Niagara Falls. It is supplied to us 24 hours in the day 365 days in the year. We buy it by the total amount and as we have only about a 33 per cent load factor, we purchase 8,000 h. p. from the Falls; a portion of the time we only use perhaps 2,000 h. p. and have 6,000 for six hours out of the 24 going

to waste, except so much as we are able to utilize in the storage batteries. During the period when we are using in the neighborhood of 2000 h. p. for a length of time perhaps covering an hour and a half or two hours, we are able to take off seven or possibly eight thousand horse power. So that we are utilizing something which would otherwise go to waste. Then we find, too, that our storage battery eases up our machines and relieves them of the great strain of the fluctuating load. We have combined some of our sub-stations. One of our reasons for that is that by that means we are able to centralize our storage battery nearer the center of the load, which enables us to use it to much better advantage."

The next paper was "Maintenance of Electric Cars and Their Equipment," by Mr. H. A. Benedict, of the United Traction Co., of Albany, which was read by the author.

Maintenance of Electric Cars and Their Equipment.*

BY H. A. BENEDICT, MASTER MECHANIC, UNITED TRACTION CO., ALBANY.

The street railway company of to-day, operating in each of our large cities, is formed, in many cases, by the combination of a number of railway companies each operating over individual lines with their special type of car. In the operation of such a combination a number of problems present themselves:

(1) The adoption of standard types of car bodies.
(2) Standardization of trucks and electric equipment.
(3) Reconstruction of car houses and repair shops.
(4) Equipment of repair shops.
(5) Organization of maintenance department.

In the adoption of standard types of car bodies many local conditions are to be considered and only in a general way can certain characteristics be decided upon. If the car is for city service on short lines, requiring many stops with fast time, the 20-ft. box car mounted on single truck for winter service and the 10-bench open car mounted on single truck for summer service, have a number of points in their favor. If it is city service on lines of ten miles or more, the light double truck box car 28 to 30 ft. long for winter service and the 13-bench open car for summer service, present a number of points in favor of their adoption. For interurban service, the high speed double truck box car is the only type that may well be considered, although there is a tendency at the present time to enlarge upon this type of car and copy steam railways as to size, weight and general outline of car, giving the interurban car the appearance of the steam "Pullman" coach. If this type of car is to be adopted for use upon private right of way, the experience of steam roads should be given consideration.

If, however, the interurban car is to be operated not only upon private right of way but through city streets, it is the writer's opinion that the interurban car should not exceed 50 ft. in length and should in appearance resemble the city service car.

The standardization of trucks and electrical equipment is determined largely by local conditions and the type of car body. If for city service under a twenty-foot body the single truck with 7 ft. 6 in. or 8 in. wheel base with two 40-h. p. motors should give good service. If for city service on long lines, under 28 or 30-ft. car bodies, the double truck with 4 ft. 6 in. wheel base and four motor equipment will give satisfactory service. The trucks for interurban cars have been developed upon steam railroad principles and the standard adopted should follow closely those trucks developed by high speed steam roads.

Upon the adoption of a standard type of car and the rearrangement of the various lines to meet the conditions caused by consolidation and the demands of the public, it becomes necessary to rearrange buildings for the storage of such cars and arrange the proper facilities for inspection and repairs. The remodeled horse-car barn which has answered the purpose of storing cars since the introduction of electricity is no longer satisfactory.

In the erection of a car-house the following general points are considered:

(1) The fire risk.

*Abstract.

(2) Facilities for inspection, cleaning and making light repairs.
(3) Heating and lighting of car house.

The insurance companies have given the subject of fire risks on electric cars and car-houses considerable study and the Board of Underwriters have adopted standard rules for their protection in the construction of car-houses. The writer is of the opinion that improvements can be made in the construction of fireproof car-houses. It has been found that concrete is one of the best fireproof materials, and also a poor conductor of heat; it therefore becomes one of the best materials for the construction of car-houses. By the use of concrete, reinforced with steel bars for the roof and wall construction, and introducing a four-inch partition wall between each track, one practically has as many fireproof car-houses all contained in one building as there are tracks. For inspection, each track should have a pit between the rails, four feet deep, extending from rail to rail.

Repair Shop.

The general repair shop should be centrally located with reference to car-houses, where all general repairs can be done economically and quickly. The general repair shop of an electric road for both city and interurban service should consist of a paint shop, carpenter shop, machine shop, electric repair shop, blacksmith shop and truck shop.

Floor space, light and heat are the most important factors in the paint shop. The tracks should be so arranged as to give ready access to cars so that any car can be removed without the necessity of moving but one or two other cars. Light obtained by skylights in the roof gives satisfactory distribution of light. Steam is the most economical and satisfactory form of heat for the paint shop. The carpenter shop under the same roof as the paint shop, with the same general design as to trackage, light and heat has proven very satisfactory. The machine shop, electric repair shop, blacksmith shop and truck shop can be under the same roof and arranged to meet the local conditions. They should all be upon one floor and lighted by means of skylights as well as side windows.

Storehouse.

All supplies required in the operation of the railway system should be stored in a building located convenient to the repair shop and should be a building devoted entirely to the storage of supplies and separate from the other buildings.

The equipment of repair shops depends largely upon local conditions. The truck shop in general should be equipped with overhead traveling cranes which span at least two tracks. The floor level between the tracks should be depressed twelve inches and the floor between the rails of each track should be 4 feet 6 inches lower than the tread of the rail, with a light narrow gage track in the bottom of the pit so formed for the use of a hydraulic jack.

The electric repair shop should be equipped with forms for making armature and field coils, and arrangements made for their proper insulation; also armature banding machine with other labor-saving devices depending upon the type of electric equipment to be maintained.

The machine shop should be equipped with lathes, drill presses, a milling machine, a thirty-six inch boring machine, hydraulic wheel press, emery wheel and grindstone and such other special devices as the local conditions may demand. In the organization of a department of maintenance the personality of the organization should be of a high order.

Particular attention should be given to the inspection of cars. As much depends upon, not only the system of inspection, but the care with which cars are inspected. All cars should be thoroughly inspected at least once every twenty-four hours and records should be kept of such inspection, not only for the benefit of the master mechanic and foreman, but these records will be found valuable in damage suits. The great part of the inspection of cars must necessarily be done at night, but repair work at night should be avoided as much as possible. Night work is generally found to be expensive and unsatisfactory.

Well designed electric equipment having been installed to meet the local conditions, the wearing parts of such an equipment which need the most attention are the motor armature bearings, which being babbit lined, lubricated by either oil or grease (preferably oil), need close attention from the motor inspector. The quality of babbit required depends largely upon the conditions of operation.

Mr R E Danforth, of Rochester, pointed out that methods differ somewhat in the frequency with which cars are brought into the shop and overhauled. The practice in some cities is to overhaul cars according to the calendar, that is, every three to six months. In other cities it is according to the mileage made by the cars, the number of miles to be made by the car being determined by the equipment and the character of the service. The speaker was of the belief that the latter method is the more economical generally, as the old type of motors require careful overhauling after ten to fifteen thousand miles, while modern motors may possibly run twenty-five thousand miles. The practice followed in Rochester has been along the latter line. The cars are generally overhauled, trucks, motors, and bodies, on that basis, depending on the equipment, which brings the cars into the shop on an average of every four months. On the third visit of the cars to the shop the bodies are revarnished. In the daily inspection the work is only carried so far as is necessary to keep the car in good operating condition in respect to trucks, controllers, wheels, commutators, brushes, etc., including the inspection of the lubrication.

Mr. Benedict, in reply to a question concerning his experience with the use of oil for lubricating motors, stated that he has found bearings do not heat so rapidly with oil as with grease. On the larger and newer types of motors, where the design will permit of having packed boxes, the advantages of oil can not be questioned. For the use of oil it has become necessary to design a box which will go inside the grease box, and by means of some method feed the oil to the journal. The difficulty comes in regulating the flow of the oil.

Mr. Mitten spoke as follows: "I have made some study recently of the methods adopted by different railway companies in their care and maintenance of cars, and I have found in two of the larger cities quite a change being made. In fact, they are advocating doing away entirely with car storage or car housing, so known, and letting their cars stand out at night, and making their inspection at the ends of the line during the day instead of that inspection being done at night, as by many it is done now and was formerly done by us all. While at the first glance this seems to be a questionable proceeding, as I have looked into the work of the companies who either did their inspection at night or thought they did, I have found that because of car-houses originally built for horse-cars being used, in which the pit capacity was inadequate, the inspection was such that it did not recommend itself to me at all.

"The railways that I speak of placed their car inspectors in the morning at the ends of each line, and they inspected the cars as they passed. Usually they take the car to the end of the line and let it stand the interval between cars,—that is, the headway of five minutes or ten minutes, as the case may be. They would hold each car there for inspection as to trolley, controller and such matters as were supposed to require it, and let the crew take the following car; using the house capacity for the washing and general inspection of the cars, which they attempt to do, as I gather, about once a week.

"We had some experience last winter in attempting to house some of our cars out of doors, with not very good results, in that we found that the working parts would stiffen up and the grease would freeze and we would have rather bad work on our first two or three trips in the morning, particularly after heavy snow falls; and our car roofs would become covered with snow and the windows would be obscured. What I am trying to get at particularly is, however, whether we do get proper inspection at night; whether we do not in many cases run our cars until something breaks or the armature gets down on the poles, or something of that kind. It seemed to me that the daily inspection at the ends of the lines, unless the car-house facilities were of the best, could be done better than to attempt to do it in the car-house such as I have seen in many cities built for horse-cars. The cars are crowded in, and there are no facilities for getting under the cars. Now compare the inspection under those conditions with that at the end of the line, where the crew bringing the car into the end of the line can readily tell the repair crew of any particular trouble that they are having with the car. It seems to me that it is well worth consideration as to whether that is not a better method, considering our car-houses, than the one which is in general use."

Mr. [illegible], speaking on this subject, referred to the argument some time advanced in favor of "housing cars out of doors," that the steam roads keep their cars out doors, either all or a larger portion of the time. The distinction that suggested itself was that the electric car is not only a passenger coach, but it corresponds also to the locomotive of the steam railroad, and steam roads always provide storage for their locomotives. It would appear to be in the interest of economy to give electric cars the same care.

Mr. W. W. Cole, of Elmira, then spoke as follows:

"I have some figures that I have been collecting that may be of considerable interest on this point. Our man at the switch-board keeps a chart of the car operation each day which shows the coal consumption per kilowatt and also the temperature and the mileage. It is of considerable interest to know that the curve of coal consumption follows the temperature very much closer than it does the mileage. We had one car barn located near our power station and we heated the barn from our station. This arrangement was abandoned, and early in the winter the switch-board man began to complain that the cars starting out of his house for some reason used an excessive amount of power. Tests were made, and it was found that a car 38 ft. long, equipped with two 35-h. p. or two 50-h. p. motors would average a consumption of current of about 160 to 171 amperes, but the same car starting out of the car barn in the morning with the journals all freely lubricated would consume from 50 to 60 amperes; so that suburban cars starting from this place would use about three times as much current as they did ordinarily. I think when you look at the figures, and consider that running the cars represents only about seven and a half per cent of the original energy of the coal pile, while in using the coal to heat the barns directly you are getting practically all the energy out of it, that it is very much cheaper to heat the car barn and start the cars out warm in the winter months."

Mr. Benedict expressed himself in favor of building car houses with pits in all tracks, as this plan gives the men better opportunity to thoroughly inspect the under portions of the car. The tracks in the car house should also be laid farther apart than has been the general practice so as to enable the men to get around the cars easily and make proper inspection.

In reply to a question by Mr. Allen as to whether it was preferable to inspect cars on the mileage basis or on the time basis, Mr. Benedict said: "I prefer the time method—that is, not in months but in days. I believe that a car that goes out and runs for 18 hours should be thoroughly inspected. The car should be run in and should be inspected by the motor inspector; the controller should be inspected by the controller inspector; the same with the trolley, the circuit breaker, and, in fact, all of the working parts of the car should be thoroughly inspected before the car goes out the next day.

"In reference to bringing the cars in and overhauling them every four or five months, our experience has been with flat wheels that we have to bring the car in to change the wheels oftener than every four to five months. And when you have to change the wheels in a car that is the time to put the truck in perfect shape before it goes underneath the car again. It may be that a truck will go out to-day in perfect condition and come in to-night with flat wheels. When those wheels are taken out, if there is anything about that car which should be repaired it should be done then, so that you will know that the car is in perfect condition. I think it has been considered that a man who was getting 15 cents an hour (practically the compensation paid conductors and motormen) was competent to inspect cars. I believe that a man who is an inspector should be as well paid as any man in the maintenance department."

Mr. Rockwell, of Syracuse, did not think the mere taking out or examination of portions of the car was good inspection. Continuing the discussion, Mr. Rockwell said: "In operating a car there are two important things: One is to make the car go and the other is to be able to stop it. Therefore, the motor and the brakes are the vital parts of a car. There are very few other things in connection with a car that would seem to me likely to lead to the causing of an accident or hampering the road by stalling the cars in any way. I believe that the only way that you can operate a road that is carrying a great many people with frequent service,—that is, a minute or a minute and a half headway, where by the stalling of a car the whole line would be seriously hampered, is to so inspect the cars that there is no question when they go out of the barn that they will come back in proper condition, barring possible accidents or collisions. The only way to do that is to have a systematic way of inspecting your cars. In order to do that the motors have got to

is taken, clean the copper dust and the carbon dust, scrape out the commutators thoroughly examined and get put back in place. That should be done repeatedly, as done on the mileage basis; days, months, has nothing to do with it. It frequently depends on the service done, whether the car is in use or not. When I was running a certain road operating 88 cars on a minute headway, I established a system of inspecting a car every time it ran 3,000 miles. Now that mileage will be considered by many managers not sufficient perhaps. You may be able to go five, ten or twenty thousand miles, but in my estimation it is best to say from three to six. Every time a car made 3,000 miles I brought that car to the barn and had it entirely overhauled from A to Z, the same as if it had been in a smash-up, leaving nothing untouched. Understand that is in addition to the ordinary 24-hour inspection of controllers and such things as that. The 3,000-mile inspection refers more particularly to the motors and brakes. In that case the result was that we ran the road for over three years without having a car stalled on the line from any motor defect. I don't think you can do it in any other way than a systematic way of that kind. If you keep track of your mileage you know just what condition your car is in.

"One word I would like to say in regard to storing cars. I think the only excuse for not housing cars is that you haven't got the price—and that is inexcusable. My experience is that the extra cost of painting cars alone would pay the interest on four times the price of a car barn."

A member asked Mr. Rockwell what percentage of his cars were in the house for such overhauling as he described.

Mr. Rockwell replied: "It takes two men one day to a car. It depends entirely upon the cars in operation. Out of 88 cars we would average for daily use from 40 to 45 cars; sometimes we would, perhaps, ease up on that a little, and frequently we would have the whole 88 cars in service. We would have rush hours in the morning and at night and run out the entire car equipment for possibly two hours, and then after that it would drop down to about two-thirds. But it would take two men a day to properly inspect a car."

President Connette then announced the appointment of the Nominating Committee to nominate officers for next year. He named as members of this committee Mr. Vreeland, of New York; Mr. Ely, of Buffalo; Mr. Rogers, of Binghamton; Mr. Shannahan, of Gloversville, and Mr. Clarke, of Syracuse.

The convention then took a recess until 2 o'clock in the afternoon.

TUESDAY AFTERNOON SESSION

Immediately on reconvening, the convention proceeded to take up the report of the Standard Rules Committee. The report of this committee has been printed in pamphlet form and is available to all members. Mr. Mitten, chairman of the committee, read the report. In further explanation Mr. Mitten stated that the main point which the committee has tried to cover has been to so arrange the rules under the different headings as to permit of changes being made by a continued Rules Committee as it might find necessary. Under the old arrangement of the rules, where the numbers ran consecutively from one to the last number, and different headings were inserted, it was absolutely impossible to insert rules pertaining to any of those headings without disturbing the arrangement of the numbering. But with this wide scope given as between the numbering of the three sections there is abundance of room left for the addition of rules required by various systems without in any way interfering with those rules which have been made standard.

The report of the committee was adopted by unanimous vote.

A rising vote of thanks was tendered Mr. Barnes, of the New York Board of Railroad Commissioners, for the work he has done in assisting the Rules Committee in getting up a standard code of rules.

A vote of thanks was tendered the Rules Committee and the committee was continued for another year to give especial attention to the subject of rules for interurban roads.

The next order of business was the reading of a paper, "Freight and Express Business on Street Railroads," prepared by Mr. C. R. Van Etten, general freight agent of the Brooklyn Rapid Transit Co., which, in his absence, was read by the secretary.

The president stated that two other papers had been contributed on this subject, and these were read before discussion ensued. Mr. Clark, of Syracuse, read the paper on "The Question of Freight" prepared by Mr. L. W. Sewell, consulting engineer of the Oneonta, Cooperstown & Richfield Springs Railroad Co.

The next paper was "Methods of Handling Interurban Express Matter" by Mr. George Dunford, general express agent of the Utica & Mohawk Valley Railway Co., read by the author.

Mr. Sanderson, of New York, opened the discussion and gave a long review of the experience in handling express matter on the Metropolitan system in New York. Mr. Beebe, of Syracuse, spoke on the legal aspect of the express question and pointed out the necessity for protecting the interests of the members of the association in this respect.

Mr. Robinson, of New York, pointed out the necessity for preparing more carefully the language used on express receipts, bills of lading, etc., in order to afford better legal protection in case of loss of goods by fire or other causes. It was not until after some actions went to the Court of Appeals that attention was given to the construction of those papers. The Court of Appeals has enunciated the doctrine that a man may contract against his own negligence, but if he attempts to make such a contract he must specify the cause which he intends to guard against, and that any loose forms of expression will not protect him in cases where negligence has been proved. The United States courts, on the other hand, say that, although a man may make such a contract, it is against public policy and it will not be enforced. The large express companies shipping to other states have, therefore, left out the limitations in their bills of lading as a rule, omitting any stipulation against negligence. The question as it involves the street railroad companies of this state is not affected by the doctrine of the United States Supreme Court, but it would seem that the decision of the Court of Appeals should be carefully regarded in the preparation of these receipts.

After some further remarks by Mr. McNamara and others in reference to the legal side of the express business, the meeting took up the report of the Committee on High Tension Tests. The report was read by Mr. Storrer, the chairman.

The report was adopted.

President Connette announced that immediately upon the adjournment of the session special cars would be in waiting to convey those who desired to see the tests made to the Frankfort sub-station of the Utica & Mohawk Valley Railway Co. A large party afterward took advantage of this opportunity and witnessed the methods used by the committee for making the tests.

The convention then adjourned until Wednesday morning. Immediately after adjournment those in attendance at the convention were photographed in a group in front of Masonic Temple.

WEDNESDAY MORNING SESSION.

The convention assembled promptly, with President Connette in the chair.

The secretary, in the absence of the author, read the paper, "Block Signalling of Electric Railway with Track Circuit Control," prepared by Mr. J. B. Struble, of the Union Switch & Signal Co.

Block Signaling of Electric Railway with Track Circuit Control.

BY J. B. STRUBLE, THE UNION SWITCH & SIGNAL CO.

The system of protecting railway traffic by means of signals automatically controlled by track circuits has been in operation on steam roads a number of years, but only recently has the demand been felt for a like means for protecting electric traffic.

As applied on steam roads, the track circuit consists in insulating the tracks so as to form sections or blocks. Across the rails at one end of the section are connected the terminals of a few cells of gravity battery, and across the rails at the other end are connected the terminals of the relay.

A track circuit so equipped is not applicable to a road using direct current electric propulsion, provided the rails serve as return conductors for the motor current, because of the influence which the return current would have upon the track relay, which in turn controls the circuit governing the position of the signal. To overcome this difficulty it is necessary to employ a current for the track circuit which has such characteristic difference from that of direct current

as will operate selectively upon the track relay. Alternating current accomplishes this because of its ability to induce a current in another circuit brought within its magnetic field, a property not possessed by direct current.

The track relay is, therefore, of the induction type and responds to alternating current and not to direct current. An excess of direct current cannot cause a wrong operation of the signal other than to cause it to indicate danger, for if a fuse or other protective device fails to open the circuit, the relay coils would be destroyed, resulting in the signal indicating danger. With this relay there is no such thing as residual magnetism; in this respect differing from the direct current relay.

Two main feed wires bearing alternating current at, say, 60 cycles and 2,000 volts, extend the length of the system, and across these are connected the primaries of the track circuit transformers, the secondary leads of which are connected through low ohmic resistance, across the rails at the exit end of each track circuit. Across the rails at the entering end are connected the terminals of the induction relay. We now have a circuit consisting of the secondary of the transformer, the rails and the coils of the track relay.

Through the track rails of this circuit passes simultaneously two kinds of current, alternating, induced by the primary of the transformer, and direct, the return from the car motors.

Since direct current tends to make ineffective the alternating current, an impedance coil is connected across the relay terminals, or the track rails; this has low ohmic resistance, but high inductive resistance or impedance to the passage of alternating current, and serves to shunt the direct current from, while compelling the alternating current to pass through, the relay.

In one arrangement of the track circuit it is necessary to insert insulations in but one of the rails at the end of each section, the other rail remaining continuous and serving as a return conductor of the motor current.

Another arrangement is that of continuing the use of both rails in their original capacity, while at the same time serving the purpose of block rails for the operation of signals. This is done by applying insulations in one or both rails at the terminals of block sections and connecting around these insulations by inductive bonds. These bonds are simply impedance coils of very low ohmic resistance, permitting the return direct current to pass through them but impending the passage of alternating current.

The track circuit, whether operated by direct or alternating current, and whether applied to steam or electric roads, has no relation to the type of signal which it governs. Signals are of many designs and are actuated manually or by power in a number of different forms, but the functional relation of the track circuit to all of them is the same, i. e., the signal is caused to indicate danger as long as the track section which it governs is occupied by a pair of wheels. There are, however, usually certain conditions associated with track circuits which make signals of a certain type preferable.

Thus the alternating current track circuit, which applies almost exclusively to electric roads, is associated with electric power which is at all points available for the operation of purely electric signals. Such signals are of various types, but the simplest in form is that of the direct acting solenoid. This preferably uses for its operation the direct current of the propulsion system. Another form is that of the motor geared, using storage batteries which are charged through resistance from the trolley or third rail.

Should trains other than electric traverse the system at times when the power is shut down, these batteries serve to keep the signals alive and operative. Then again a signal driven by induction motor, drawing power from the alternating mains which supply the track circuits, has advantages, one of which is that of making the signal system self-contained and independent of other departments of the road.

The important matter of lighting the signals at night is a valuable incidental feature to the alternating current track system. For this purpose the track transformers are supplied with two secondary coils, thus securing any desired voltage for the lights.

Way stations may be lighted from the signal mains, thus securing the advantage of high voltage transmission. Usually the size of the mains need not be increased because of the additional duty, [illegible] wire of sufficient mechanical strength has a larger section than that required for supplying current to the signal system.

The first signal installation in service, using alternating current, is that on the North Shore Railroad in California. This was installed by the Union Switch & Signal Company about one year ago, and has given the best of satisfaction. The same company is now installing a similar and very extensive system in the subway of the Interborough Rapid Transit Company in New York City.

In developing this system great care has been used to exclude any apparatus or feature of design, the failure of which might result in a clear signal indication.

This is not a new principle in signaling apparatus, but it is of such vital importance, and is, moreover, so frequently lost sight of, that it will bear repetition.

Any failure of the apparatus or of the active forces employed, must result, due to the force of gravity, in the display of a danger signal.

Mr. Barnes, of the New York Board of Railroad Commissioners, was asked to open the discussion. He emphasied the fact that whatever he might say on this subject was said strictly as expressing his own individual ideas and not in his capacity as representative of the Railroad Commission. He then went on to say, in part:

"The question of controlling the movement of trains is one of vital importance not only to the electric railroads of this country, but to the steam railroads. The system of handling train orders in use at the present time is one which has resulted from the best efforts of the most practical steam railroad men of this country. That it has its defects no one will dispute. Before coming to this convention I investigated an accident on a steam railroad where two trains came together head-on. In the pocket of the dead engineer of one of the trains the order was found, the disobedience of which resulted in the collision. To my mind that man was guilty of no greater breach of memory than the man who at night brings home the letter which his wife gave him in the morning to mail. The results were more serious, on account of the responsibilities which a certain method of handling trains placed on him. If the train dispatching system is itself defective, where are we to look for more perfect control of the movement of trains? Only to some means of block signals. I will, for one, undertake at some future time to prepare a paper on this subject."

There being no further discussion, the chair announced that Mr. W. B. Potter, of the General Electric Co., would address the convention on the subject of the new a. c.-d. c. motor. Mr. Potter spoke at length on the different features of the new motor chiefly in the line covered by the published descriptions of the motor and its methods of application.

The president then announced that, owing to the lack of time, only one of the three remaining contributed papers would be read and discussed. One of the latter was entitled "The Minimum Population Necessary to Make Interurban Roads Pay." This was chiefly a statistical paper prepared by Mr. H. M. Beardsley, auditor of the Elmira Water, Light and Railroad Co., who has been collecting valuable data for a year or more from roads all the way from San Francisco to New York from which to compile this table. Another paper was "The Relation of the Technical School to the Business and Profession of Electric Railways" by Professor Norris, of Cornell University.

The next and last paper was then taken up. This was "Relative Economy in the Operation of Long and Short Cars" by Mr. W. J. Davis, jr., of the General Electric Co.

Relative Economy in the Operation of Long and Short Cars.

BY W. J. DAVIS, JR.

In cities of the first and second classes the headway between cars on the principal lines is as short as safe operation will permit, and on many of the less important lines is such that no stimulation in travel will result from further decrease. In such cases it is obviously necessary in order to handle the traffic to use long, heavy cars having the greatest seating capacity allowed by clearance diagrams and other local conditions. Not only are the gross receipts increased thereby, but the expense of operation is materially less on account of the reduced cost of transportation wages per passenger carried.

In cities of the third class, however, the question becomes more complicated and difficult of solution. In the first place the frequency of service must be regulated with reference to securing maximum patronage; secondly, the size of the car best suited to the average travel must be determined, consideration being given to the interest cost of equipment and to gross operating expenses. Finally the above items must be balanced one against the other in order to make the most economical selection of equipment and schedule.

This paper will be limited in scope to a discussion of power consumption of cars of various sizes and weights, and relative cost of operation as applying to cities of 30,000 to 50,000 inhabitants.

Power Consumption.

It is assumed that the cars will operate at schedule speed of 8.5 m. p. h., making 6 to 10 stops per mile and giving maximum speed of about 22 m. p. h. on tangent level track. We will consider four sizes of car, having seats for 22, 30, 40 and 48 passengers respectively. The following data will apply:

DESCRIPTION				
Type	Closed	Closed	Closed	Closed
Truck	Single	Max track	Max track	Double
Length of body (feet)	16	22	28	35
Length over all (feet)	22	30	37	45
Seating capacity	22	30	40	48
WEIGHTS				
Car body (pounds)	6,000	8,400	11,700	18,000
Trucks (pounds)	4,500	6,700	6,700	12,400
Equipment (pounds)	4,600	5,200	6,200	7,100
Passengers (pounds)	3,000	4,000	5,400	6,500
Total	18,100	24,300	30,000	44,000
Tons taken	9	12	15	22
EQUIPMENT				
Number of motors	2	2	2	2
Horse power, each	25	35	40	60
COST				
Car equipped complete	$2,550	$3,120	$3,640	$5,050
POWER.				
Watt hrs. per ton mile	140	140	140	140
Kw. hrs. per car mile	1.26	1.68	2.10	3.08
Av. kw. at power house	10.70	14.3	17.9	26.2
Max. kw. at starting	57	70	86	125

Attention is directed to the estimate of energy consumption as shown above. The values given are based on wattmeter tests and indicate the average energy throughout the day as recorded at the power station switchboard,—modern equipment, good bonding, adequate feeder system and capable handling of the car being assumed. Observation has shown that energy demanded by cars of equal weight varies largely in different localities, in some instances running as low as 110 watt hours per ton mile, and in others reaching as high as 180 and even 200 watt hours per ton mile. This wide variation is due largely to local conditions, such as obstruction of the tracks by teams, necessitating frequent slow downs and considerable running on resistance, a gear reduction giving a maximum speed too high in proportion to the average frequency of stops, or careless and inefficient handling of the controller by the motorman. The latter item is of more importance than it is ordinarily credited with, as trials with recording wattmeters placed upon the cars have shown a possible saving of 15 to 20 per cent due to motorman giving closer attention to track and car conditions having an influence on power consumption. The value of 140 watt hours per ton mile as given above is being regularly obtained in actual service in many places, but does not include power demanded by the heating and lighting circuits. The average energy at the power house is seen to vary from 10.7 kw. for a 16-ft. car to 3.08 kw. for a 35-ft. car. Assuming rate of acceleration of 1.5 to 1.75 m. p. h. per second, power at starting will vary from 57 kw. for the 16-ft. car to 125 kw. for the 35-ft. car.

Cost of Operation.

For purpose of illustration, the writer has assumed operating conditions such as would normally exist in a city of about 40,000 inhabitants. The average mileage per car per day has been taken at 112, average car mileage per day 3,650, cost of power, exclusive of fixed charges, one cent per kw.-h., and total wages of motorman and conductor 42 cents per hour.

In making a general comparison between long and short cars two cases must be considered, one based on constant seat mileage and the other on constant car mileage per day.

Case I.

Number of cars in service and headway between them adjusted to give constant seat mileage per day.

Size of car (length of body, feet)	16	22	28	35
No. of seat miles per day	80,300	80,300	80,300	80,300
No. of car miles per day	3,650	2,670	2,010	1,670
No. of cars in service	33	24	18	15
Kw. hours per day	4,600	4,220	3,780	4,400
COST PER CAR MILE IN CENTS				
Power house expenses	1.26	1.68	2.10	3.08
Transportation wages	4.94	4.94	4.94	4.94
Maintenance, car bodies and trucks	.64	.91	.93	1.06
Maintenance, electrical equipment	.45	.54	.60	.65
Maintenance, road bed	.36	.49	.65	.79
Maintenance, overhead lines	.24	.24	.24	.24
Salaries and general expenses	1.30	1.73	2.23	2.84
Legal expenses	.40	.55	.73	.87
Total per car mile	9.59	11.08	12.42	14.47
Total per seat mile	.44	.37	.31	.30

Case II.

Number of cars in service and headway between them constant for all sizes of cars:

Size of car (length of body)	16 ft.	22 ft.	28 ft.	35 ft.
No. of seat miles per day	80,300	109,500	146,000	175,200
No. of car miles per day	3,650	3,650	3,650	3,650
No. of cars in service	33	33	33	33
Kw. hours per day	4,600	5,770	6,800	9,640
COST PER MILE IN CENTS				
Power house expenses	1.26	1.68	2.10	3.08
Transportation wages	4.94	4.94	4.94	4.94
Maintenance, car bodies and trucks	.64	.91	.93	1.06
Maintenance, electrical equipment	.45	.54	.60	.65
Maintenance, road bed	.36	.36	.36	.36
Maintenance, overhead lines	.24	.24	.24	.24
Salaries and general expenses	1.30	1.42	1.56	1.87
Legal expenses	.40	.40	.40	.40
Total per car mile	9.59	10.49	11.13	12.60
Total per seat mile	.44	.35	.28	.26

From the above tabulated data it appears that while the cost of operation per car mile increases directly with the size of car, the cost per seat mile decreases. Also that both of these items are diminished up to a certain point by increase in the number of cars operated.

In cities of the third class, the normal headway between cars will vary from five minutes on the trunk lines to fifteen minutes on the suburban lines. This frequency cannot be diminished without danger of reduction in traffic as the average able bodied citizen will walk a mile rather than wait twenty minutes or half an hour for a car to carry him that distance. Generally speaking, a 16-ft. or 18-ft. car will be found large enough to handle the average travel, extra cars being put on during morning and evening rush hours. There may be cases, however, where the use of a 22-ft. or even a 28-ft. car for normal service would be justified by the necessity of moving a large number of passengers during hours of opening and closing of business. Such a case would occur where the business section lies at one end of the city and the residence section at the other end. As an example, assume that normal service on a given line requires four 16-ft. cars operating on 15-minute headway, and that for two hours in the morning and two hours at night 5-minute service is necessary, calling for 12 cars. Equal carrying capacity during rush hours may be secured with six 28-ft. cars. Assuming maintenance of permanent way and general expense charges to be unchanged, the following comparison may be made:

	10-ft. car.	28-ft. car.
Number of cars	12	6
Car miles per day	884	680
Cost power, transportation wages, and maintenance of equipment per car mile	$ .0720	$ .0857
Cost power, etc., per day	$ 64.04	$ 58.28
Initial cost of cars	$ 30,000	$ 21,840
Average kw. at power house	128.4	107.4

It will be seen that there is a saving in operation for this particular line of $6.36 per day, or $2,300 per annum, a reduction in initial cost of rolling stock of about 30 per cent and a reduction in power of 15 per cent. Another point of importance not shown by the tables is that the number of extra crews is reduced, thus simplifying arrangement of runs and introducing other small economies in general expense.

It may be broadly stated that when double service is required on any line for at least three hours per day, the use of long cars is preferable. The operating cost will just about equal that of small cars having equal aggregate carrying capacity, the gain consisting in considerable decrease in cost of equipment and appreciable reduction in average power consumed.

Another condition favorable to the use of long cars exists on those roads catering especially to holiday and pleasure travel during the summer months. An investment in 15-bench and 18-bench open cars will obviously yield larger net income than an equal investment in seven and nine-bench cars, although frequently a combination equipment will be found economical, small single truck cars with two motors being employed for normal daily service and large double truck cars mounting four similar motors held as reserve for special service. The motors will thus be all alike and interchangeable from one style of equipment to the other.

Mr. Cole opened the discussion as follows:

"I think that in cities of the second and third class there are two points that will bear very close investigation. One is the load factor at the power station, and the other is the interest on an idle investment in extra cars, which in cities of the third class runs up to a considerable amount. A city of the third class will ordinarily operate from 22 to 28 regular cars and from ten to twelve of what may be called regular extra ones, and on holidays and days of celebration they will operate from 60 to 80 cars, if they have them. That necessarily means that in the power station operation they are operating the installation either overloaded or underloaded a good portion of the time. There are several points which have got to be filled up in the valleys between the peaks of load. Another thing is the increasing tendency to put on very heavy cars in cities of the third class, even on the shorter lines. I believe this is wrong, and that a car 20 or 22 ft. long is amply large for operation on most lines with the exception of suburban lines, for the reason that a car 20 ft. long will consume but a small percentage of the power consumed by a 36-ft. to 38-ft. car in ordinary operation, and the repairs on a double-truck car are about 75 per cent more than on a single-truck car, so that approximately you can operate two 20-ft. cars on a 10-minute schedule as against one double-truck car or a 38-ft. car on a 15-minute schedule, and the expense of operation is almost the same. In operating your two 20-ft. cars you are getting a more frequent schedule, giving the people a more constant service and increasing your riding, instead of putting on the large, heavy cars, of which they claim they are increasing the weight so as to take care of collisions. I think if that is the case they better design some sort of a pneumatic platform to take care of the collisions and keep the weight of the cars down, because with three or four tons of increased weight your current consumption and cost of operation is running up very high.

"The question of running one or two trailers is coming to the front. Most of us now are putting in loops at the ends of our lines, so that in operating a three-car train it is done without the old delay and obstruction of having to shift the cars at the end of [illegible]. Take a double car with 60 seats weighing 11.75 tons and equipped with [illegible] motors, the consumption would be 12,040 [illegible] a single-truck car weighing eight tons, and it would [illegible] watts, so that the same car, taking two trailers, will only take 12,680 watts, as against 12,040 watts with the double-truck car, and yet you will have a seating capacity of 63 as against 38 in the eight-wheel car. Then you have this condition that, instead of having an expensive car of the double-truck variety, costing about $5,200, you have two trailers which, if you buy them second-hand, you can get very good ones nowadays for about $250.

"In a city of the third class your regular extra cars will average about four hours a day, but you are paying your interest for 24 hours each day. I don't think that an eight wheel car in a city operating suburban lines should be equipped with more than two motors of 35 h. p. to 50 h. p. capacity. With a four-motor car, should one be used on the regular suburban lines where you are operating 18 to 20 miles on a high-speed basis, the question of a heavier car might be taken up, because it is necessary for the interurban lines to put the weight into the car on account of high speed. Taking the double-truck car, having a seating capacity of 36, in comparison with a trailer, the average watt hours per mile with the double-truck car are 1,334; on the single-truck car with trailer there are 1,440. The average speed per mile is 9.3 in both cases. The average watts per seating capacity in the double-truck car is 335 as against 201 on the single-truck car. The average watts per ton, empty, is 1,025 with a double-truck car and 1,208 with a single-truck car with trailers."

Mr. Lewis: "I want to ask Mr. Cole his reason for stating that he does not believe in four-motor equipments on city cars. Does he wish to make that unqualified statement, or is not that very possibly very much modified by local conditions?"

Mr. Cole: "Of course, conditions alter cases; but in general operation I make that statement, because you have this condition; that with a road operating 24 to 25 cars your installation at the power house is generally either underloaded or overloaded, so that you are increasing your peaks all the time, and your attention should be directed to getting a better load factor at your station than you get in the ordinary city of the third class. That is one of the principal reasons why the cost of power is so much larger in a small city than in a large city where they can give better attention to the load factor and fill up the valley between the peaks of load."

The reading and discussion of the Question Box was next in order. In the absence of Mr. Probasco, the editor of the Question Box, the discussion was conducted by the secretary.

Most of the discussion brought out by the Question Box centered in the subject of Block Signals.

Mr. Barnes, again emphasizing the fact that anything he might say must not be considered as coming from him in his official capacity, said: "I don't want to take up the time of the convention, but I take it that the passing of these questions by this convention gives a semi-endorsement to them, or, rather, while not a direct endorsement, that it carries some weight. Without detaining the convention too long, I wish to mention the fact that in the answers to question No. 32 I find an argument in favor of manual signals, or signals operated by hand. I simply wish to say that they are subject, perhaps, to some of the same objections as automatic signals. For instance, in this city, before the present efficient management of this railroad company, I had occasion to investigate three accidents resulting fatally caused by the use of manual block signals.

"In answer to question No. 33 I wish to say that more than one car never should under any circumstances be allowed in a block. The block system should be arranged to accommodate the travel, not the travel to accommodate the block signals. And I want to add to my previous remarks on the block signal system that, while I suggested that the future safety of operation pointed in the direction of block signals, I do not wish to be understood as referring to the present block signals. I make the statement that with the present block signals a collision can occur despite their use, and that applies to block signals on steam as well as on electric roads."

Mr. Lewis: "Does Mr. Barnes say he does not approve of allowing more than one car to pass in the same direction in the same block?"

Mr. Barnes: "I certainly do not. My idea is that a block signal should be absolutely safe. With the permissive block signal system as used on steam railroads collisions do occur which should not occur."

Mr. Lewis: "It seems to me that in the operation of city cars it becomes absolutely necessary to allow the passage of more than one car in a block in the same direction. The Schenectady Railway Co.

has been experimenting for the last two years with nearly every type of signals which attempt to serve the purpose stated in the question and with quite indifferent success. We are still experimenting. We hope to discover some form of apparatus that will solve the question, but so far have not found the apparatus, and it seems very probable that we will have to fall back on hand signals."

Mr. Hart, of Fall River: "Mr. President, may I say a word in regard to block signals? I had considered the block signal as the only real hope that we ever had in regard to coming anywhere near a signal that would be operative. It would seem to me that as the ray of hope that we had for some device to utilize the track circuit is blasted by the paper read this morning, and, no one being here to suggest any other way to do it, we must drop back on the handling of the roads to about the same system as steam roads have been using since 1895 under the new standard code. We know that the number of accidents has been reduced about 50 per cent from what it was previously. Of course, we cannot prevent the men violating their train orders, and they do violate them at all times. I think that in a paper read last year before this Association it was said that the control of any car or of any crew should be from the central office, allowing one man to do the thinking for the entire road and taking the control of the road out of the hands of the crews. I think that would be a step in the right direction. I will say that on a street railroad running 25 miles out from New Bedford for four years there has been in operation a system of telephonic intercommunication, operated under a set of rules prepared for that purpose, and in that time we have never had two cars meet on a piece of single track. They run that line of 25 miles on a half-hour schedule, and sometimes two express cars and two or three work trains are being operated. If there is a new meeting point to be made, the operator sets the two signals, gives the order to the two crews and allows them to go to the new meeting point. The orders are entirely verbal. The order is given to the four men; the conductors take it first, the O. K. being given by the dispatcher, and the motormen answering. The two crews receive the order in exactly the same words. If an order reads "Smith and Jones will meet at a certain turnout" it is repeated by the four men in exactly the same language, not reversing the wording. The system is almost identical with that of the standard code adopted in 1895 for the use of steam roads, and no deviation is made from that."

Mr. Barnes: "The suggestions made by the last speaker in reference to the method of operation of a road in the East does not cover the trouble by any means. Collisions on electric roads, and not only on electric roads, but on steam roads also, are not due to defects or mistakes in giving the train orders to the train crews nor to the illegibility of the orders. Orders are plainly written and delivered, and accidents result after they have been so delivered to the train crews.

"I am not prepared to offer a solution of this problem, but simply bring it up as one which should receive the most careful consideration of everybody interested, and every railroad man is interested, because it is a problem that is confronting not only electric road managers, but steam road managers. They cannot claim that their system is perfect with their record, nor can we by any means with our record claim that ours is perfect.

"This is my last appearance on this subject, so you will excuse me for taking up a minute more of time. I do not agree with some of the speakers that a block signal as an auxiliary is a good thing. A defective block signal system I consider an added element of danger in the operation of a railroad instead of affording additional safety in operation."

The next order of business was the report of the Nominating Committee, which was as follows:

For President, C. L. Allen, of Utica.

For Vice-President, J. H. Pardee, of Canandaigua.

For Second Vice-President, A. B. Colvin, of Glens Falls.

Executive Committee: E. G. Connette, Syracuse; R. E. Danforth, Rochester; B. B. Nostrand, jr., Peekskill; E. F. Peck, Schenectady.

Secretary and Treasurer, W. W. Cole, of Elmira.

The report was unanimously adopted and the Secretary was instructed to cast the ballot in favor of the candidates named.

Mr. Allen brought up the question of selecting a hotel resort as the next place of meeting. Mr. Colvin extended a cordial invitation to the association to meet at Fort William Henry, on Lake George. A delegate suggested that it would be better to set the date of meeting earlier if some summer resort was to be selected. After further discussion on the best time and place it was decided to leave the selection of the place to the executive committee, and to change the by-laws so as to permit the executive committee to set the date.

On motion a vote of thanks was extended to Mr. C. Loomis Allen, of Utica, for the great courtesy and consideration that he had shown the Association in his entertainment of its members through the entire convention.

On motion a vote of thanks was extended to President E. G. Connette, of Syracuse, for his efficient and courteous discharge of his duties and careful attention to the affairs of the Association during the past year.

On motion, duly seconded, the convention adjourned sine die.

Entertainment.

As usual at New York State Conventions, the delegates and supplymen began to arrive on the afternoon and evening preceding the opening session, and by Monday evening a large advance guard was in evidence about the hotel córridors of Utica. The privileges of the Fort Schuyler Club were extended to all street railway men and guests, and Monday evening was spent pleasantly at the club and in the hotel corridors, everyone taking advantage of these opportunities for renewing old acquaintances and in talking over matters of general interest to the street railway and supplymen.

On Monday, while the convention sessions were being held, the visiting ladies were royally entertained by the Local Ladies' Entertainment Committee. At 10:30 in the morning special cars, furnished through the courtesy of the Utica & Mohawk Valley Railway Co., were boarded and a ride to Clinton enjoyed. Here carriages were in waiting for a drive to the summit of College Hill and about the campus of Hamilton College. Returning to the cars, the body proceeded directly to the Yahnundasis Golf Club on Genesee St., where at 1:30 p. m. luncheon was served. At 3:30 cars called for the party at the golf club, and a trip was taken over the line to Little Falls and return.

The annual banquet was served on Monday evening at the Masonic Temple, and in the work of the caterer, the achievements of the florist, the efforts of the orchestra, and the ability of the speakers, the banquet proved a record-breaking success.

On Wednesday morning the ladies were taken in cars to Willowvale, and thence to the club house on the Sadaquada golf grounds, where luncheon was served.

Immediately after luncheon the convention adjourned to witness a test of the new alternating-direct current electric system mentioned elsewhere in this issue. The car, equipped with the new motors, had been brought up from Schenectady over the New York Central railroad, and the test run was made to Oriskany and Rome. In addition to the attendants at the convention there were present at this test a number of New York Central officials, together with Mr. Andrews and Mr. Stanley of Cleveland, and other gentlemen prominent in the field. After the test the party returned to Summit Park where a private car, carrying the ladies, met them, and all then enjoyed an excellent clam bake, after which the party enjoyed dancing for a while. The arrangements had been well made, and Mr. Allen, together with Mr. Baker, manager of the park, received many compliments upon the excellent way in which the entertainment had been carried out.

Exhibit From Accountants' Association.

Through the courtesy of Mr. W. B. Brockway, secretary of the Street Railway Accountants' Association of America, there was placed at the disposal of the attendants at the New York State meeting at Utica a complete file of the proceedings and papers of the Accountants' Association. The books while in Utica were in charge of Mr. Arthur L. Linn, jr., assistant secretary and treasurer of the Utica & Mohawk Valley Railway Co.

The downtown terminal of the Metropolitan Elevated, of Chicago, will be opened for traffic October 1st.

The General Electric Alternating Current Railway System.

[illegible] exhibition of the new alternating current railway system of the General Electric Co. was given on August 18th in the presence of a large party of prominent electrical engineers and representatives of the technical press. The exhibition took place on the newly completed line of the Schenectady Railway Co. from Schenectady to Ballston Spa, the operation of the system being a complete success and the occasion being a most pleasant and enjoyable one. The visiting party from New York were taken on a special parlor car as guests of the General Electric Co. and at Schenectady the party was augmented by a number of street railway men from New York state and several representatives of the western technical press. The party was entertained at luncheon served in the rooms of the Schenectady Railway Employes Benefit Association, after which the official trip to Ballston Spa was made.

The alternating current system which has been devised by the General Electric Co. consists briefly of series wound motors of the compensated type which are operated by means of a series parallel controller. One of the most valuable features of this system and one which, we believe, will appeal strongly to railway managers, is the fact that the motors and system of control are designed to operate with equal facility upon both alternating currents and upon the ordinary 600-volt direct current. This arrangement makes it possible to operate cars over existing city tracks without in any way sacrificing their running qualities upon the interurban sections equipped with alternating current. The Ballston extension of the Schenectady Ry. is 15½ miles long including 3.9 miles in the city of Schenectady, the latter being equipped for direct current. The interurban section is double track on private right of way, laid with 75-lb. T-rails and has a maximum grade of 1.8 per cent. The sharp[illegible] 4 [illegible]. Center pole and bracket construction is used for supporting the direct current trolley wires and a cross arm supports the 2,200-volt alternating current trolley wires. The direct current overhead system is of conventional design, while the alternating cur[illegible] supported from a [illegible] steel catenary. The alternating trolley is clipped to the catenary midway between poles and the catenary [illegible] on porcelain insulators on wooden cross-arms. This provides excellent insulation with standard porcelain insulators and eliminates span wires adjacent to the trolley wire. This construction is well adapted to high potential high speed work, [illegible]

With the alternating current system using a trolley and track return there is an inductive drop in the trolley and rails with an additional loss in the latter due to eddy currents and hysteresis. Measurements made upon the Ballston line indicate an apparent trolley resistance of 1.3 times the ohmic resistance and a rail resistance of 6.55 times the ohmic resistance. The resistance of the alternating current trolley wire is somewhat reduced by the steel catenary in parallel with it. This increased resistance with alternating current would be a serious factor in low voltage city systems, but since the compensated motor operates efficiently on direct current city systems no necessity exists for a low voltage alternating trolley line.

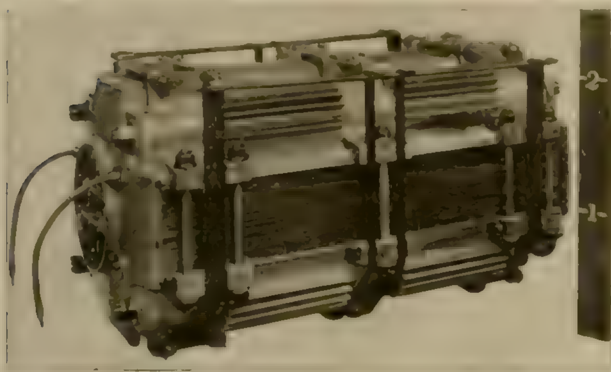
The form of overhead construction adopted for the Ballston line is well adapted to the requirements of steam roads where the local service is operated electrically and through passenger and freight service handled by steam locomotives. The trolley wire and insulators being off center are not exposed to the gases of the locomotive exhaust and this construction can therefore be hung much lower than a standard center wire without interfering with brakemen on freight cars. A low running trolley at the side of the car is also preferable in mine line operation as it conforms better to the clearances of railroads without calling for a great change in the height of the trolley wheel. The sub-stations on the Ballston line feed directly into the trolley circuit at 2,200 volts.

As 25-cycle, 3-phase generators are almost universally used for interurban railway systems, the General Electric Co. has adapted the compensated motor and the alternating current distributing system to operate from existing 25-cycle generating stations. As the alternating current motor is single phase a single phase generating and distributing system is preferable on account of its simplicity. The step-down transformers may be tied together on the low tension side through the trolley with consequent reduction in the amount of copper required. Each sub-station acts as a reserve to the adjacent one and a transformer may be cut out without shutting down a section of the trolley. When it is desired to make use of the three-phase generator to take care of rotary converters, induction motors, etc., the preferred arrangement to balance the load at each sub-station is to install three-phase, two-phase transformers connected two-phase on the secondary side and feeding separate trolley sections from the two phases.

GENERAL ELECTRIC ALTERNATING CURRENT MOTOR CAR

The car shown in the accompanying illustration is equipped with compensated motors and weighs 30½ tons without passengers. The body is mounted upon Brill No. 27 trucks with ... wheels, each truck carrying two motors. Each of the motors is equivalent to a 50 h. p. direct current motor according to standard railway rating.

The compensated motor consists of an annular laminated iron field with a distributed winding similar to that of an induction motor. The armature is provided with a commutator of the same type of mechanical construction found on direct current railway motor armatures. The motors are wound for 200 volts and are permanently connected two in series. They are fed from a 400-volt secondary of an 80 kw. air blast step-down transformer carried on the

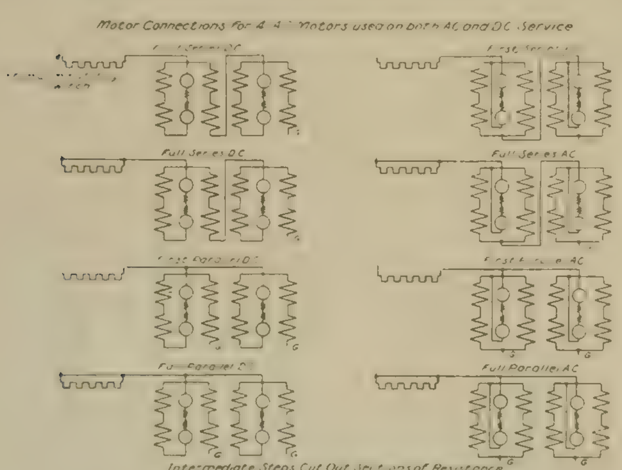


G. E. STEP-DOWN TRANSFORMER FOR CAR.

cars. The distributed field winding is designed to fully compensate for the armature reaction so that the power factors are relatively high throughout the range of operation. The motor is designed so that at the free running speed of the car, which is the speed most generally used in suburban work, the power factor and efficiency are nearly at their maximum values.

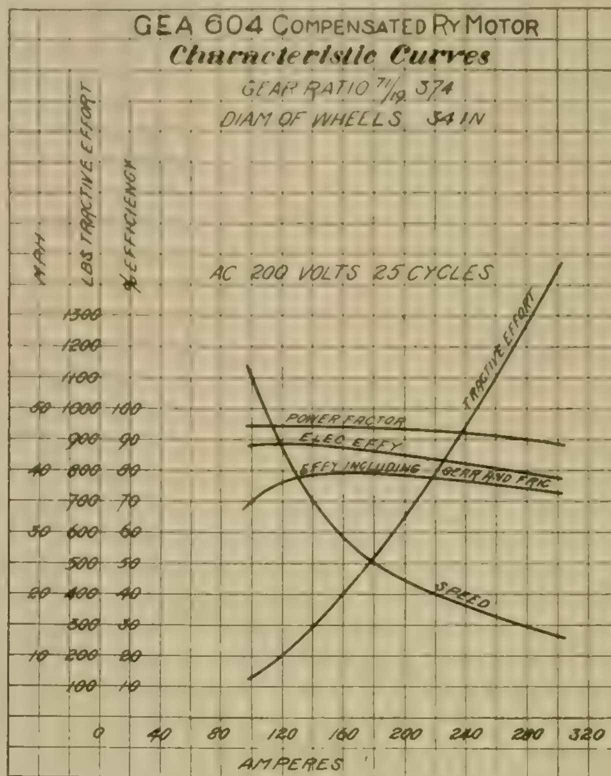
The motor characteristic curves are shown herewith for both alternating current and direct current running, from which it will be seen that the compensated alternating current motor varies its speed with the load and is therefore well adapted for operating trains over a line of irregular profile. The commutation of the motor is satisfactory for both alternating and direct current lines and good commutation is secured without resort to high resistance leads which are liable to give trouble in case of sustained heavy overloads.

There is a comparatively small additional expense required to adapt alternating current equipments to run on direct current and in the



GENERAL ELECTRIC A. C. AND D. C. MOTOR WIRING.

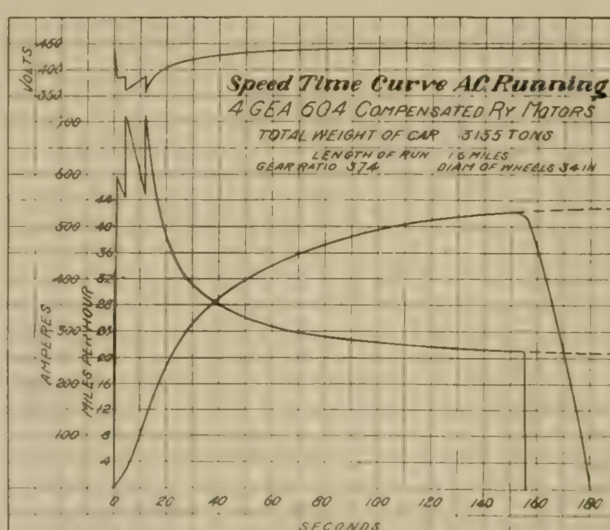
present case this is accomplished by the use of a standard K-28 direct current series parallel controller used in connection with the commutating switch to change field connections, cut out step-down transformers, change line fuses, etc. Only a few seconds' time is required to operate the commutating switch, which is interlocked with two main oil switches, one in the high tension and the other in the direct current circuits. The interlocking is arranged so that only one switch can be closed at a time and the commutating switch can only be thrown when the oil switches are in the off position. As will be seen in one of the illustrations, there is a double set of trol-



GENERAL ELECTRIC A. C. MOTOR CURVES.

leys, one for the alternating and the other for the direct current, hence the necessity of interlocking the oil switches, as trouble would ensue in case both trolley poles should be up at the same time.

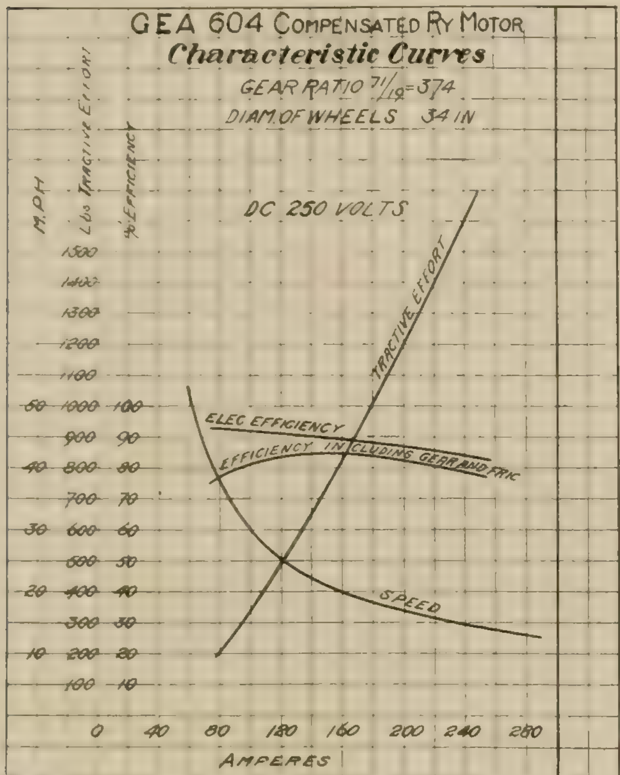
With cars operating over city lines it is preferable to use the standard series parallel controller in order to minimize the weight



GENERAL ELECTRIC COMPENSATED MOTOR A. C. SPEED CURVES.

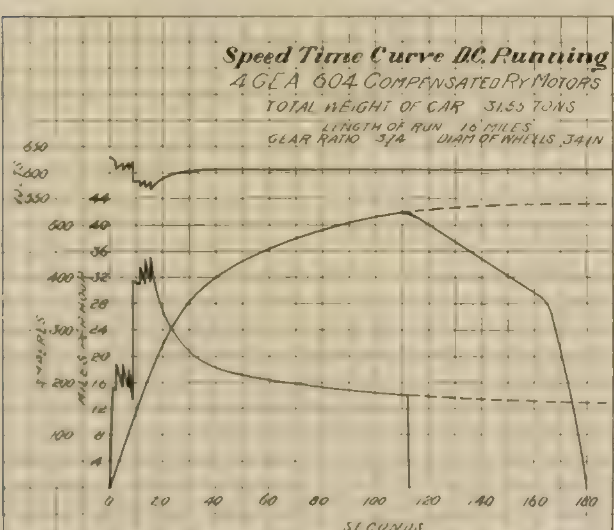
of controlling apparatus. This method of control will not give quite so high efficiency when accelerating with alternating current as could be obtained with potential control. The difference in efficiency, however, is very small owing to the infrequency of stops upon the sections of road equipped with alternating current and also

on account of the flexible character of the speed torque curve of the alternating current motor which gives a high efficiency of acceleration with series parallel control. If the method of potential control were used the car must be operated upon alternating current throughout the interurban and city parts of the line or else two separate



GENERAL ELECTRIC D. C. MOTOR CURVES

controlling systems must be installed, involving a considerable increase in weight and difficulty in providing necessary room for the apparatus. The efficiency of the potential control is not over two or three per cent higher than that of the series parallel control and the latter is much more flexible. It has also a higher efficiency in



GENERAL ELECTRIC COMPENSATED MOTOR D. C. SPEED CURVES

running on the direct current part of the system. For locomotives, however, where the necessity exists of operating over city streets, the potential method of control may offer advantages sufficient to warrant its adoption.

The step-down transformer on the car is air cooled, the draft being obtained by the motion of the car itself. Current for car lighting and heating is obtained from the direct current trolley in the usual manner and from the alternating current trolley from the secondary of the transformer. The trolley poles and wheels are of standard design, the alternating current trolley pole being somewhat shorter, as this trolley wire is lowest. The base of the alternating current trolley is treated with vacuum compound and also insulated with composition insulators. The air compressors for the brakes and whistle is operated by a compensated motor, taking current from either circuit.

A set of speed time curves are shown in the accompanying illustration, the runs being taken over the same stretch of track with alternating current and repeated with direct current. These runs were taken over a distance of 1.6 miles on a level tangent at an average speed of 32 m. p. h., or a schedule speed of 29.5 m. p. h., including 15 seconds' stop. The details of this new system have been carefully worked out with reference to operation not only upon roads running through cities but upon long main line railroads where the direct current system involving rotary converter sub-stations is prohibited on the score of first cost and cost of operation. The form of trolley suspension described is capable of being operated at a considerably higher voltage, which helps to solve the question of current collection for heavy units running at high speed.

Chicago & Eastern Illinois Between Chicago and St. Louis.

Those going to the street railway conventions from Chicago or from the north and east via Chicago will be interested in some details concerning the new Chicago-St. Louis through service on the Chicago & Eastern Illinois R. R., which was inaugurated in July last. This line was only recently completed to St. Louis. It is 90 miles long, double track throughout, with 85-lb. rails, rock and gravel ballast, steel bridges and culverts, and without any tunnels. Trains enter St. Louis over the Merchants' bridge, thus avoiding the Eads tunnel and enabling passengers to alight at the Washington St. station in St. Louis if they so desire. The Chicago terminus is the new LaSalle St. station, the same depot used by the Lake Shore, Nickel Plate and Rock Island railroads, making it most convenient for passengers from the east by the Lake Shore or the Nickel Plate, while connections are made at Englewood, 63d St., with the Pere Marquette and Pennsylvania lines.

Forty new coaches were built for this service, comprising combination baggage and smoking cars, day coaches, chair cars (seats free), and standard Pullman sleepers. The entire train is lighted by electricity and all cars are equipped with electric fans, a luxury much appreciated in warm weather. The whole of the equipment is a model of excellence in construction and good taste in furnishing and decoration.

The "Frisco Express" is No. 21, daily leaving Chicago at 9:10 p. m. and arriving at St. Louis at 7:03 a. m., and No. 22, daily leaving St. Louis at 9:46 p. m. and arriving at Chicago at 7:36 a. m.

The C. & E. I. is intending to have a special car on this train Sunday, October 9th, and the Monday, Tuesday and Wednesday following, for the accommodation of Chicago and eastern delegates. The convention arrangements are in charge of Mr. Ross Bookwalter, C. T. A. of the C. & E. I. R. R., Marquette Bldg., Chicago.

Electric Heaters for New York Subway.

The Consolidated Car-Heating Co. has just closed a contract with the Interborough Rapid Transit Co. for heaters for 200 steel cars for use in the subway. There will be 24 heaters of the panel type in each car and two special heaters for motormen's cabs. One mile of wire will be used in the coils for each equipment. The Consolidated company has also just received an order for electric heaters for 100 cars for the Manhattan Elevated Division.

The Consolidated company has sold to date 75,000 electric heaters for use in the city of Greater New York, more than 54,000 of which have been sold during the last three years.

The Consolidated company has also just received an order from the Chicago Union Traction Co. for 12-heater equipments for 100 cars. These heaters are of the company's new cross seat type.

Coasting Through Switzerland.

One of the new summer resort "attractions" this year is "Coasting Through Switzerland," which has been one of the conspicuous features all summer at Dreamland, Coney Island. The tour comprises a ride in sleighs through a labyrinth of painted scenery showing clever stage effects illustrating life and scenes in Switzerland. In the matter of construction, "Switzerland" is a model for amusement ventures, with a front of 85 ft. and a depth of 584 ft. It comprises over a mile of rail, 25 distinctive scenes, and 30 sleighs in use. A notable feature is the cooling apparatus which diffuses iced air throughout the whole structure.

"Coasting Through Switzerland" strikingly illustrates the remarkable change that has come over the modern summer amusement field. The demand for high class, clean and instructive attractions in the so-called "out door" resorts has developed so notably during recent years as to absorb the greater part of the attention and capital of the owners of summer parks and pleasure grounds.

Ten, or even five, years ago, to have employed the highest talent of the scenic artist in combination with the most intricate electrical and mechanical appliances and a modern system of refrigeration in a merely summer amusement enterprise, as has been done in "Coasting Through Switzerland," would have been to excite the derision of experts and doubtless to court financial disaster. Today, however, no up-to-date summer park manager would think of limiting his patrons to the old-time rough-and-tumble amusements.

Major Ryan was one of the first to discuss the full scope of the revolution in the demands of the amusement-loving public. This was but natural, for all his life he has been engaged in the promotion of big summer amusement enterprises, in which he has enjoyed a practically unbroken record of successes. As one of the pioneers of modern Atlantic City, Major Ryan foresaw the possibilities of that unique seaside resort years before it had attained anything near its present development, and he profited accordingly.

Major Ryan was probably the originator of the scenic railway, today a prominent and paying feature of almost every park in the United States. For years he has been operating the principal amusements at Philadelphia's celebrated park, Willow Grove, and the phenomenal development of that park has been in large measure promoted by his enterprising effort. He has operated extensively also at Asbury park and other Jersey coast resorts.

Quick to foresee the success ahead of Senator William H. Reynolds' Dreamland project, Major Ryan early associated himself with that enterprise, establishing there his latest and most successful scenic production, which is "Coasting Through Switzerland." In this were combined the best ideas evolved from his long experience, and it has proved an exceptional money maker from the start.

William H. Reynolds, president of Dreamland, says of "Coasting Through Switzerland": "The attraction is unique and pleasing in every detail and is a delightful conception carried out to the most gratifying and entertaining completion. The expressions of pleasure that come to my attention from those who have availed themselves of this trip through Switzerland certainly indicate that it is in high favor with the public. I consider it one of the most attractive features of Dreamland."

Major Ryan is preparing to construct and sell a limited number of duplicates of "Coasting Through Switzerland," and well-known park managers and summer amusement men of several of the larger cities are already negotiating for the exclusive use of it in their respective communities.

THE LATEST PARK ATTRACTION—"THE START."

Major Ryan is best known as one of the leaders of the Democratic party in Philadelphia and Pennsylvania. Since 1881 he has been a member of the city councils of Philadelphia and also has been harbor master, city commissioner and chairman of the Democratic city committee. His home office, as president of the American Amusement & Construction Company, is No. 1028 Land Title Building, Philadelphia.

"Trolley Talk."

The Pittsburg, McKeesport & Connellsville Railway Co., Connellsville, Pa., in July last began the publication of a four page pamphlet entitled "Trolley Talk." The object is the same as that of similar publications issued by other railway companies, to give the patrons information which it is to the advantage of the company to have them know and which they can get in scarcely any other way. The points covered in the August issue are trolley parties, the coke region lines, and the duties of the conductor. It is the intention of the company to publish Trolley Talk monthly and possibly more frequently, as it has found that the paper within the first few weeks was productive of considerable special car business.

Personal.

MR. W. C. SMITH has resigned his position as general manager of the Pennsylvania & Mahoning Valley Railway Co.

MR. H. L. BEACH has been appointed superintendent of the Chicago Union Traction Co., to succeed Mr. R. R. Hertzog.

MR. S. B. LIVERMORE has been appointed superintendent of the La Crosse Street Railway Co., to succeed Mr. Peter Valier, resigned.

MR. R. R. HERTZOG has been appointed general superintendent of the Chicago Union Traction Co., to succeed Mr. Millard B. Hereley.

MR. WILLIAM H. HALL has been appointed chief engineer of the Lehigh Valley Traction Co., with headquarters at Allentown, Pa.

MR. H. K. S. WILLIAMS has been elected president of the John Stephenson Co. to fill the place made vacant by the death of Mr. Joseph C. Willets.

MR. R. C. DORNBLASER has been appointed superintendent of the Lehigh Valley Traction Co., at Allentown, Pa., to succeed Mr. George H. Wolfe, resigned.

MR. GEORGE H. EARLE, JR., has recently been elected to fill the unexpired term of the late William L. Elkins as a director of the Philadelphia Rapid Transit Co.

MR. PETER VALIER, superintendent of the La Crosse Street Railway Co., has resigned to become superintendent of the La Crosse & Southeastern Railway Co.

MR. L. C. MOORE has resigned from the board of directors of the Northern Colorado Electric Railway Co., Fort Collins, Colo., to become treasurer of the company.

MR. MILLARD B. HERELEY has resigned his position as general superintendent of the Chicago Union Traction Co. to become traffic manager of the same company.

DR. R. C. RIND has been appointed chief surgeon of the Springfield, Troy & Piqua Electric Railway Co., at Springfield, Ohio. President John L. Bushnell made the appointment.

MR. FRED. S. BORTON has been elected a director of the Cleveland, Painesville & Eastern Railroad Co., to fill the vacancy caused by the recent death of Mr. I. N. Topliff.

PROF. A. V. SIMS has been elected vice-president and general manager of the Cuban Eastern Railway Co. and five other concerns controlled by the Knickerbocker Trust Co.

MR. D. C. HINSTORFF, formerly with the Chicago General Ry., has been appointed general storekeeper for the Aurora, Elgin & Chicago Ry., with headquarters at Wheaton, Ill.

MR. JOHN H. CAMLIN, secretary of the Rockford & Freeport Interurban Railroad Co., has resigned, this company having been consolidated with the Rockford & Interurban road.

MR. J. A. BARREY has been appointed general manager of the Northern Indiana Traction Co., having succeeded Mr. H. F. Coleman, who had charge of the construction of the line.

MR. W. R. RATHVON, of Boulder, Colo., who is manager of the western fields of the Continental Oil Co., has been made a director of the Northern Colorado Electric Railway Co.

MR. CHARLES C. BENSON, general manager of the San Juan Light & Transit Co., San Juan, Porto Rico, has resigned and will be succeeded by Mr. Charles E. Warner, of Pittsburg, Pa.

MR. CHARLES F. GOODRICH, general superintendent of the Fox River Electric Railway & Power Co., and secretary and treasurer of the Knox Construction Co., resigned September 1st.

MR. W. WORTH BEAN, JR., was on August 1st appointed secretary of the Benton Harbor & St. Joseph Electric Railway & Light Co. of St. Joseph, Mich., succeeding Mr. W. H. Hull, resigned.

MR. H. C. MORRIS, superintendent of the Bay City Gas Co., Bay City, Mich., has resigned his position to succeed Mr. W. P. Jackson, who recently resigned as superintendent of the Bay City Traction & Electric Co.

MR. CHARLES M. M'ELROY, formerly assistant superintendent of the Tri-City Railway Co., has been appointed superintendent of the Davenport & Suburban Electric Railroad Co., with headquarters at Davenport, Ia.

MR. GEORGE G. MULHERN has resigned as director of the Cleveland Electric Railway Co. Mr. Mulhern has been identified with the street railway business of Cleveland for 12 years, having served first as a driver of a mule car; after a few years he became superintendent, and afterwards general superintendent. He resigned as general superintendent last January.

MR. N. C. SMITH, of Auburndale, Mass., formerly superintendent of the Newton division of the Boston Suburban Electric Cos., has been appointed superintendent of the Groton & Stonington Street Railway Co., Groton, Conn.

MR. W. P. JACKSON, superintendent of the Bay City Traction & Electric Co., Bay City, Mich., has resigned his position to become master mechanic of the traction and light properties of the Saginaw Valley Traction Co., Saginaw, Mich.

MR. URIAH FOSS, for the past three years superintendent of the East End car barns of the Connecticut Railway & Lighting Co., at Bridgeport, Conn., has been appointed superintendent of transportation of that company, with headquarters at Hartford.

MR. J. A. BRETT, for the past several years general manager of the Electrical Installation Co., of Chicago, will on October 1st retire from that company to engage in other business. Mr. Brett has made no definite arrangements, but has several prospects under consideration.

H. B. BRYDON.

MR. H. BOYD BRYDON, who for the last three years has been with Messrs. Sargent & Lundy, of Chicago, as testing engineer and confidential assistant to Mr. Sargent, resigned that position September 6th, and will hereafter be associated with Mr. James W. Lyons, 605 Fisher Bldg., Chicago, as his principal assistant in charge of designing and construction work. Mr. Brydon has had an extensive experience in steam and electrical engineering work. After graduating in electrical engineering at Finsburg Technical College, London, of which Prof. Sylvanus P. Thompson is principal, Mr. Brydon was with the City of London Electric Lighting Co., the Peninsular & Oriental Steam Navigation Co., and H. F. Parshall, carrying out all of the Dublin United Tramways Co. electrification work under Mr. Parshall. While in Dublin Mr. Brydon served as consulting engineer for the Great Northern of Ireland Railway on its Dublin Terminal. He came to America in 1900 and was with the Yonkers (N. Y.) Street Railway Co. and the Chicago Edison Co. in the power stations. In January, 1901, he engaged with Sargent & Lundy, and during the three years has had charge of all testing work in connection with the power plants for which they are consulting engineers.

MR. HOWARD FRAVEL, superintendent of the Dayton & Western Traction Co., Dayton, Ohio, has tendered his resignation, and Mr. Valentine Winters, of Dayton, president of the company, will assume the duties of manager until Mr. Fravel's successor can be appointed.

MR. JOHN W. OGDEN was on July 6th elected treasurer of the Lowell, Acton & Maynard Street Railway Co., succeeding Mr. Geo. F. Marshall, resigned. Mr. Ogden is also general manager and purchasing agent for the company, and of the Concord, Maynard & Hudson Street Railway Co., controlled by the same interests.

MR. M. J. KINCH, of Holland, Mich., has been appointed superintendent of the Green Bay Traction Co., which was formerly the Fox River Traction & Power Co. Mr. Kinch is an experienced street railway man and for the last two years has been associated as an electrical engineer with the Knox Construction Co., of Chicago.

MR. O. L. REMINGTON, of Wm. McLean & Co., electrical engineers and contractors of Melbourne, Australia, sailed for the United States on August 8th. While here Mr. Remington's address will be care of the Bullock Electrical Manufacturing Co., Cincinnati. After his visit in this country is completed, he will spend some time in Europe.

THE SPRINGFIELD, CHARLESTON, WASHINGTON & CHILLICOTHE RAILWAY CO., with offices at 128 Bushnell Bldg., Springfield, Ohio, has chosen officers as follows: President, H. L. Rockfield, vice-president and general manager, Frank Patter-

son, secretary, F. Atkinson, treasurer, A. M. Winger. Mr. J. E. Gunn will have charge of the construction work; the line will be 70 miles and will be put through as soon as possible.

MR. GUIDO PANTALEONI, who has been for so many years manager of the St. Louis office of the Westinghouse Electric & Manufacturing Co., has been relieved of these duties in order that he may act as the personal representative of Mr. Westinghouse during the St. Louis Exposition in the reception and entertainment of distinguished visitors. He has been appointed general southwestern manager of the company, in which capacity his duties will be with the large financial interests of the southwest. Mr. Wm. Clegg, jr., who has for the past five years been the active man in the St. Louis territory as Mr. Pantaleoni's associate, has been advanced to be special agent for the handling of the specially important contracts in this field. This mark of the high regard in which Mr. Clegg is held by the company is due to his excellent record, and to the desire to leave him free from the executive duties coming upon a district office manager, so that his marked ability as a salesman may have a wider scope. Mr. D. E. Webster comes from the Denver office to be acting manager of the St. Louis office. During his eleven years with the Westinghouse company, Mr. Webster has held a number of important positions, including that of chief of the testing department at East Pittsburg, so that he brings to his new office fine ability as an engineer as well as commercial experience.

Obituary.

MR. C. J. HARRINGTON, the well-known electrical supplyman of New York City, died at St. Vincent's Hospital in New York on August 10th.

MR. JOSEPH C. WILLETS, president of the John Stephenson Co., died on August 31, 1904, at his home in Skaneateles, N. Y. Mr. Willets has lived at Skaneateles for the past 25 years, and has taken a conspicuous part in the development of the community. He was especially active in the building of a new public library at Skaneateles, and was also interested in many philanthropic movements in that part of the state. He was a business man of wide activities, and in addition to his association with the John Stephenson Co. he was president of several manufacturing and financial establishments throughout New York State. He was a director in the E. W. Bliss Co. and several other well known business houses. Mr. Willets was born in Cincinnati, Mar. 4, 1846. He is survived by a wife and four children.

MR. RICHARD S. WARING, of Pittsburg, Pa., founder of the Standard Underground Cable Co., and pioneer in the business of underground cable manufacturing in the United States, died on Tuesday afternoon, August 23rd, at Elmira, N. Y. He was born in Saratoga county, N. Y., in 1833, and began his business career in Pittsburg in 1856 or 1857. During the early part of his life Mr. Waring was extensively interested in the oil business, forming the firm of Waring Bros. & Co. about the year 1870. Mr. Waring's energy and enterprise soon gave him a leading position in the oil business, and he was at one time one of the most prominent independent oil refiners of Pittsburg, the properties later being absorbed by the Standard Oil Co. One of the largest and most enduring achievements of Mr. Waring was the founding of the Standard Underground Cable Co. by him in 1882, a company which has become one of the most prosperous manufacturing corporations in Pittsburg. In 1887, Mr. Waring went to England and founded the Fowler-Waring Cables Co., Ltd. After remaining in London until 1890, he spent about two years in France, returning to Pittsburg in 1893. Mr. Waring has also been interested in the Susquehanna Water Power Co., was a member of the American Institute of Electrical Engineers, a trustee of the Western University of Pennsylvania, and a director of the Morganza Reform School of Western Pennsylvania.

Ohio Interurban Railway Association.

At the last meeting of the Ohio Interurban Railway Association, in Columbus, the monthly meetings were discontinued on account of the extra duties which fall upon the officials of interurban lines during the summer season. The executive committee, however, has held a number of meetings at which matters pertaining to work of the association have been discussed and such action taken as seemed desirable. In a circular letter issued to the membership by Mr. J. H. Merrill, secretary and treasurer of the association, it is stated that the several standing committees have reported at all the meetings of the executive committee held this summer and the work of these committees is well in hand. The membership list is rapidly increasing and the secretary is in receipt of several inquiries from Pennsylvania and Indiana requesting information as to the progress and future of the association. The present membership numbers 132.

The subject committee has assigned topics for discussion to several of the members. The legislative committee did some very efficient work during the past session of the legislature. The transportation committee after a long struggle has succeeded in formulating a contract covering the interchangeable coupon ticket which has been accepted and signed for by representatives of the following companies: The Cleveland & Southwestern Railway Co.; Lake Shore Electric Railway Co.; Western Ohio Railway Co.; Dayton & Troy Electric Railway Co.; Toledo, Fostoria & Findlay Electric Railway Co.; Dayton & Northern Traction Co.; Dayton, Covington & Piqua Traction Co.; Springfield, Troy & Piqua Railway Co.; Springfield & Xenia Traction Co.; Dayton & Western Traction Co.. In addition to these roads assurance has been received from two roads out of Toledo and two roads out of Columbus that they will sign the contract at once. The interchangeable coupon ticket will be known as form O. I. R. A. No. 3, and will be good for transportation over all the properties named. The committee desires that the progress of this movement be carefully watched by other members of the association with a view of later becoming parties to the agreement.

The committee on standard rules covering the operation of interurban railways and general instructions to all employes has prepared and forwarded to a number of the members of the association a draft of the proposed rules and it is hoped that these will be freely criticised in order that the committee may have some definite recommendations for the next meeting which will occur in October.

The executive committee requests that all members will take sufficient interest in future meetings to write the chairman of the subject committee, Mr. E. C. Spring, West Milton, O., suggesting subjects of particular interest to those engaged in this line of business and it is hoped that each member will come to the meeting prepared to discussed the subjects assigned. The discussion at the Columbus meeting on the subject, "What Compensation Should Interurban Companies Give Newspapers for Advertising Privileges?" did not result in any definite recommendations and a motion provided that the executive committee recommend to the association at the next meeting some uniform plan providing the press with compensation in lieu of advertising. Members are requested to communicate with Mr. E. C. Spring, outlining the practice of their roads and making such suggestions as may be of interest to the committee in preparing the recommendations.

Three delegates have been appointed to the American Street Railway Association convention: Messrs. H. P. Clegg, E. C. Spring and F. J. J. Sloat. The chairman of the subject committee is having a new and attractive button prepared for distribution at the October meeting.

Rooms in St. Louis.

The hotel problem in St. Louis will doubtless prove to be a more or less exasperating one to many of our readers because they are not familiar with the districts where satisfactory accommodations can be obtained. In the vicinity of 5700 Von Versen Ave., a choice residence district, there are several small hotels with bath and cafe, while there are many private houses at which rooms can be secured at reasonable rates. This district is only four blocks from the main entrance to the World's Fair grounds and is conveniently reached from downtown by the Olive St. and the Delmar Garden cars, which pass one block east of 5700 Von Versen Ave.

The Brooklyn Rapid Transit Co. has presented its employes a $37,000 clubhouse where free educational classes will be conducted from October 10th to March 3rd under the auspices of the Employes' Benefit Association. The courses will include electricity, civil engineering, reading, mathematics, stenography, physical culture, vocal and instrumental music.

Hamilton-Holzwarth Steam Turbine.

The accompanying illustration shows the new Hamilton-Holzwarth steam turbine, just introduced by the Hooven-Owens-Rentschler Co., direct connected to a 1,000 kw. generator. This set, which is now on exhibition at the company's space, block 46 Machinery Hall at the World's Fair, is designed to operate with 185 lb. initial steam pressure at a speed of 1,500 r. p. m. with a 28-in. vacuum. These turbines are of the horizontal type and have a number of stationary disks and running wheels, both of which have vanes placed all around the circumference. In these turbines the steam is expanded only in the stationary blades by means of increasing the height of the stationary blades to an amount corresponding to the expansion of the steam. The leakage caused by radial clearance between the running wheel shaft and the bore of the stationary blades is reduced to a minimum by the special construction of the stationary disks. The axial thrust of the running wheel shaft is small enough to be easily carried by a thrust ball bearing. For units of 750 kw. capacity and upward the turbine is divided into two parts; the smaller units are built in one part. The casing and pedestals for bearings as well as the generator are placed upon a rigid bed plate the top of which is planed to insure perfect alignment. All steam, oil and water piping is placed below the bed plate.

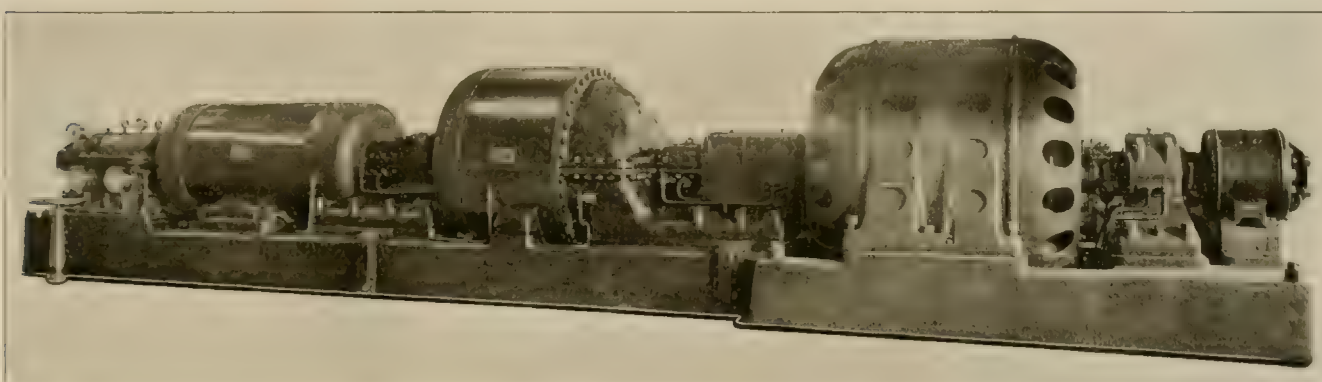
The steam is led through the regulating valve to the ring channel in the head of the high pressure end of the turbine and thence flows through the first set of stationary vanes which changes its direction and imparts the necessary velocity to it. From here the steam flows in a full cylindrical belt, interrupted only by the vanes of the first running wheels to the following stationary disks, and so on. From the last running wheel the steam is led through receiver pipes to the front head of the low pressure casing, or if there is only one casing, immediately to the condenser. The condenser is placed as near as possible to the exhaust opening. The low pressure end of the turbine is similar to the high pressure end except that the front of the frame has an additional nozzle through which live steam enters the low pressure casing in case of overload. The steam coming through this nozzle is controlled by the governor and it exerts no back pressure on the steam from the high pressure turbine but on the contrary works like an injector, sucking the low pressure steam through the first set of stationary vanes of the low pressure end.

As mentioned, the expansion of the steam takes place within the vanes of the stationary disks. In the bore of the stationary disks runs, with as small a clearance as practicable, the hub of the running wheel, and to reduce the leakage loss to a minimum the stationary disks extend nearly to the shaft of the turbine. The vanes are of drop forged steel milled and located in the groove on the outside periphery of the disks. The vanes are fastened to the disks by rivets and after the disks and vanes are ground on their outside edges a tough steel ring is shrunk over the vanes and steam channels. This design allows absolute control of the length and spacing of the vanes.

The running wheels are built as light as possible with cast steel [illegible] and steel disks are riveted to both sides of the hub forming the ring space in which the vanes are riveted. On the outer edge of the vanes is placed a thin steel band around the wheel to give an outside wall to the steam channels. The vanes are accurately milled on both edges. Tests made with these vanes have showed that it takes over 1,000 lb. to pull one of them out of the clips.

In order that the machine shall run quietly it is necessary that the rotating part be perfectly balanced. As the rotating parts of these machines consist of a number of wheels, each wheel is balanced by itself. The maker has designed and built a machine in which every wheel can be balanced to within 1-10 of an ounce, and the balancing is the last operation in the manufacture of the running wheels.

The bearings are the only parts of the turbine where metal comes into contact with metal, and provision is made here for using ample quantities of oil. The bearings of the turbine shaft have much less weight to support than those of the generator shaft, and therefore can be made short with straight shells, while the generator bearings have ball shaped shells to insure their alignment with the shaft. In these bearings the oil flows to the bottom bushings under a slight pressure, then follows around with the rotating shaft and is taken off in the cap. From here it flows back to the oil outlet in the pedestal. With the thrust ball bearings on the exhaust side of the turbine the whole shaft can be moved in an axial direction and the position of the running wheels can be adjusted to the stationary disks. Flexible couplings are used between the shafts of the high and low pressure parts and between the low pressure part and the generator. The shaft and casing of both parts of the machine can expand easily. Both are held rigid only at the exhaust end which is the coolest part, by the pedestal. On the intake end there is no rigid connection between the pedestal bearing and high pressure casing or between the low pressure bearing and casing.



HOOVEN-OWENS-RENTSCHLER CO.—HAMILTON-HOLZWARTH STEAM TURBINE.

The governor is of the spring and weight type and is directly driven by the turbine shaft, revolving with the same regular velocity.

The regulation is effected by throttling all the steam in a single throttle valve before it enters the turbine, according to the load which it has to carry. The main regulating valve is of the double seat poppet valve type and is not actuated directly by the governor but by means of a special regulating mechanism. The reasons for this are that the resistances of the governor should be practically the same in all positions and the angular velocity of the turbine should be independent of the load. As these two effects cannot be attained with direct acting governors the indirect acting regulation has been adopted in spite of some additional complications. The governor has been arranged so that it will shut down the whole turbine as soon as the angular velocity reaches a point 2½ per cent higher than normal, and in case of any accident happening to the governor the only result would be to shut down the turbine.

Lubrication of the entire machine is effected by feeding oil from the tank in the bed plate by means of an oil pump driven by worm gearing by the turbine itself. A pressure pipe to each bearing can be closed by a valve so that the flow of oil to the different bearings is readily regulated. Every part is lubricated automatically.

Plaster models have been completed for three bronze tablets to be set in the wall of the City Hall station of the New York subway, to commemorate its inception and completion, and bearing names of Interborough officials, engineers and designers.

Manufacturers and Supply Houses of St. Louis Prominent in the Electric Railway Field.

THE ST. LOUIS CAR CO.

The history of the St. Louis Car Co. is very admirably given in a recent publication issued by that company, entitled the "St. Louis Car Co. at the Universal Exposition," from which we quote the following:

A study of the growth, development and expansion of the St. Louis Car Co. is, at the same time, a study of the electric street railway industry. While the development of the latter has been astounding, the former has kept right abreast with the great progress made by this industry, and today the St. Louis Car Co. is the largest as well as the leading plant of its kind on the face of the earth. Truly, this great establishment of the World's Fair City fully represents the American idea of push, progress and advancement.

The company was organized in 1887, and its growth for the first ten years was sure and steady. Mr. J. H. Kobusch was its founder. He was succeeded by his son, Mr. George J. Kobusch, whose business acumen, combined with extraordinary energy and clearsightedness, have played no small part in the growth of the company. During the last six years the progress made has been so remarkable as to excite the wonder and admiration of all who have visited the mammoth works. That this company has grown so rapidly is, in a great measure, due to the systematic and up-to-date methods of manufacture and modern equipment, as well as a thorough knowledge and understanding of the requirements of the electric street car industry.

J. H. KOBUSCH,
Founder of the St. Louis Car Co.

The original works of the company were located at No. 3000 North Broadway. It was an humble beginning, some 250 men being employed at the time, and the capacity being between 400 and 500 cars, of an average length about 20 ft. The work of the shops in the early history was distributed among three or four departments. Today there are thirty distinct and separate departments, each one of which has a share in turning out the work. In 1898, new works were erected at Baden, a suburb located in the extreme northern part of the city. The present manufacturing equipment is the most modern that can be found anywhere. A comparison of the original works with the shops of the present day illustrates the expansion of the company more than mere words possibly can.

The capital stock of the company in 1887 was $25,000; in 1888 it was raised to $150,000; in 1894 to $500,000, and this latter amount was tripled in 1903, making the capitalization $1,500,000. In 1904 the capital was increased to $2,000,000. The sales of products in 1898 amounted to $[illegible]; in 1902 to $2,[illegible], while in 1903 the sales exceeded $5,000,000. In April, 1903, the St. Louis Car Co. acquired the Laclede Car Co. of St. Louis, by purchase. At the two institutions are employed close to 3,000 men and the capacity of the two plants is about 3,000 cars per annum, average length 34 ft.

Besides this, there is a large output of trucks, the trucks of this company being noted for their easy-riding qualities, strength and durability. The St. Louis Car Co. also manufactures its own seats, arc headlights and arc lamps for interior car lighting; curtains, vertical wheel brakes (patented), spiral journal bearings, and many other specialties that are essential to an uptodate, modern car. The company also operates its own brass foundry where all brass and bronze trimmings are turned out, also a malleable and gray iron foundry. Manufacturing these specialties and material itself has proved quite a factor in the career of this company, as it enables it to take large contracts and make quick deliveries.

The entire works cover an area of 52 acres, while the floor space under roof is 900,000 sq. ft.

The products of the St. Louis Car Co. are not only to be found in every state and territory of the United States, but also in Germany, France, England, Russia, South America, Mexico, Australia, New Zealand and other foreign countries.

The officers and representatives of the company are: George J. Kobusch, president; H. F. Vogel, vice-president and general manager; Geo. A. H. Mills, secretary and treasurer; W. B. Phelps, assistant secretary; E. I. Robinson, manager Laclede plant; Geo. L. Kippenberger, purchasing agent; Chas. G. Ette, secretary St. Louis Malleable Casting Co.; Warner S. McCall, general sales agent, St. Louis; Frank E. Huntress, general eastern agent, Boston; Frank McCoy, Pittsburg agent; Gus Koch, Pacific Coast agent, San Francisco.

THE HEINE SAFETY BOILER CO.

The Heine Safety Boiler Co. was incorporated in December, 1884, taking over the boiler business of Adolphus Meier & Co. The Heine boiler was invented in Germany by a native of that country, whose name it bears. Col. E. D. Meier, the president and chief engineer of this company since its incorporation, saw the boiler during a trip to Germany and recognizing its possibilities, acquired the rights to manufacture it in this country. The boiler as originally designed would hardly be recognized as any relation to the boiler in its present state, the development and improvement made by Col. Meier having brought the boiler to its present very remarkable state of perfection and efficiency.

But very few Heine boilers had been built up to the time the company was incorporated, but since then under a vigorous and aggressive management the business has grown and the sales multiplied to a most gratifying extent. Up to early in 1899 the boilers were built by contract in outside shops under the Heine company's supervision and specifications, but the impossibility of getting satisfactory service in many respects led the company to put up shops of its own, and now all Heine boilers are built in the shops owned and operated by itself. The shops are located at Phoenixville, Pa., and St. Louis, Mo., and are of ample capacity to meet all demands which may be made upon them. The great success of the boiler is attested by the rapid growth in business.

The present officers of the company are: E. D. Meier, president; F. G. Meier, vice-president and treasurer; E. R. Fish, secretary; H. C. Meinholtz, superintendent. The offices of the company are at 421 Olive St., St. Louis.

To Col. E. D. Meier is due the credit and honor of the establishment and development not only of the boiler but of the business. Associated with him in the selling department are the following

sales managers, located in the several leading cities: P. H. Brangs, New York City; H. M. Lyman, Philadelphia; E. S. McGregory, Boston; J. E. Whittlesey, Pittsburg and Cleveland; E. D. Ivy, New Orleans; J. H. Harris, Chicago; H. W. Graber, Dallas, Tex.; J. C. Murphy, St. Louis. These gentlemen have all been with the company varying lengths of time, the oldest of them being Mr. Harris, who is manager of the Chicago office, since 1886. They are all very thoroughly versed in the technicalities of the business, and are at all times eager to get in touch with anyone interested in water tube boilers.

ST. LOUIS CAR WHEEL CO.

The St. Louis Car Wheel Co. was organized in 1868. The original plant of this company was located at 18th St. and the railroad tracks, near where the Union Depot now stands. In order to better facilitate the manufacture of its products, and to meet the steady increase of its business, the company moved to its present location on Spring Ave., between the Wabash and the Missouri Pacific R. R. tracks. The offices of the company are in the Bank of Commerce Building, while the plant of the company is readily reached by the Market St., Vandeventer and Chouteau Ave. cars of the St. Louis Transit Co.. The daily capacity of this plant is 425 car wheels, in addition to which the company manufactures general railroad machinery castings. This concern is the originator of the well known "20th Century" channel spoke car wheel, which has given very satisfactory service and met with deserved success, to which the following list of sales testify: In 1897 the company sold 1,281 street car wheels; in 1898, [illegible]; 1899, 2,037; 1900, 6,471; 1901, 18,917; 1902, [illegible]; 1903, 23,557, and for 1904 the sales of street car wheels will reach over 30,000. The company's total wheel business has grown since 1891 from about 25,000 wheels per year to 100,000 wheels per year, and it ships these wheels not only to every state in the Union but to nearly all the countries in South America where street car wheels are used, besides to Japan, Korea, Portugal, England and elsewhere.

The officers of the company are: John W. Nute, president and general manager; James Gray, vice-president; J. J. Morse, secretary and treasurer. J. L. Butterfield is general sales agent of the company and Wm. W. Talman, sales agent.

Mr. John W. Nute, president and general manager, was born in Burlington, Me., Dec. 6, 1860. Soon after the family moved to Franklinville, N. J., where he lived until he entered college in 1878, at Easton, Pa. He was graduated from Lafayette College with the class of 1882 and received the degree of civil and mining engineer. The following year he returned to the college as a tutor in the studies in which he had graduated. After teaching for a year, Mr. Nute became an engineer in the coal mines of the anthracite region of Pennsylvania and at one time held the position of assistant engineer in the survey department of the city of Philadelphia. Jan. 1, 1886, Mr. Nute went to Moberly, Mo., as assistant engineer on the [illegible] R. R. After [illegible] he left the railroad and went into the [illegible] business. In 1891 he became associated with the St. Louis Car Wheel Co. as general sales agent and through his integrity, application and ability has become president and general manager of the company.

JOHN W. NUTE.

J. J. MORSE.

J. L. BUTTERFIELD.

W. W. TALMAN.

Mr. [illegible] J. Morse, secretary and treasurer of the company, was born in Vermont on the shores of Lake Champlain, in October, 1864. His early boyhood was spent on his father's farm; he graduated in the high school of Wellsville, Mo., and attended Lewis College at Glasgow, Mo., leaving at the close of his sophomore year to become teacher in the grammar grade of the high school from which he had graduated. After teaching for two years, Mr. Morse came to St. Louis to engage in commercial work. The year 1899 was spent in the master mechanic's office of the Missouri Pacific R. R., whence he entered the employ of the Merchants National Bank of St. Louis, where he spent the years 1900 and 1901. In May, 1902, Mr. Morse entered the service of the St. Louis Car Wheel Co. as a bookkeeper, and has remained since that time, filling various positions until he was elected secretary and treasurer of the company.

Mr. John L. Butterfield, who for several years has been general sales agent of the company, is a native of Michigan and was educated in the schools of that state. Mr. Butterfield was formerly associated with the Bass Foundry & Machine Co., of Lenoir City, Tenn.

Mr. Wm. W. Talman, sales agent of the company, was born in Detroit, Mich., in July, 1878. He was graduated from the mechanical engineering department of the University of Michigan with the class of 1900. Mr. Talman spent the year 1901 with the Development Company of America, when he entered the service of the St. Louis Car Wheel Co. in the mechanical department.

THE COLUMBIA INCANDESCENT LAMP CO.

Among the well established and progressive manufacturers of St. Louis is the Columbia Incandescent Lamp Co. The company was organized in July, 1889, and was incorporated in 1890 with the following officers: J. H. Rhotehamel, president; W. H. Welsh, vice-president; E. J. Keist, secretary and treasurer. The company began business at 515 Elm St., St. Louis, with an output of about 50 lamps per day. The latter part of the year of its incorporation, the factory and offices were moved to 1912 Olive St., to accommodate its increased business, the manufacturing capacity being doubled and the output increased to 100 lamps per day. The company continued at this address until 1902, when it changed its location to its present quarters at 2115 to 2119 Locust St., moving into a factory building which is new and modern in every respect and well fitted for so successful a business, and where every facility is provided for the making of a good product.

The company has been foremost in all that is good and progressive in the manufacture of an incandescent lamp, making a special feature of the careful inspection of each lamp. The policy of the company has been that the lamps must be perfect in every respect, that they shall stand the test of hard and long-continued use and as a result of this policy, the business of the company has extended into every part of the United States, into Canada and into Mexico, and in addition to which a very considerable foreign trade has been secured. The company has kept pace with the increasing and varied demand for lamps by manufacturing almost every conceivable shape and size, including not only a full line in standard voltages and for high potential circuits from 200 to 250 volts, but also special lamps for railroad car lighting on low voltage.

In 1891 Mr. W. O. Garrison was elected vice-president of the company and Mr. A. C. Garrison, secretary and treasurer. In 1898

the first president of the company died and Mr. W. O. Garrison was elected as his successor. In January, 1904, the company sustained a severe loss in the death of Mr. W. O. Garrison who was succeeded to the presidency by Mr. A. C. Garrison, who now holds this position. Mr. D. E. Garrison became vice-president and Mr. J. R. Baker secretary. Mr. A. C. Garrison has been officially and actively connected with the business since January, 1891. Mr. J. R. Baker has been identified with the company for several years in the auditing department and is well fitted for his recent promotion to the position of secretary.

The company has had an exceptionally successful career in the 15 years of its existence, which is due in a marked degree to the fidelity of its officers and its employes, the heads of the various departments having remained with the company for long periods of time and being men of large experience in their respective work. The manufacturing establishment of the company is thoroughly equipped and is complete in every detail, the machinery and appliances being the best that can be procured and are modern in every respect. The Columbia Incandescent Lamp Co. wishes to extend a cordial invitation to all the delegates to the convention in St. Louis in October to visit the office and factory at 2115 Locust St.

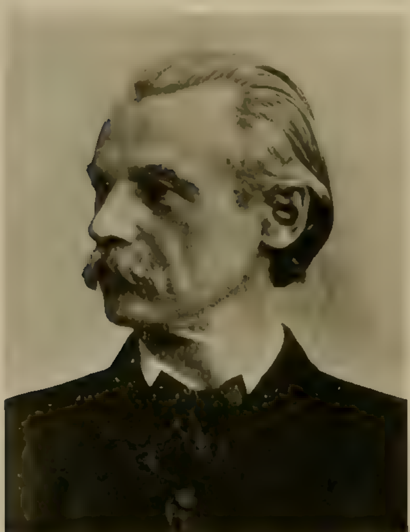
ST. LOUIS IRON & MACHINE WORKS.

Among the older and well established manufacturing companies of St. Louis is the St. Louis Iron & Machine Works, which was organized in 1854 and incorporated in 1875. The business was founded by Mr. G. H. Timmerman, now president, and from a small machine shop it has grown to such proportions as to require two entire blocks for its buildings, involves the employment of many mechanics, and extends in all directions throughout the country. The company is more generally known in the street railway field as the manufacturer of the St. Louis-Corliss engine, while its products also include heavy machinery in general. The officers of the company are: G. H. Timmerman, president; H. Krutzsch, vice-president and manager; J. H. Timmerman, secretary and treasurer.

Gerhard H. Timmerman is a native of Hanover, Germany, where he was born in 1823. He received his education in his native country, and acquired his knowledge of English in America, whither he removed at an early age. He located in Baltimore, but hearing of the wonderful advantages of the West, he came to St. Louis where he worked for many years for his brother, who was a teamster. Having learned the trade of wood turning in Germany, Mr. Timmerman longed for a field in which his technical knowledge could assert itself, but finding no immediate opportunity he opened a grocery store, which he successfully conducted for some years, looking in the meantime for an opening in his favorite field. A few years later he started a machine shop with a partner, but his partner finally withdrew, after which time the concern continued under Mr. Timmerman's direction until the present proportions of business were achieved.

Herman Krutzsch, vice-president and manager of the company, was born in Saxony, Germany, in 1843, receiving his education in his native land. At Chemnitz, he took the degree of mechanical engineer. Mr. Krutzsch then spent four years in England and came to America in 1873, soon after locating with the St. Louis Iron & Machine Works, where he has since been engaged.

John H. Timmerman, secretary and treasurer of the company, is a native of St. Louis, where he was born in 1849. He received his early education in the schools of St. Louis, after which he learned the trade of pattern maker. He entered his father's service, learned the machinery business and when the present company was organized, he was elected to his present position.



HERMAN KRUTZSCH, Vice-President and Manager.

GERHARD H. TIMMERMAN, President.

JOHN H. TIMMERMAN, Secretary and Treasurer.

St. Louis Iron & Machine Works.

W. N. MATTHEWS & BRO.

W. N. Matthews and Claude L. Matthews compose the firm of W. N. Matthews & Bro., 600 Carleton Building, St. Louis. This firm has become familiar to those in the electrical field in the past four years through its very able exploitation of the Stombaugh guy anchor. In 1900 when the firm obtained the Stombaugh patents, the only method of anchoring poles was that known as the "dead man" method. This, at the best, was an expensive and troublesome operation. Recognizing this fact and realizing the simplicity and excellency of the Stombaugh guy anchor, the Messrs. Matthews immediately started in motion a campaign of advertising, which, coupled with the merit of their device, has placed the Stombaugh guy anchor on the staple list of high-class street railway material. Their methods of advertising have always been unique and convincing. The first thing that they did was to send several of each size of their anchors to Prof. R. C. Carpenter of Cornell University, with instructions to make the severest tests that he could devise and to make a report thereon. These tests were made with astonishing results and a full report with photographs is published in their catalog. Professor Carpenter's formula made the use of the Stombaugh guy anchor scientific. It made the anchor popular and it allayed the fears of the doubtful.

The fact that W. N. Matthews & Bro. have always been ready and willing to send any quantity of Stombaugh guy anchors, freight prepaid, on thirty days' trial with the understanding that they may be returned at their expense if not satisfactory, has invariably made converts for their device. Their motto is "Honorable, Reputable and Profitable." Honorable dealings and reputable goods that are profitable to those who use them.

THE SCARRITT-COMSTOCK FURNITURE CO.

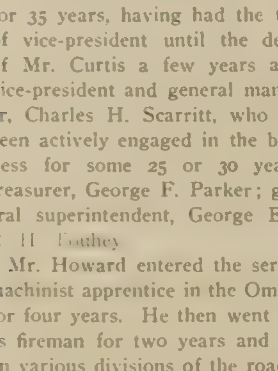
The Scarritt-Comstock Furniture Co. is one of the oldest manufacturing concerns in St. Louis, the business having been founded in 1839 by Russell Scarritt. Latter the concern was known as Scarritt, Curtis & Mason. It rapidly grew in size and importance and gradually developed its railway specialty, car seats. The company was incorporated in 1876 as the Scarritt Furniture Co., and about 10 years ago the name was changed to the Scarritt-Comstock Furniture Co. The works which were formerly at 600 Main St. were recently moved to 1800 Main St., where more room was available and better facilities for shipping could be obtained. The officers of the company are: President, Sanford G. Scarritt, who has been identified with the business for 35 years, having had the title of vice-president until the death of Mr. Curtis a few years ago; vice-president and general manager, Charles H. Scarritt, who has been actively engaged in the business for some 25 or 30 years; treasurer, George F. Parker; general superintendent, George E. Howard; assistant superintendent, R. H. Fouhey.


GEORGE E. HOWARD.

Mr. Howard entered the service of the Union Pacific railroad as machinist apprentice in the Omaha shops in 1872, where he continued for four years. He then went into the road service, being employed as fireman for two years and as locomotive engineer for six years on various divisions of the road in Wyoming, Nebraska and Kansas. Mr. Howard engaged in the hardware business in Nebraska for a while but later came to St. Louis to assume charge of the railroad department of the Scarritt Furniture Co. This was in 1890 and he has been continually in its service since that time, having charge of both the manufacture and sale of the products of this department.

GENERAL ELECTRIC CO. IN ST. LOUIS.

The St. Louis office of the General Electric Co. has been in charge of Mr. George D. Rosenthal since 1892, the territory for this office being southern Illinois, Missouri and Arkansas. Mr. Rosenthal entered the service of the Edison Lamp Works at Harrison, N. J., in 1887. He was at Schenectady part of 1888 and in the supply department of the Edison-General Electric Co. under Mr. J. I. Beggs, from 1890 to 1892, and after the consolidation as the General Electric Co. in 1892, he went to St. Louis and assumed charge of that territory under the direction of Mr. B. E. Sunny, western manager.


GEO. D. ROSENTHAL.

Some of the principal installations secured by the St. Louis office comprise the equipment of the large Northern power station of the St. Louis Transit Co., including the 6,600-volt transmission system and the equipment of the substations of the St. Louis Transit Co.; the St. Louis & Suburban high tension power station with 6,600-volt, 3-phase distributing system; [illegible] sub-stations of the East St. Louis & Suburban Railway Co. and [illegible] distribution system; equipment for two sub-stations for the line which the East St. Louis & Suburban is building to Alton, a distance of 23 miles, and electric car equipment of type M control and four G. E.-73 motors per car, for the same company; the car equipment for the Intramural Railway at the World's Fair, [illegible] per G. E. 70 motors with type M control for 51 cars; four 5,000-kw. and two 2,000-kw. 6,000-volt machines direct connected to Curtis turbines for the Union Electric Light & Power Co's. new station, which is to furnish 9,000 kw. for the St. Louis Transit Co.

Since Mr. Rosenthal has represented the General Electric Co in St. Louis his headquarters have been in the Wainwright Building. Mr. Rosenthal is a member of the Mercantile, Missouri Athletic, Engineers, Jockey, and Glen Echo Country clubs.

CENTRAL UNION BRASS CO.

For more than 23 years the Central Union Brass Co., of St. Louis, has supplied car trimmings to the leading car builders, including electric railway companies which build their own cars, and in addition it broadened its scope a few years ago, so that now it handles a full line of supplies which include motor bearings, journal bearings, mica and mica bond, commutator bars. line material and insulating material, its stock of overhead material being especially complete and up-to-date.

The Central Union Brass Co. supplied much of the line material for the Intramural Ry., and also filled several large orders for brass and iron castings of special design for the St. Louis Exposition Co., including the brass parts for the coin-in-the-slot turnstiles used at the Exposition entrances. Among other specialties handled by the company is a ratchet brake handle which is most favorably known.

The Central Union Brass Co. was established in 1881 by Mr. George Kingsland. The present officers of the company are: President, George Kingsland; vice-president, Abe Cook; secretary, F. L. Bouquet. Mr. Cook was formerly secretary of the Laclede Car Co. The foundries and shops of the Central Union Brass Co. occupy nearly a city block at 11th and Mullanphy Sts.

New Lines and Extensions Opened.

The Cedar Rapids, Iowa City & Southern Railway Co. has completed its line between Cedar Rapids and Iowa City and the same was formally opened August 13th.

The Muskego Lakes' line of the Milwaukee Electric Railway & Light Co. was opened for traffic August 14th. The terminus of the line is Muskego Center and cars will leave Milwaukee every hour, requiring fifty-five minutes for the twenty-mile run to that point.

Construction work on the new Davenport & Suburban Electric Railroad has been completed and the line opened August 15th. The line may be extended to Muscatine, as that was a part of the original plan.

Cars on the Oneonta, Cooperstown & Richfield Springs Electric Ry. were run on August 15th and the following day the line was formally opened. Connections will be made with cars on the Utica & Mohawk Valley line.

The first cars on the new beach line of the Los Angeles Pacific R. R. from Ocean Park to Playa del Rey were run August 10th. Regular trips will not begin until the completion of the bridge at Playa del Rey.

August 19th, the Stark Electric Co's. line connecting Salem and Sebring, Ohio, was thrown open to the public.

August 20th the Hanson Heights extension of the St. Joseph Railway, Light, Heat & Power Co's. line was formally opened. The extension is 38 blocks long.

August 29th, the new branch of the Hartford & Springfield Street Railway Co., from Windsor Green to Suffield, via Windsor Locks, was formally opened to traffic.

September 1st, the Louisville & Interurban Railway Co., Louisville, Ky., formally opened its line to Pleasure Ridge Park. A special car carried a number of business men and financiers over the line.

August 26th, the Lewistown & Reedsville Electric Railway Co., Lewistown, Pa., opened its extension from Lewistown to the Pennsylvania R. R. depot at Lewistown Junction.

September 10th, the line of the Albuquerque Traction Co., of Albuquerque, N. M., was put into service.

September 9th, the first car was run over the line of the Ft. Wayne & Lima Electric railway between Lima and Elida.

September 13th, cars began running over the new Reading & Birdsboro electric line as far as Gibraltar.

The Swedish Government is considering using electric traction on the state railroads, the current to be obtained from numerous waterfalls, which are found in that country.

NEW YORK.

FLORIDA.

MISSOURI.

NEW ENGLAND.

INDIANA.

OREGON.

The Brill Semi-Convertible System for Interurban Cars.

Among the cars built during the last few months for high speed interurban service are many which have semi-convertible window systems, increasing the comfort of travel during the summer by making the cars more open than with ordinary windows. The arched twin-window arrangement, which is in vogue at present, serves no useful purpose, and is only intended to improve the exterior appearance of the car. Whether it is better to attract passengers by the imposing arched twin window arrangement, which is something of a sham, or to make the car more attractive from the inside by providing a system of sashes which may be so disposed as to leave the entire window space free and clear during warm weather, is a question which has heretofore not been discussed by the press. Apparently, cars with semi-convertible window systems are not limited by climatic conditions, as the photographs reproduced herewith show.

BRILL SEMI-CONVERTIBLE CAR FOR CALIFORNIA.

These cars are in operation in New England, Florida, Oregon, California, the middle west and elsewhere. They include the semi-convertible window system of the J. G. Brill Co., which is simply the storage of the sashes in pockets in the side roofs when not in use. The sashes are guided into the pockets by means of small projections at the corners, known as trunnions, which move in runways in the posts. Several advantages are claimed by the builders over other systems, among which are the easy operation, one motion only being necessary to raise or lower the sashes, and the elimination of wall pockets, thereby appreciably increasing the interior width and permitting the window sills to be as low as desired. It is also claimed that with this system there is less cross section of material in the sides, and therefore a reduction in weight. For instance, the car No. 276, which is shown, measures 37 ft. over the body, and 46 ft. 5 in. over the vestibules, 8 ft. 2½ in. wide over the sills, and 8 ft. 6 in. over the posts at belt. The weight of the body without seats, is 14,975 lb. The weight of the car equipped, including trucks without motors and controllers, is 30,920 lb. The importance of getting rid of all unnecessary weight is well understood by those who consider the operating cost per car-mile. Much money would be saved in operating expenses if buyers of cars in general were more careful in the specifications with the regard to weight. The standard practice of the builders of this type of car is to include in the bottom framing 12x⅜-in. sill plates, extending the full length of the body, to which the base of the posts are secured. It is said that these cars are very durable, and in every respect excellently suited to high-speed interurban service.

Campaign Against Damage Fakirs.

The New York City Railway Co. has selected James L. Quackenbush [illegible] to take charge of its trial department and vigorously prosecute lawyers, doctors, ambulance chasers and fraudulent damage claimants who prey upon the company. If a case is tainted with fraud it will not be allowed to drop with a verdict in the company's favor, but everyone connected with it will be prosecuted [illegible]. Special attorneys will be employed.

Steel Tired Wheels in Interurban Service.

BY KNOX TAYLOR, GENERAL SALES AGENT, TAYLOR IRON & STEEL CO.

It is often said that the managers of electric railroads do not profit to as great an extent as they might by the experiences and failures of the steam roads. In the matter of the use and adoption of steel tired wheels, however, the results that have been obtained in high-speed passenger service seem to have produced their fruit. For strictly city service under medium-sized cars the cast iron wheel still holds its own, and probably will for some time to come, until it has been demonstrated by the tests of time in actual operation to be more expensive than its steel tired competitor.

In interurban work, on the other hand, the conditions imposed are so severe that it is well within bounds to say that the cast iron wheel, as ordinarily used, is positively unsafe. This refers not so much to the plates and hubs, as to the flange. Here we find the limiting point of strength in all wheels whether of cast or rolled metal. The stresses imposed upon a chilled iron flange are often more than it can stand even when the flange is full M.C.B. size, but when these dimensions are cut down in height and thickness to meet the requirements of the rails in a city street so that ¾ in. is substituted for 1⅛ in., the work required of the wheel to carry the heavy interurban cars that are now in operation becomes too great for the chilled iron to withstand, and recourse must be had to a stronger metal.

At the same time there is ample opportunity, as already indicated, to put all of the strength needed into the plates and hub by the use of castiron. It follows, then, as a matter of course, that for interurban service a combination wheel having a rolled steel tire, to give the proper strength to the flange, and a cast iron center should be produced that will fulfill the two-fold requirements of high speed interurban service and the slow work within city limits where the width of tread and the dimensions of the flange are controlled by other elements than the desires of street railway officials and wheel makers.

These premises would probably be granted by an electric railway manager even though financial exigencies might require him to sacrifice both future economy and present safety to the demands of first cost and use a cast iron wheel where his own better judgment tells him that he should have one with a steel tire.

There is, however, another limitation in the dimensions of wheels intended for this dual service that mitigates, to an extent, against a built up wheel with retaining ring fastenings, and that is the overall width of tire that is permissible. This is one of the reasons that the fused steel tired wheel, such as is made by the Taylor Iron & Steel Co. of High Bridge, is better suited for such use. The tire in this type of wheel is supported across its entire width and the overall width of tire can therefore be made as small as the narrowest requirements and still have ample bearing surface between the tire and center; this together with the fact that the tire is "welded" or fused to the center makes it possible to get more wear and insure a greater degree of safety with a given thickness of tire than is possible in steel tired wheels of other types.

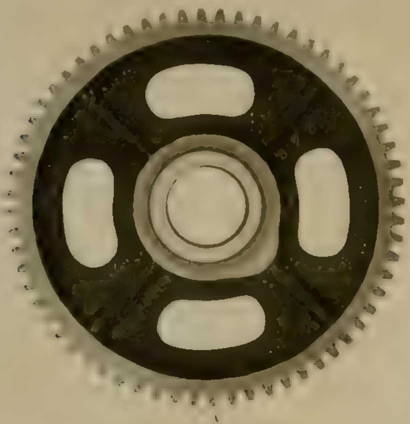
The simplicity of the construction makes it possible for the inspector who is competent to look after cast iron wheels to take care

of these dies, and the result is that the steel tired wheel of this type is rapidly gaining favor for the work that we have under consideration.

It is unfortunate that the value of records is not yet appreciated by electric railway managers as highly as it is by those of steam railways. The result is, that the mileage that has been and can be secured with the steel tired wheels, under the combined service on a city street and in the open country, is very difficult to obtain. Records of wheels having made from 75,000 to 125,000 miles and "not yet worn out and yet doing satisfactory service" give some indication of what may be expected. That the wheel can give the same mileage under the same weight of equipment and speed as its fellow on steam roads, can hardly be expected. The reason for this is the greater wear from dirty rails in the city work, and the frequent stops and starts, the sharper curves and steeper grades that obtain in the country. But, that the steel tired wheel is better adapted for interurban work than its cast iron rival, from the two-fold standpoint of safety and economy there cannot be doubt.

Nuttall Solid Gears.

The R. D. Nuttall Co., of Pittsburg, Pa., has developed a line of solid gears for electric railway service, represented by the accompanying illustration. The solid type of gear is put onto shaft under a pressure of from 10 to 25 tons, which is sufficient in itself to insure a permanent and tight fit. The design of the solid gear allows a perfect distribution of the material, the result of an exceptionally strong gear without the disadvantage of great weight thereby being



NUTTALL SOLID GEAR.

obtained. The solid gear is recommended especially for high speed interurban service where heavy cars and large motors are used, requiring axles of proportionally large diameter, but the company states that it has received some very flattering reports from the management of systems using lighter cars equipped with solid gears. The solid gear eliminates a danger of accidents due to the breaking or loosening of bolts, which almost invariably results in a bent armature shaft and injury to the gear case and other parts that are directly connected.

The illustration shows the general design of the Nuttall solid gears but this design may be modified to some extent in order to meet the requirements as to axle and gear diameters. The company has a complete line of patterns and full data on gears for different motors, so that orders for solid gears can be filled with exceptional dispatch.

Plans of the New York, New Haven & Hartford Railroad Co.

The New York, New Haven & Hartford Railroad Co. has announced that it will expend eight million dollars or more for improved rapid transit in the Bronx Borough, of New York City, and that part of Westchester County lying along the Sound. Plans have been made and estimates submitted for "six-tracking" the Harlem branch of the road, and of the six four are to be equipped for electric operation, using the third rail system of distribution; this leaves two tracks for the use of steam trains. The line will connect with the Interborough Rapid Transit Co's. lines near West Farms station.

The formal application to the Railroad Commissioners shows the present estimate of the cost of the improvements is $7,701,891. This includes 70 cars equipped with electricity complete, four third rails, bonding surface rails with necessary marine cables at drawbridges, feed wire, high tension wires and pole line complete, two substations, car barn, and power house with all material. The rebuilt line will be practically without grades and curves and entirely free from grade crossings and the number and arrangement of the tracks will allow exceptionally fast time to be made. Two of the electric tracks will be for express trains and the other two for local trains. As a result of its experience in the operation of electrically equipped lines in Connecticut, the New Haven road is prepared to go forward with the establishment of an extensive and complete auxiliary electrical system.

French Work on Electric Traction.

TRAITE PRATIQUE DE TRACTION ELECTRIQUE, by L. Barbillion and G. J. Griffisch. Published by E. Bernard & Cie, 29 Quai des Grands-Augustins, Paris. Two volumes, 7 x 10 in., together comprising 1,530 pages, profusely illustrated. Price of complete work 40 francs ($8.00). Vol. I appeared in 1903, and Vol. II early in 1904.

This book on electric traction is another example of the thoroughness and painstaking care with which the work of French writers on technical subjects is carried out. An idea of the scope of the work can perhaps best be given by summarizing the subjects covered by chapters. The introduction deals with preliminary survey and a discussion of the formulas as to train resistance and motor performance, and the data on which these formulas are based, upon which an engineer must depend in his preliminary estimates, as to expected performance. Chapter I is on roadbed, rails, switches, bridges, etc., with estimates of cost. Chapter II covers the production of energy, and is subdivided into discussions of the general conditions governing the choice of different sources of power; of steam apparatus, both engines and boilers; of electrical equipment, and of the relative cost of plants of different types; an appendix gives sample specifications and estimates of costs. Chapter III is on the different systems of transmitting energy. Chapter IV discusses the details of construction and operation of the power and return circuits and the apparatus used in connection with the distribution of energy, in the various systems of electric traction, including storage battery cars. Chapter V, which concludes Vol. I, similarly covers the electrical equipment of the cars or locomotives, with discussion of both motors and controlling apparatus. Chapter VI, under the general title of rolling stock, deals with all the important parts of the car, aside from electrical equipment, in detail; under this head are included brakes and lighting. Chapter VII is on the special characteristics of urban, suburban and interurban railways, their modes of exploitation, their requirements in the matter of depots, car houses, repair shops, etc. Chapter VIII is devoted to electric traction on railroads, under which term are classified elevated and underground roads in cities, and high speed lines in general, as distinguished from tramways; this chapter concludes with an extended description of the Zossen trials. Chapter IX has for its subject special applications of electric traction to freight service on land and on canals, to mining, to mountain railways with steep grades, to industrial railways, etc. Chapter X, which concludes Vol. II, is a resumé of the French laws and regulations affecting electric traction.

The plan followed with each branch of the subject is to give a discussion of the theory involved, giving due attention to the underlying principles but omitting calculations of purely theoretical value, then show the practical applications, with examples of modern construction and apparatus. In appendices are given forms recommended for specifications and much valuable data on costs.

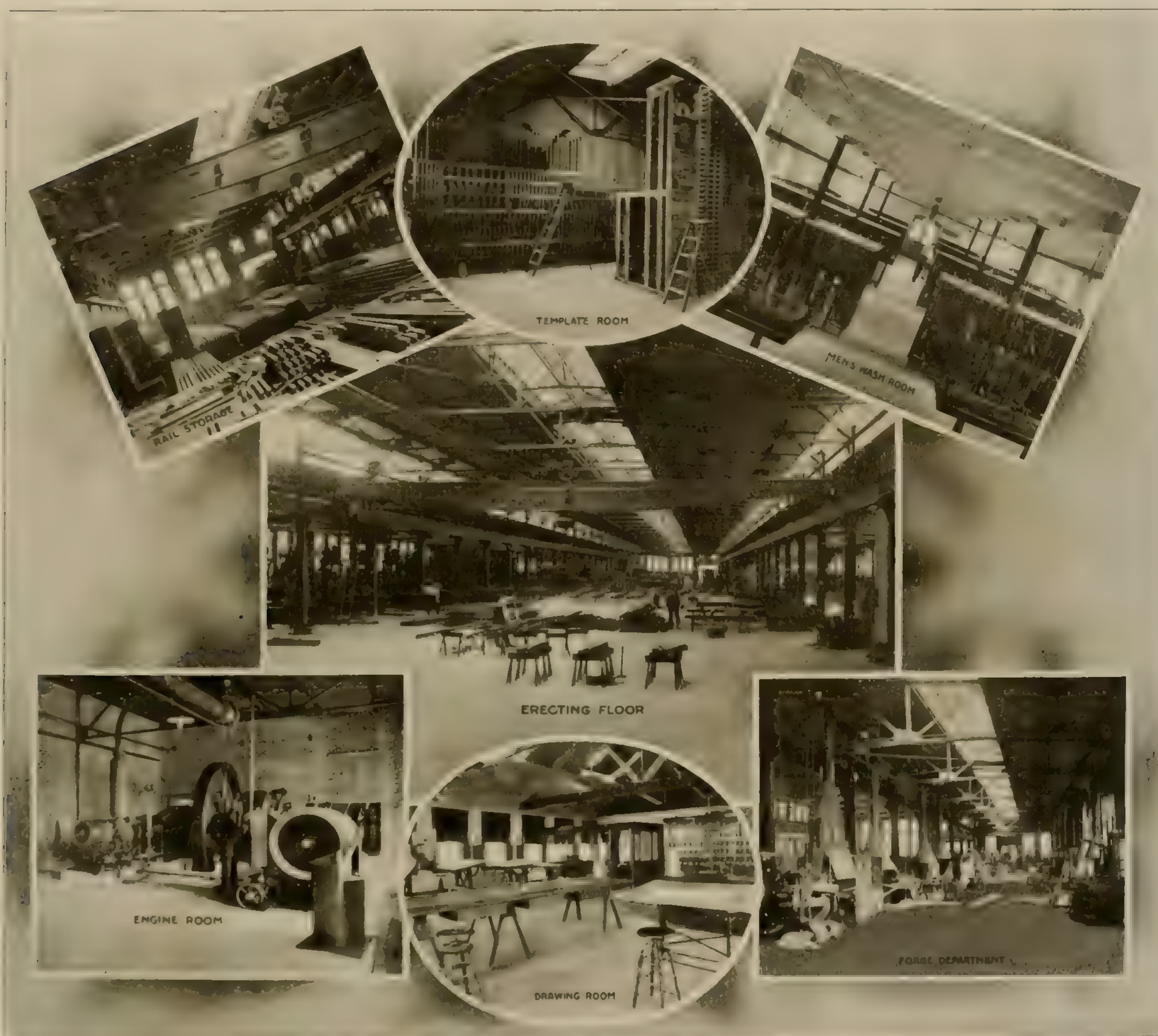
Brooklyn Rapid Transit cars will be operated over the new Williamsburg Bridge by November 1st. Owing to delays on the Manhattan side, cars of the Metropolitan Railway Co. cannot be operated on the bridge before the first of the year. The shuttle-car system will not be in readiness until about that time.

New Plant of the Weir Frog Co.

The Weir Frog Co., of Cincinnati, has every reason to be proud of its new manufacturing plant, which has recently been completed. The new plant is located at Norwood, Ohio, a suburb of Cincinnati, and is reached by the Baltimore & Ohio Southwestern, Cincinnati, Lebanon & Northern and Pennsylvania railroads, also by the line of the Cincinnati Traction Co. The buildings were designed by Bert Baldwin & Co., architects and engineers, of New York and Cincinnati.

The plant comprises three brick buildings, two of which are two [illegible] in height, 40 ft. by 60 ft., one used for general offices and drafting room and the other used for men's wash and locker rooms on the first floor and pattern shop and storage on the floor above. Each of these buildings is connected to the main shop by covered passageways. The main shop is a one story building 125 x 662 ft., giving nearly 83,000 sq. ft. under roof. It is heated by the American Blower Co. and the Webster vacuum system, using exhaust steam from the engine. The roof is carried by steel trusses supported on steel columns. The light comes from the windows in the side walls, which are set about 6 ft. above the floor, from the four skylights in the roof, and from the side windows above the roofs of the side bays.

In entering the main shop from the office building, the shop office, tool room and template storage room are first entered, next to which is the erecting and machine floor room, 125 ft. by 260 ft., with a cement concrete floor, as have also the drill press, engine, filter and boiler rooms. On this floor are the planers, straightening machines, and some special machines, which are served by two electric cranes, one used principally to unload and load cars, the second to supply the erecting floor and machines with material from the stock department. Beyond the erecting floor is the stock department, into which end of the building is brought the railroad track, which holds ten cars. This track is set low enough to bring the car floor even with the level of the shop floor. The stock department is 60 ft. by 400 ft.



SCENES IN THE NEW PLANT OF THE WEIR FROG CO., CINCINNATI

and is enclosed by a fence. The heavy material, such as rails, plates and bars, are piled on the floor, while the small supplies, like rivets, bolts, nuts, etc., are placed in storage bins. The forge department is on the south side of the main building, and is equipped with forging machines, presses, hammers, heating furnaces and blacksmith fires. On the north side of the building, opposite the forge department, are located special tools for bending, curving, drilling rails, etc.

Power is furnished by a 500-h. p. Brown automatic compound engine, manufactured by I. & E. Greenwald Co., Cincinnati, which is direct connected to a 300-kw. Bullock 220-volt generator. Every machine in the shop has an individual motor, with the exception of a few small machines taking power from a line of motor driven shaft

ing. An Ingersoll Sergeant air compressor furnishes power for riveters and for pumping water, which is supplied from an 8-in. artesian well, 320 ft. deep. The water is stored in an elevated tank 60 ft. above the ground, with a capacity of 20,000 gallons, and supplies all the water used. The floors of the filter and boiler room are 10 ft. below the level of the engine room floor, and about 8 ft. below the level of ground outside. All coal is received in hopper bottom cars and dumped direct on the floor of the boiler room. There are four 250-h. p. Stirling boilers, equipped with "American" stokers. The well water is softened and filtered by the Wefugo process and heated in a Webster exhaust steam heater.

New Wabash Train to St. Louis.

The Wabash R. R., on August 1st, placed in service between Chicago and St. Louis a new train built expressly for the World's Fair service. It is a daylight special and will be known as the "Blue Banner Limited." The train is a new departure in that it is an attempt to offer to persons traveling by day the same conveniences that may be had in a Pullman sleeper. Each train consists of four cars—a combination baggage car and smoker, a combination coach and chair car, a combination diner and buffet and a combination parlor and observation car. The interior finish of the car is African mahogany and the decoration holly inlaid. The entire train is lighted by electricity by a consolidated generator of the Gould pattern, the energy being derived from the car axle. Two rows of lights are placed on the sides of the car, one just above the seat back and the other at the lower line of the roof arch. In connection with the generator is a storage battery of sufficient capacity to provide lighting for 24 hours after the train stops. Two electric fans are placed in each car. The color scheme in the decorations and furnishings is green, admirable taste having been shown in the design and quality of the materials.

Westinghouse Automatic Couplings.

The operative exhibit of the Westinghouse Automatic Air & Steam Coupling Co. at the Louisiana Purchase Exposition, in the Palace of Transportation, shows in operation a simple, substantial, automatic hose connection. The objects in the design of a device to do away with a common method of hand clamping of inter-car hose connections were three-fold; first, to insure the safety of the railroad employe, second, and of no less importance, to secure time economy, and third, to provide an apparatus which would reduce the necessary quantity and wear of hose to a minimum.

It is claimed for these couplings that their use will give positive assurance that the couplings are at all times perfectly made, without friction or pull on the hose connections, and at the same time that the incoupling, which is always automatic, will positively be effected without strain of any kind on the apparatus, should the train be parted by accident, the air brakes being thus automatically applied.

The operative exhibit at the Fair consists of an arrangement of two short car platforms, modeled to represent the ends of passenger and freight cars, together with a locomotive pilot. The model is operated by compressed air and the couplings shown are in three instances passenger equipment and in two the single hose equipment for freight car brakes. A miniature model of two complete car trucks and frames, fitted with air and steam and signal hose coupling and air cylinder, supplements the heaviest exhibit, and both are in more or less constant operation.

One of the most enjoyable trolley trips in Ohio is from Conneaut to Erie, Pa., over the Conneaut & Erie Traction Co's. line, which follows Crooked Creek and crosses it below East Springfield, passing through the Canyon, where the scenery is beautiful, into fine farming country. The round trip mileage is 100 miles.

The special touring car trips of the Cleveland Electric Railway Co., of Cleveland, Ohio, are becoming more popular and the good advertising of this feature has resulted in its very liberal patronage. The latest poster is in green and red, calling attention to the car, the time of the daily trips, the starting points, cost of the trip and the fact that it is the best way of seeing Cleveland, all points of interest being callen en route.

An Improved Hot Water Car Heater.

The past year has shown a marked increase in the use of hot water heaters for city and interurban cars, and we take pleasure in showing herewith the improved "Western" car heater and fittings manufactured by the Franklin Railway Supply Co., Franklin, Pa.

The "Western" car heater has been on the market during the past year and has met with an unusually favorable reception. Last winter it was placed upon a car of the Chicago & Milwaukee Electric Railroad Co., Highwood, Ill., in competition with other makes. The result of the test made by this company at that time resulted in this heater being made standard and adopted on the new cars recently built by the Jewett Car Co. Since then it has been placed upon 30 new cars of the Milwaukee Electric Railway & Light Co., 23 new

REVOLVING SMOKE JACK.

OPEN. CLOSED.

THE WESTERN HOT WATER CAR HEATER.

cars of the Metropolitan West Side Elevated Ry., Chicago, 10 new cars of the South Chicago City Ry., 8 cars of the Central Illinois Construction Co., 4 cars of the Green Bay Traction Co., and a contract closed as we go to press results in the heating systems of this company being placed upon all the closed cars of the Syracuse Rapid Transit Co., and on 60 large cars for the Rochester Ry.

The "Western" car heater has a water jacket surrounding the entire fire space. Its outer shell is composed of ¼-in. flanged steel, which extends from the cast iron base plate to the ornamental hood. Within this shell, extending from the grate to the top ring, is another flanged steel shell, which is flanged and riveted to the outer shell. The two nickeled rings hide the rivets from view. Between these two shells is the 1¼-in. water jacket, the outer shell being tapped at the top and bottom of the water jacket and connected with the radiating pipes. Water circulates freely around the entire stove. This construction has many advantages. It prevents the overheating

of the air or wood work in the immediate vicinity of the heater. The heat ordinarily radiated to the air, in this construction is imparted to the water, increasing the efficiency of the equipment. There is no danger of the walls of the heater burning out because the water jacket forms a most perfect insulation resulting in a more durable equipment. The outer shell being of heavy steel, it cannot be marred or dented, therefore the equipment presents a neat appearance at all times as the water jacket prevents the shell of the heater getting hot enough to burn off the enamel. The heater has a heavy cast iron base plate, which has a generous ash lip in front of the bottom door, preventing ashes from being scattered over the floor of the car. The top of the heater consists of two cast iron hoods, resting

Open. Closed.

IMPROVED FILLER COCK.

upon a cast iron top plate. The outer ornamental hood is open scroll work, nickeled, forming a perfect insulation preventing passengers from getting burned should they fall against the heater. The inner hood is a one-piece heavy casting, the only opening being the coal door and the flue for the stove pipe. This construction, in connection with the gas chamber which rests upon the top ring extending over the magazine hole, immediately in front of the coal door, prevents the escape of smoke and gases into the car. From the center of the top ring hangs the coal magazine and around the magazine is a coil of 1¼-in. pipe, its length depending upon the heating surface desired in the equipment. Over the top of the magazine swings a

EXHIBIT OF FRANKLIN COMPANY AT THE WORLD'S FAIR.

cast iron door, preventing a draft from passing through the coal [illegible]

It is readily seen that this magazine construction, besides acting as a feed to the fire, prevents the coal from obstructing the heating surface, and acts as a flue guiding the gases freely around the entire surface of the coil.

On another page is shown a sectional view of the heater indicating more clearly the parts described. This heater has the advantage of taking up very little space in the car, being only 16 in. outside diameter. If it is placed on the platform ample room is allowed the motorman to operate the car without being crowded.

The improved filler cock shown herewith is one of the fittings used upon the "Western" car heater system. It has the advantage of being composed of but two pieces of brass, requires no wrench, and has an automatic outlet for the air when water is poured into the expansion drum.

Attention is called to the improved safety valve in which cinders and dust cannot block or aid in the corrosion of the seat of the valve; and the revolving smoke jack, which acts as an improved ventilator, preventing smoke and gases from being blown down the stove pipe into the car.

This heater was designed and patented by Mr. Kenneth D. Hequembourg, formerly of Dunkirk, N. Y. Mr. Hequembourg was at one time connected with the Brooks Locomotive Works. Before taking the management of the car-heating department for the Franklin Railway Supply Co. he was connected with the Chicago office of the Consolidated Car-Heating Co. Mr. Hequembourg's headquarters are at Franklin, Pa., which is the main office of the company. Messrs. Porter & Berg, 303 Dearborn St., Chicago, represent the car-heating department of this company in the central west, and Mr. W. H. Schofield, 505 Kemper Bldg., Kansas City, Mo., looks after the trade in Missouri and west of the Missouri River.

The exhibit of the Franklin Railway Supply Co. at the World's Fair is in the Palace of Transportation, aisle D, opposite post 58, and shown in the accompanying illustration. The exhibit consists of the "Western" water jacket car heater manufactured by that company, and the "New Columbia" car heater.

The principal exhibit is the "Western" car heater. To the right of this heater is the "New Columbia" car heater, designed to be used in smaller cars. This is a magazine self-feeding car heater and has a magazine capacity for a day's run. There is no necessity for handling coal or ashes during the run and the design of the heater is decorative and ornamental.

Mr. W. H. Davis is in charge of this exhibit as well as that of the McGuire-Cummings Co., and has arranged the booth as an office, furnished with a desk, chairs, tables, and seats, as may be seen in the accompanying engraving. Mr. Davis will be very glad to meet those who are interested in car heating and will be glad to point out the various merits of these two heaters.

Ohmer Register Contracts.

The Ohmer Fare Register Company, of Dayton, O., has just closed contracts for equipping 16 additional properties for the Public Service Corporation of New Jersey. The contracts are for several types of registers, mounted for recording from two up to twelve different classifications of fares. Besides receiving this large additional order, the Ohmer company has also just closed a renewal contract with the Indiana Union Traction Co., of Anderson, Ind., for all its various branches between Anderson, Indianapolis, Muncie, Logansport, Marion, Alexandria, Elwood and other points. The renewal contract provides for the equipping of a number of cars. New and renewal contracts have also been made by the Ohmer company during the past few weeks with other street and interurban railway companies, notably in Ohio, Pennsylvania, Kentucky, California, Colorado, Arizona, Michigan, Illinois, New York and Canada.

The Only Way to St. Louis.

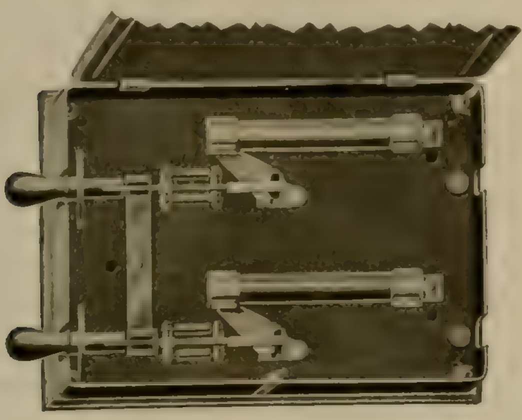
The Chicago & Alton Ry., widely known as "The Only Way," operates eight fast limited trains, daily including Sundays, between Chicago and St. Louis. All day trains are equipped with new and modern day coaches, chair cars, free of extra charge, cafe cars with smoking-library-compartment, and Pullman parlor observation cars. Night trains are equipped with reclining chair cars, free of charge, Pullman standard first-class drawing-room sleeping cars, and sixteen-section sleeping cars. All cars are lighted by electricity and cooled with electric fans. The Alton Limited is one of the most handsome and most luxurious trains run by any railroad company in the world.

A trip over the Chicago & Alton to St. Louis would be of especial interest to street railway men as the Aurora, Elgin & Chicago electric line parallels the Chicago & Alton for some distance and gives opportunity for comparison of the construction and maintenance of the steam and electric lines.

New Electric Heater and Switch.

The accompanying illustration shows the Consolidated Car Heating Co's. new double coil electric heater for cross-seat cars and parlor cars. The heater is intended for installation along the truss plank and projects but 2⅝ in. The lead wires are carried through the ends of the heater cases and in consequence molding is required only between the heater cases. Where a continuous row of heaters is used, the coils from one heater can be connected to those of the next without bringing the wires outside the heater cases.

The switch illustrated is the Consolidated Car-Heating Co's. new regulating switch for heating circuits. In this there are two quick break knife switches and two fuses mounted on a slate base. The



DOUBLE QUICK-BREAK KNIFE SWITCH—COVER REMOVED.

frame and cover are of malleable iron, finished in copper bronze. The cover is hinged to the frame at the top and locked by a spring at the bottom. This cover is raised when it is desired to change the position of the switch.

Three-Phase Static Ground Detector.

Static ground detectors are now recognized as a necessary part of every first class installation. The single phase instruments are entirely satisfactory on single or two-phase circuits, and for three-phase circuits the practice has been to use two or three single-phase instruments either separately or combined in the same case. This arrangement is open to the objection that the indications of the pointer are not direct and it is difficult to determine which line is grounded.

A new instrument, which has been recently placed on the market by the Westinghouse Electric & Manufacturing Co., enables a ground to be indicated directly by the use of one instrument, and these instruments are supplied for circuits of from 1,000 to 50,000 volts. Each of three fixed vanes in the instrument is connected to a line of the three-phase circuit. The central movable vane is electrically connected to the case which is grounded. When there is no ground upon the circuit the attraction between the fixed and movable vanes is balanced and there is no deflection. If one of the lines becomes grounded the potential of that line is the same as that of the movable vane and there will be no pull in that direction and the movable vane will be deflected away from the grounded line.

The three leads to the ground detector have a condenser inserted between each line and the instrument. This avoids carrying high tension wires in front of the switchboard. The condenser consists of brass tubes covered with insulating material and placed within a copper sheath the line being connected to the inner tube and the lead to the copper sheath. The instruments in shape and size correspond to Westinghouse round pattern switchboard instruments. The interior of the case is given a dull black finish against which the aluminum vanes stand in distinct relief.

The Columbus, Newark & Zanesville Traction Co. has reduced its schedule to three hours between Columbus and Zanesville, and is now giving hourly service over the entire line.

H. A. Dorner & Co.

The electric railway supply house of H. A. Dorner & Co., 806-7 Great Northern Building, Chicago, has added several new lines to its already large business and purposes in the near future to open

HEATER NO. 203M FOR CROSS SEAT AND PARLOR CARS.

a branch office in the New England Building, Cleveland, O. The firm will sell the following well-known specialties: The Dorner high-speed motor trucks; McGuire-Cummings snow sweepers, sprinklers and trucks; Spear patent insert brake shoes; Logan chemical fire engines for car houses, and hot water heaters for cars; Erie self-oiling trolley wheels and harps. They will also handle fenders, pit jacks, cars, motors, shop machinery, copper wire, weather-proof wire, and galvanized steel strand wire and cables.

The business of H. A. Dorner & Co. has shown a steady increase and indications point to some large contracts being booked within a short time. Mr. H. A. Dorner has been in the railway supply business continuously since 1885, as manufacturer and sales agent.

Shanahan Trolley Catcher and Retriever at Utica.

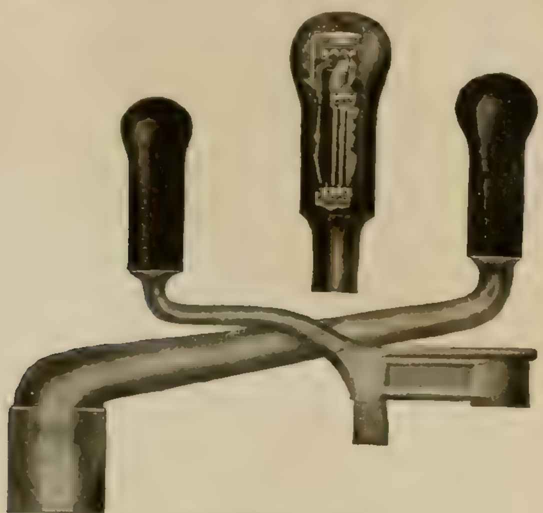
Delegates to the recent meeting of the New York State Street Railway Association at Utica were interested in the trolley catcher and retriever shown by the Shanahan Trolley Specialty Co. of Little Falls, N. Y. This device is intended to pull down the trolley wheel and pole the instant the trolley wheel leaves the wire, and thus do away with injury to either the pole or overhead construction. The motive power of the retriever is a large spring which can be adjusted to any tension to correspond with the tension on the trolley pole. The device was described and illustrated in the "Street Railway Review" for July 20, 1904.

The device is the invention of Mr. Thomas B. Shanahan, who is a street railway man of wide experience, and who for the past ten years has been master mechanic for the electrical branch of the Fonda, Johnstown & Gloversville Railroad Co. Mr. Shanahan is president of the company organized to put the device on the market. The vice-president of the company is Mr. John N. Shanahan who holds the office of general superintendent of the Fonda, Johnstown & Gloversville Railroad Co. The catcher and retriever is being used on a number of roads in New York State with satisfactory results.

The Toledo, Bowling Green & Southern Traction Co. has purchased three package freight cars and will on October 15th begin to carry freight between Findlay and Toledo. J. S. Young, of Chattanooga, is general freight agent, with headquarters at Findlay.

Anti-Friction Brake and Controller Handle.

The Anti-Friction Handle Co. of Amsterdam, N. Y., is putting on the market a new anti-friction ball and roller bearing handle, designed for brake and controller handles of electric cars. The improvement has reference to the hand hold or grip of the handles. This roller bearing grip allows the motorman considerable wrist motion, and it is believed by using the device on both the brake and controller handles, the chances for accidents will be perceptibly decreased, because the motorman is relieved of much of the strain on his arms. It has frequently happened that a motorman will take his hands off the handles in order to relieve his wrist and arm from the strain of grasping the old style of brass handles. With this new attachment, the motorman can change the position of his hands



ANTI-FRICTION HANDLE.

and arms and at the same time keep his hands on the handles ready for any emergency. The new roller bearing handles are fitted with rubber grips which render the brake and controller handles non-conductors and prevent electrical shocks to the motorman. The use of padded gloves is therefore rendered unnecessary. The construction comprises a series of hardened steel rollers and balls, revolving between a shaft and steel shell, encased in the hard rubber grips. When desired old brake handles of any make can be fitted with anti-friction handles at small cost. The Anti-Friction Handle Co. will send sample handles to any road upon request.

To the Convention via the Illinois Central.

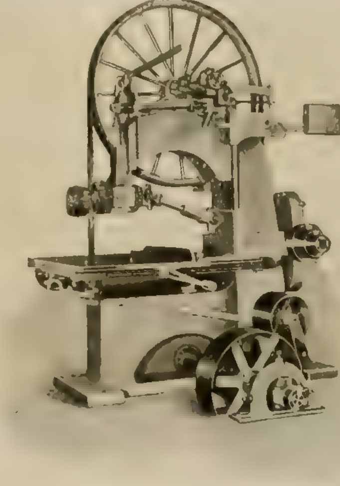
The geographical relation of the Illinois Central R. R. to St. Louis and to the country as a whole, with its principal main and subsidiary lines, the "Central Mississippi Valley Route," is such that, by both its own through lines and those of connections, it is in a position to serve a vast territory with frequent and efficient train service to St. Louis. During the St. Louis World's Fair its service has been increased and largely extended in various directions. In general it may be said that the number of additional trains and the shaping-up of through connections to St. Louis over its lines has been considerable; also that the establishment of traffic arrangements with connecting lines for through service to St. Louis from the east, north, southeast and south is on such comprehensive plans as to greatly benefit the traveling public from sections of the country mentioned. The service between Chicago and St. Louis has been increased from two to four trains daily, as follows: 8:50 a. m., 12:04 p. m., 9:27 p. m., and 11:36 p. m., and there has been through sleeping car service established over various connecting lines

The through trains of the Illinois Central are composed of modern equipment of the finest order, including buffet-library-smoking cars, parlor cars, Pullman sleeping cars, Illinois Central complete dome-deck dining cars, free reclining chair cars and comfortable day coaches. Trains of the Illinois Central enter St. Louis over both the Eads' and the Merchants' bridges, and, in common with all roads entering the World's Fair City, have their terminus in the Union Passenger Station.

Band Saw for Timber Ripping.

Most every woodworking shop has more or less lumber to rip and car shops and other places where ripping is done have for a long time used circular saws which have answered the requirements as no better tools could heretofore be procured. Recently band rip saws have been introduced and these tools are now largely used in lumber ripping. The thin saw blade saves a large waste in the saw kerf and this soon amounts to a big sum, especially when fine lumber is cut. The band saw is replacing the circular saw for the reason that it effects a great saving in economy, efficiency and output.

This innovation in ripping machinery is due to J. A. Fay & Egan Co., 250 W. Front St., Cincinnati, O., which is the largest builder of standard woodworking machinery in the world. Recognizing



BAND SAW FOR RIPPING.

the demand for a machine capable of answering these particular requirements this company, after many experiments, has now produced a tool which is said to be one of the very finest for this class of work.

The accompanying illustration shows the company's improved No. 109 patent band rip saw which is recommended for doing fine ripping in light or heavy timber and which will rip with facility any thickness from half and one inch to 14 and 28 in. wide between the saw blade and the fence. Where long timbers are ripped by hand feed this tool will repay its cost in a very short time.

While it is adapted for heavy work it is equally good for ripping the finest lumber into small strips and it is under these conditions that the thin blade of the saw will be appreciated better than at any other time. This new tool presents a large number of original features and improvements too numerous to describe in detail. One of the most important features is a patent straining device on the saw blade which is hung solely on a knife-edge balance. This gives continued uniformity in the strain and prolongs the life of the blade to a considerable extent.

THE UNIVERSITY OF ILLINOIS STUDIES NO. 7 has just been issued, bearing the title "The Coals of Illinois; Their Composition and Analysis," by S. W. Parr, Professor of Applied Chemistry. This is by far the most comprehensive work so far undertaken on Illinois coals. One hundred and fifty samples fairly representative of the coal producing area have been studied and the results conveniently arranged in a table for reference. Several unique features are evident. The samples collected between January and June, 1904, were subjected to the same processes carried on by the same persons; the results, therefore, are more uniform and comparable than any heretofore available. Another striking feature is the introduction here for the first time of a new factor in the proximate analysis of coal, that of "water of composition" as part of the volatile constituent. It is a little startling to see a non-combustible as part of the volatile matter, equaling and often surpassing in amount the sum of the ash and moisture. Special development has been made, also, of processes for determining the total carbon, sulphur and coke. Altogether, the work is a valuable contribution to our knowledge of bituminous coals in general and Illinois coals in particular.

Best Adjustable Wedge Gate Valves.

The Best Manufacturing Co., Pittsburg, Pa., which has also branch offices at New York, 39 Cortlandt Street, and Philadelphia, Pa., Betz Building, furnishes and erects complete piping systems for power plants, making a specialty of high pressure valves and fittings, especially piping fitted with its "Climax" rolled and corrugated pipe joint. The valves and piping are especially well adapted for superheated steam.

The company has just issued a new specialty pamphlet No. 6, which illustrates the different specialties made by it. The Best adjustable wedge gate valve, "Climax" globe and angle valves and the "Climax" rolled and corrugated pipe joint, as well as the pipe bends, are well known.

BEST ADJUSTABLE VALVE.

The accompanying illustration is a "phantom" view of the Best adjustable wedge gate valve. It will be noted that the wedge is in the same form as the double seated taper wedge, except that it is in two parts. There is a ball joint on the inner surfaces the entire circumference of the disks, insuring a positive seating and adjustability, thus taking up the wear and making the valve very durable. There are splines or guides cast in the body on either side, and also wings cast on either side of the wedges, which fit on the inside of the guides of the body, designed to absolutely prevent the valve becoming disarranged. It is so constructed that it has practically no more parts than a solid taper wedge gate. The wedges have bronze facings, all spindles are fitted with packing collars, the bronze seats are screwed up in such a manner as to leave no pockets in their rear for steam and water to attack the threads. This valve is especially fitted for all pressures, and particularly high pressures and superheated steam.

The many orders received for these valves from some of the largest concerns in this country is good evidence of their durability and success. All the valves in the new power house of the Manhattan Elevated, in New York, were made by this company, including both high and low pressure valves. Another large order for Best valves, fittings and piping with "Climax" rolled and corrugated pipe joints, for superheated steam, 200 lb. working pressure, 600° F. was from the Copper Queen Consolidated Mining Co., Douglas, Ariz. This company also equipped a large power station for the General Electric Co., of Schenectady, N. Y., at Darling Harbor, Sidney, Australia; also its works at West Lynn, Mass.

The White Star Oil Filter.

In many engine rooms, and indeed, in every factory and mill where a large amount of machinery and long lines of shafting are in operation, there is a great waste of lubricating oil, owing to the fact that often no provision is made for catching the oil after it passes through the bearings. Where provision is made for catching the oil after passing through the bearings and purifying these drippings through an oil filter, a great reduction in the oil bills will be found.

Every engineer appreciates the value of good oil and having obtained a good grade of oil, the engineer will naturally be glad to use some filtering device for purifying the oil which has passed through the bearings, thus permitting its use over and over again.

An interesting test of the "White Star" oil filter, made by the Pittsburg Gage & Supply Co., Pittsburg, Pa., was conducted recently in the factory of O. J. Beaudette & Co., Pontiac, Mich. It was found that in six months' operation of the "White Star" filter, a saving of 364 gallons of oil, amounting to $54.60 was effected. As the original cost of the filter was but $28 the profitableness of the investment is easily figured.

In this oil filter are found the essentials of a complete device for accomplishing the purifying of dirty, or used, lubricating oil. As seen in sectional view the filter is divided into two compartments. The smaller one is a reservoir for impure oil and water, containing a funnel for receiving the dirty oil and steam coil for heating the water.

The impure oil is poured into the funnel, drains through a sieve and is discharged below the surface of the water through holes in the foot of the tube. The thinning of the oil by its exposure to the heat in passing through and resting on the surface of the water, promotes the precipitation by gravity of all heavy particles of grit

"WHITE STAR" OIL FILTER.

and dirt, the accumulation of which at the bottom can be quickly flushed out by opening the faucet for this purpose.

When sufficient impure oil has been introduced to reach the level of the inlet pipe, it flows into the filter cylinder which is suspended in the larger compartment. This cylinder is unique in that it consists of a sheet metal neck and bottom with a section of coarse wire mesh between, around which several layers of cloth are wrapped. The oil in passing out of this cylinder through the cloth is thoroughly and quickly freed of every remaining impurity and accumulates in the surrounding chamber which comprises the remaining two-thirds of the filter, giving the White Star a large storage capacity for pure oil. The filtering cylinder and every part of the filter may be quickly and easily removed and cleaned, enabling it to be always kept in perfect filtering condition.

The Bellamy Vestlette.

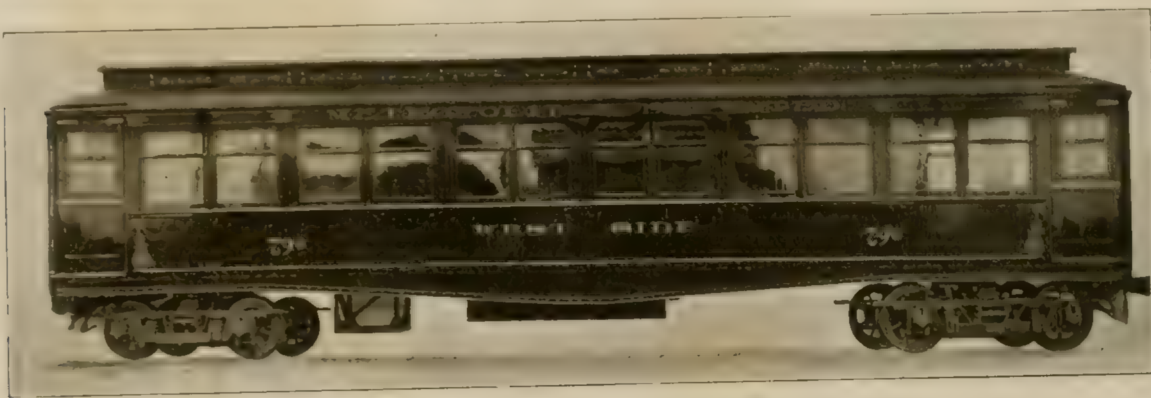
The accompanying illustration shows the Bellamy vestlette, made exclusively by the Bellamy Vestlette Manufacturing Co., of Cleveland, O. This device has been adopted and recommended by about 100 street railways in this country and about 50,000 of the vestlettes are now in use. It has proved itself a safeguard to the conductor on account of the peculiar construction of the pockets which makes it impossible for a pickpocket to get his hands into them without being detected. Neither can change be lost out of the pockets in jumping on or off cars. It is also claimed to save conductors considerable money each year in the expense of clothing as coats will last as long again and the pockets will not become ragged as when used for carrying change. The uniform vest can also be dispensed with as it need only be worn when off duty.

Most all of the companies where the vestlette has been adopted permit their conductors to wear light skeleton uniform coats in place of the heavy coat in general use. These vestlettes are provided with sufficient pockets to carry money, tickets, reports, punch, transfers, watch, etc., and are made of strong, durable material with cloth finish of the same color as the uniform and of good quality.

Vestibule Cars for Chicago Metropolitan Elevated.

The Metropolitan West Side Elevated Railroad is about ready to put into service a new type of car, twenty-three of which have been built by the Jewett Car Co., of Newark, N. J. A general description with drawings of this car was published in the "Review" for July, page 486, and owing to the completion of part of this order a general view of this type of car, shown herewith, will be of interest. Fig. 1 shows an exterior side view of the car and Fig. 2 the plan of the vestibule.

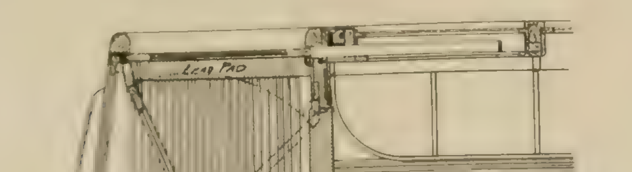
The cab is so arranged as to form an enclosure on the platform when closed, giving ample room for the motorman, as shown in dotted lines. When not in use, the cab folds up into a very compact space against the end of the vestibule, enclosing the engineer's valve and master controller, so as not to obstruct the passage way for passengers going in and out of the car.



STEEL FRAME CAR FOR METROPOLITAN ELEVATED, CHICAGO—JEWETT CAR CO.

The opening on each side of the vestibule is closed by a sliding door which is operated by a pneumatic door-opening and closing device. This device is operated by the guard who stands across the two platforms, in a manner similar to that which is in use in operating platform gates.

This device consists of an air cylinder which is fastened to the side plate of the car, behind the headlining, with its piston rod attached direct to the door, and is operated by means of a four way controlling valve, which admits the compressed air to either end of the cylinder at will. The construction of this door operating device is such that the speed of the door is automatically controlled by exhausting the air in the four way valve.



PLAN OF VESTIBULE END

The end bulkhead is left out, thereby greatly increasing the rapid loading and unloading of passengers, whose entrance and egress is only dependent upon the width of the sliding door, which is 35 in. wide. Another advantage of the omission of the end bulkhead is that the interior carrying capacity of the car is greatly increased.

The floor framing of these cars is of steel construction, the side sills being extra heavy, consisting of a 5-16-in. vertical plate with angles at the top and bottom, the cross section of which gives the appearance of a large I-beam. This side sill is designed in the form of a truss, which does away with the truss rods. The entire floor framing is covered with 3-16-in. steel plates to which the stringers for holding the floor are bolted. The body framing throughout is made of ash and the end of the car is strengthened by an anti-telescoping device.

The inside finish is mahogany inlaid with neat marquetrie. The headlining is painted green with gold decoration. The seats at ends are longitudinal and in the center of the car are eight stationary cross seats. These seats are of the Hale & Kilburn steel frame fireproof type. Solid bronze trimmings are used.

The cars are mounted on Baldwin trucks and are equipped with Westinghouse automatic quick acting air brakes, Van Dorn automatic couplers, Franklin hot water heaters, and pantasote curtains, made by the Curtain Supply Co. The cars were designed by Mr. W. S. Menden, chief engineer of the Metropolitan West Side Elevated Railroad.

Maintenance of Way Report.

PROCEEDINGS of the fifth annual convention of the American Railway Engineering & Maintenance of Way Association, held in Chicago, March 15-17, 1904, has just been published under the direction of the committee on publication. The book contains 884 pages and is copiously illustrated with numerous plates, tables and blank forms of records, etc. The subject matter includes complete reports of the various standing committees of the association and the discussions thereon, as well as a number of auxiliary reports and special papers on different subjects by well-known authorities in their respective fields. The book opens with a complete table of contents and at the end is an alphabetical index covering 18 pages. The proceedings of this association contain an unusual amount of valuable information and the committee reports are examples of thoroughness which merit the emulation of other engineering societies. Each report is a complete treatise on the subject which it covers and generally includes not only a theoretical treatment of the subject but examples of current practice by the leading railroads of the country. The subjects covered are too numerous to be more than touched upon within the limits of a brief review, but taking an example at random the report of the committee on ties may be considered typical. It opens with a list of definitions of terms in general use, and is followed by a valuable collection of statistics on tie renewals. Preservative processes are next considered at considerable length and a list of the timber preserving plants in the United States, and the method of treatment at each plant is given. A paper on "Seasoning Tests," by Dr. Herman Von Schrenk, of the Bureau of Forestry, follows, also a "Report on Texas Track," by the same author, dealing with experiments on treated and untreated timbers. The discussion on this subject covers 27 pages. The subject of yards

and terminals is also treated at considerable length in a committee report, this subject also including piers, loading and unloading machinery for coal, iron, ore and other staple products; switching facilities and systems of passenger and freight transfers. The report of the committee on records, reports and accounts covering 150 pages includes standard records and forms of accounting in use on the various railroads. The subjects of track and ballasting, iron and steel structures, masonry and roadway, are also very fully covered. The entire contents of the Proceedings constitute an exhaustive and thorough treatise on the work of the maintenance of way department.

Laconia Cars for Indianapolis & Northwestern Traction Co.

The accompanying illustrations show part of a shipment of 10 cars recently built by the Laconia Car Company Works for the Indianapolis & Northwestern Traction Co. The cars were shipped from Laconia, N. H., to Zionsville, Ind., a distance of over 1,000 miles, on improvised freight trucks instead of on platform cars, as is the usual custom.

These car bodies are unusually long for electric service, being 61 ft. 3½ in. over all. They have three compartments. The main passenger room seats 46 people, and is finished in selected mahogany with neat inlaid marquetrie. The seats are Heywood Bros. & Wakefield Co's. No. 45-E, with high backs and head roll, upholstered in green plush and having bronze grab handles on backs. The smoking room is finished in green mission oak, with inlaid marquetrie, and has Wheeler seats with high backs and head roll, and upholstered in green leather. The baggage room at end of car is finished in white ash.

TRAIN OF LACONIA CARS FOR INDIANAPOLIS & NORTHWESTERN TRACTION CO.

The cars are heated by Peter Smith hot water heaters, which are located in baggage room. Laconia standard basket racks of bronze are used, there being 14 in the main compartment and four in the smoking compartment. The ceiling is of semi-imperial type, painted green and decorated. Glass for doors and lower window sash is of polished plate, and upper sash as well as monitor windows are glazed with opalescent cathedral glass. Curtains are of pantasote, mounted on Hartshorn rollers with Curtain Supply Co's. fixtures.

INTERIOR INDIANAPOLIS & NORTHWESTERN CAR.

A saloon is located in the end of passenger compartment. There is a water cooler in saloon with alcove in passenger compartment.

The cars are lighted by incandescent lamps arranged in arches of five lamps each across ceiling of car, with five circuits of five lights each in main room and two circuits in smoking room.

The front end of car is equipped with locomotive type of pilot, and rear end with Van Dorn automatic couplers. Cars are also equipped with Nichols Lintern air track sanders, Westinghouse Traction air brakes, General Electric 75-h. p. motors and multiple unit control system.

Fifth International Electrical Congress.

The Fifth International Electrical Congress was held at St. Louis, Mo., during the week of September 12th to 17th and convened in the Music Hall of the Coliseum. The membership of this congress aggregated over 2,000 and of this number between 400 and 500 were foreigners. At this congress the committee on organization decided to issue invitations to read papers instead of depending upon volunteer contributions, and the number of specially invited papers reached 160, of which nearly 100 were printed and ready for distribution to members when the congress convened. In addition to the Chamber of Official Delegates there were eight separate sections of the congress, each of which held separate sessions.

Section F—Electric Transportation, is the one of most interest to our readers and its proceedings will be treated in future issues of the "Review." Much of the work of this section was devoted to the alternating current commutating motor and problems of railway operation. The Chamber of Delegates in its report recommended that a permanent committee be formed of members appointed by governments which have legislation affecting units and standards, which committee shall pass upon all such proposed legislation.

The social features of the congress week included a number of enjoyable receptions and dinners, as well as visits to places of interest, all of which were well attended and reflected great credit on the work of the committee of arrangements.

Wabash R. R. Special, Chicago to St. Louis.

The Wabash R. R. will run a special train from Chicago to St. Louis, October 9th, for the accommodation of the Chicago delegates to the street railway conventions to be held October 10th to 15th, and has accordingly sent out circulars to this effect. The train will leave the Dearborn Station at Chicago at 11:30 p. m. and will arrive at St. Louis at 8:04 a. m. In addition to this special train, the Wabash R. R. regular service provides four daily trains, which leave Chicago at 8:45 a. m., 11:03 a. m., 9:17 p. m., and 11:30 p. m. All trains arrive in St. Louis via the World's Fair grounds, stopping at the Wabash World's Fair station.

The Wabash World's Fair terminal is an important undertaking and called for an outlay of $50,000 for the station structure alone. Much time and thought has been given to the plan for the terminal, which is located directly in front of the main entrance to the Fair.

On Motor Connections.

August 1st, 1904.

Editor "Review". I have recently tried a little scheme in motor connections that I think may be of interest to others. You will understand that in the usual forms of G. E. equipment, the current after leaving the controller passes to the armature, from the armature to the reverse and from the reverse to the fields and ground. We have had some trouble with the current jumping from the brush-holder to the frame of the motor, but, after testing armatures and fields, could not locate the trouble. I made a change in the connections to the motor by putting the field leads from the controller on the armature terminals of the motors, and the armature leads from the controllers on the field terminals of the motors, and find that our motors will not short circuit to the frame as before. Of course, the result of making this change has been to reduce the voltage before the current enters the armature, as the current now passes through the fields before it enters the armature. After running these motors for some time, we find it a big improvement, and I am sure it will cut down the armature repair expenses and will also show up bad fields at once, as the current is reversed in the fields instead of in the armature as before. Of course, with G. E. K and K 2 controllers using shunts this change cannot be made.

Yours truly,

A. F. Rexroth, Master Mechanic,
Central Pennsylvania Traction Co.

Harrisburg, Pa.

The Reason for Soap Specifications.

In the course of his presidential address before the American Society for Testing Materials, entitled "The Influence of Specifications on Commercial Products," Dr. C. B. Dudley, chemist for the Pennsylvania R. R., cites the experience of the company with soap, and incidentally discusses the chemistry of cleaning compounds.

"Perhaps some additional side light on our theme may be thrown by the history of another Altoona specification. It is now perhaps twenty-five years ago that a certain special car happened to fall under the eye of one of the officers responsible for the maintenance of equipment who observed that the varnish on the outside seemed to have perished almost completely, and that the integrity of the painting underneath was in consequence seriously threatened. The car was sent to the paint shop for special examination. The shop reported that the car had been varnished at so recent a date that ordinary wear would not warrant its present condition, and that the loss of varnish was probably due to excess of zeal on the part of the car cleaners. The matter was referred to the foreman of the car cleaners, who reported that they had given the car a pretty good treatment, but that really they could not be held responsible for any better results with the soap that was furnished to them. In order not to be set aside and diverted from his efforts to secure efficiency, by the customary attempt on the part of subordinates who are called to account to transfer the blame to some one else, the officer above referred to asked for a sample of the very soap used, and a partly used cake was furnished and sent to the laboratory.

"Now, ordinary cleaning soap, as is well known, is a chemical compound of the various acids characteristic of vegetable or animal fats, with either soda or potash or both. The combination is brought about by the aid of heat, the fats being mixed with the soda or potash in water solution, and the resulting product always containing more or less water as a necessary concommitant of the manufacture. Potash, being more expensive than soda, is less often used. But soda soaps are softer than potash soaps, and, as is well known, the physical condition of a soap as to hardness is an important element in its successful use. Moreover, the nature of the fat used has a most important influence on the hardness of the soap. The soft animal fats whose characteristic fat-acid is undoubtedly largely oleic, when saponified with soda, gives a soft mushy soap which is uneconomical to use, is less easy to handle both in manufacture and transportation, and is often unsalable in appearance. These objectionable characteristics are largely increased by the practice, so common among soap makers, of adding a percentage of rosin to the fat. Tallow, which contains a considerable percentage of stearic acid, makes a much better soap. But tallow is more expensive than the soft fats and rosin. Accordingly, soap makers have sought for devices that would harden soaps made from the soft fats and rosin, and it has been found that an excess of alkali, and especially a percentage of carbonate of soda added toward the last and thoroughly mixed with the soap before it cools and hardens produces the result desired.

"Returning now to the partly used cake of soap. A careful analysis of this sample showed that it contained, in addition to the alkali necessary to combine with the fat, about 3½ per cent of free caustic soda, and over 7 per cent of carbonate of soda. It will thus be seen that the water solution of this soap which the men were using to clean the cars with was in reality a weak lye, containing quite an amount of sodium carbonate. But both lye and carbonate of soda in solution readily dissolve varnish; even the combined alkali of a normal soap dissolves varnish to a certain extent, but very much more slowly than the free caustic or carbonated alkali, even though the latter may be in very dilute solution. It is evident that the contention of the men in this case had a foundation of fact, and while it is recognized that the manipulation, that is, the method of using the soap solution, is a most important element in the problem, it is unquestioned that in the hands of the ordinary car cleaner, such a soap as has been described will result in a much more rapid destruction of the varnish than if a normal soap was used. This incident led to the formation of specifications for soap in which the amounts of free caustic and carbonated alkali were limited, and no similar case of very rapid varnish deterioration has since been noticed.

"Now this case has not been cited to show that the producer had any desire to ignore or set aside any of the rights or even desires of the consumer, or to obtain for himself any undue, ulterior advantage at the expense of the consumer. In reality, the producer was furnishing more detergent power per pound of soap than is characteristic of the normal article, since both free caustic and carbonated alkali are much stronger in detergent power per pound than the combined alkali of soaps. There is apparently no reasonable ground for an attempt to hold the soap maker responsible for the injury to the varnish, and we cannot help regarding this episode as illustrating "The Influence of Specifications on Commercial Products," in this: that they tell the producer what the consumer wants. It is not to be supposed that the producer will know all the uses to which the consumer will apply his product, and without cooperation on the part of the latter, or as we have so many times urged, without the two working together, the producer may with perfect honesty make and furnish the wrong product."

What Mr. Sueji Miyamori Saw in Grand Rapids

The Grand Rapids Railway Co. has recently published a very attractive booklet, bearing this title, and it is one of the most complete publications that has been issued descriptive of and illustrating the many attractions of Grand Rapids.

The cover is of green with lettering in black, cut so that the bird's-eye view of Grand Rapids and the portrait of Mr. Miyamori, which appear on the first page, are shown through the cover. The book contains many interesting views in John Ball Park, scenes and "doings" at North Park, the many attractions at Reed's Lake and those at Jenison Park, as well as exterior and interior views of hotels and prominent buildings of Grand Rapids.

Mr. Miyamori is a native of Japan, a country famous for the beauty of its scenery, which has made the Japanese keen to appreciate the beautiful elsewhere. Mr. Miyamori tells of the parks in Japan as compared with our American parks, and states the American parks are far superior to those of Japan, in that they are better provided with places of amusement, greater opportunities for study and far better transportation facilities.

The book is dedicated by the Grand Rapids Railway Co. to the people of western Michigan, hoping it will induce them, even more than in the past, to make Grand Rapids, with its system of beautiful parks and other attractions, which are so readily accessible by the excellent railway service, their summer playground. The pictures and sketches show what can be seen and done in Grand Rapids in such a tempting manner that the reader will hardly be able to resist the temptation of a visit to these attractions should he be fortunate enough to make a visit to Grand Rapids.

Advertising Literature.

THE AMERICAN STEEL & WIRE CO., Rookery Bldg., Chicago, has just issued a pamphlet giving list prices of steel and copper wire on spools, including bright, annealed, tin plated and hair steel wire and copper wire, all sizes.

"FALLING LEAVES are one of the most frequent causes of untrue wheels on trolley cars," says the Wheel Truing Brake Shoe Co., of Detroit, Mich., in one of its recent post cards distributed among its patrons in the interest of its product, the wheel truing brake shoe.

THE ABNER DOLE CO., engineer, San Francisco, Cal., has issued a very attractive pamphlet on tangential ellipsoidal waterwheels, its Bulletin No. 5. The descriptive article is profusely illustrated and some very interesting data and tables are published in connection therewith.

THE LUMEN BEARING CO., Buffalo, N. Y., maker of Lumen bronze bearings, has for its monthly calendar for September a picture of an Indian pappoose, entitled "A Lonesome Baby," from the painting by Esther Hunt. The monthly calendars distributed by this company are very attractive.

THE R. WOODMAN MANUFACTURING & SUPPLY CO., of 63 Oliver St., Boston, Mass., is out with a catalog showing all the various styles of ticket punches, ticket dating stamps, perforated machines and badges and checks which it manufactures. This company enjoys a large trade among street railway companies, especially in ticket punches.

THE SPRAGUE ELECTRICAL CO'S. Bulletin No. 218, superseding No. 207, concerning industrial applications of the Sprague electrical motor for direct current circuits, has recently been issued. The various applications of this motor, as described and illustrated in the bulletin, indicate their practical universal adapatability where direct current is used.

THE RAILWAY APPLIANCES CO., Old Colony Building, Chicago, Ill., sole agent for the Oldsmobile railroad inspection car, has just published Catalog No. 112, together with souvenir, covering the specifications and operation of this car. The car weighs about 800 lb., has a seating capacity for four persons and the speed is entirely flexible from 1 to 35 miles per hour.

"THE BRONCHO CHANNELER," which is manufactured by the Ingersoll-Sergeant Drill Co., Havemeyer Building, New York City, is well described and illustrated in pamphlet, Form 322, which has recently been issued by this company. The "Broncho Channeler" is one of the latest developments in quarrying machinery and the special advantages possessed by this machine are set forth in this publication.

GRAPHITE, for September, published by the Joseph Dixon Crucible Co., contains many instructive and seasonable talks on the preservation of metal surfaces, with Dixon's silica-graphite paint. Excellent half-tone illustrations of notable steel structures and information on good paint and good painting abound in this issue. The publication will be sent free of charge to our readers, upon request to the publisher.

THE BALDWIN LOCOMOTIVE WORKS, Philadelphia, Pa., has recently issued Bulletin No. 48, a record of recent construction. The publication contains illustrations and descriptions of locomotives recently built for the Delaware, Lackawanna & Western Railroad Co., the Mobile & Ohio Railroad Co., the United States Government, the Western Meat Co., the Mexican Railway Co., Ltd., the Brooklyn Dock & Terminal Co. and others, and is a very neat and interesting issue.

THE GENERAL ELECTRIC CO. has recently published the following pamphlets: "Ready Made Electric Lighting Outfits for Decorative Lighting," Flyer No. 2134; "Enclosed Fuse Cut-Outs," Flyer No. 2138; "Shunt Wound CA Generators," Flyer No. 2139; "Direct Current Ceiling Fan Motors," Flyer No. 2140; "Thomson Inclined Coil Portable Indicating Instruments," Bulletin No. 4382; "Small Plant Alternating Current Switchboards for 1150 and 2300 Volts," Bulletin No. 4381.

THE UNIVERSAL SAFETY TREAD CO., 45 Broadway, New York City, has just published a new catalog, illustrating the "Universal" tread as now applied for preventing persons from slipping on steps, sidewalks, stations, steam and electric railway car steps, etc. The company has equipped many thousand electric cars with its three-piece car step, the general adoption of which is good evidence of its value. The "Universal" tread is made with a base of steel, brass or bronze as preferred, in any width up to 12 in. out of a single plate and in any desired length.

THE KEYSTONE TRAVELLER for August, published every month at 1024 Filbert St., Philadelphia, for the purpose of bettering the business of the Mayer & Englund Co. and its customers, is as breezy and interesting as ever. This month we have the Keystone Traveller crossing the desert on the camel, with our attention called to the fact that "Railroad men who have looked into the matter say that the superiority of our supplies is as plain as the hump on the camel's back."

THE UNDER-FEED STOKER CO. of America, Marquette Building, Chicago, in the columns of its monthly publication, the Publicity Magazine, gives a very interesting description of its No. 5 pump automatic attachment to be used in connection with the Jones stoker. The attachment described was first installed in the plant of the Inland Steel Co. at Indiana Harbor, Ind., and the results obtained with the attachment have been very successful. This article appears in the August number of the magazine.

RECENT PUBLICATIONS of the American Blower Co., Detroit, Mich., include a very neat pocket edition on "ABC" fans and blowers, containing descriptions of these products and price lists; Bulletin No. 162, illustrating and describing the "ABC" vertical engines, type F; Bulletin No. 163, vertical engines, types B and C; and Bulletin 164, "ABC" horizontal engines, type I. These issues go into detail in their descriptions of the products of the American Blower Co. and contain valuable data in regard to them.

THE J. G. BRILL CO., Philadelphia, has recently issued catalog No. 148, entitled "Snow Removing Apparatus for Electric Railroads," descriptive of its modern types of snow plows and sweepers. These are the Brill standard sweeper, powerfully constructed and intended for heavy service, on which three motors are used, two for propulsion and one for the brooms; the nose plow for single track service and the shear plow for double-track service, similar in construction to the nose plow. The snow plow, baggage car and electric locomotive, a combination type built for interurban service, is one of the heaviest and most effective snow fighting machines ever put on an electric railway. Also the Brill track scraper, the special features of which are elastic arms, diagonal cross-bracing, and removable shoes. This device may be installed under platforms of any height without blocking or cutting of timbers.

THE BOOK OF THE FOUR POWERS, briefly setting forth the scope of the manufactures of the Allis-Chalmers Co., Chicago, is one of the cleverest and most interesting publications of its kind that has come to our notice. The cover is in brown and green with lettering in gold, while the back is brown with the Allis-Chalmers trade mark in green and gold. The book is profusely illustrated and the many products of the Allis-Chalmers Co. and its electrical department, the Bullock Electric Manufacturing Co., are briefly described therein. It is believed that no other company in the world covers so broad a field in its work as the Allis-Chalmers organization; its six large manufacturing plants are located at Milwaukee, Chicago, Scranton and Cincinnati, and have capacity for 10,000 men. It may be interesting to note that more than 23,000 large freight cars were required to transport last year's output. "Ours the Four Powers: Steam, Gas, Water, Electricity." That phrase tells the story, but those interested in any of the "Four" will enjoy reading the "Book of the Four Powers."

AIR BRAKE TESTS. Under this title the Westinghouse Air Brake Co. has published a very handsomely printed book of 325 pages, bound in flexible leather covers. The book is 5 x 7 in., a convenient pocket size. No better idea of the scope and nature of this work can be given than by quoting the names of the several chapters, which are: The Growth of Car Braking; Galton-Westinghouse Tests; Paris and Lyons Railway Tests; The Burlington Trials (C., B. & Q. R. R.); Westinghouse Freight Train Trials; The Karner Trials (N. Y. C. & H. R. R. R.); Snag Hollow Tests (P. R. R.); Shiproad Tests (P. R. R.); Nashville Locomotive Brake Tests; Absecon Tests (P. R. R.); Atsion Tests (C. R. R. of N. J.). The Westinghouse Air Brake Co. has for years followed the policy of giving encouragement to scientific investigation of the subject of braking and then giving the widest possible publicity to the results obtained. The data included in many of these chapters have been published by the company in separate works and the present volume will be found very convenient in bringing the results of all the tests together under one cover.

THE WALLACE SUPPLY CO., 56 Fifth Ave., Chicago, has recently issued its Catalog No. 10, which illustrates and describes the Stearns automatic stop lock, which is shown in detail in the "Review" for June last, page 424.

Trade Notes.

THE PITTSBURG GAGE & SUPPLY CO., 309-311 Water St., Chicago, is in receipt of an order from the American Sugar Refining Co., of New Orleans, La., for a 16-in. Pittsburg vacuum exhaust head. This is the fourth repeat order.

THE AMERICAN BRIDGE CO. has been awarded a contract by the South Side Elevated Railroad Co. of Chicago, for 64,000,000 pounds of structural steel for use in the construction of the proposed Stock Yards and Englewood extension.

THE STILWELL-BIERCE & SMITH-VAILE CO., of Chicago, has made a contract with the Springfield & Fort Wayne Traction Co., Fort Wayne, Ind., for one condenser and two boiler feed water pumps, to be used in the Decatur power station.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING CO. has made a contract with the Atlanta Interurban Railway Co., of Atlanta, Ga., for the installation of the new Westinghouse single-phase alternating current electric railway system.

THE J. G. BRILL CO., of Philadelphia, has begun the delivery of an order from the Philadelphia, Morton & Swathmore Railway Co. for a lot of the Brill patent semi-convertible cars. The cars are the most approved pattern and have all the modern conveniences for passenger traffic.

THE SPEER CARBON CO., of St. Marys, Mo., widely known as the maker of the Speer high grade carbon brush, has secured headquarters at the Inside Inn for the week of the electric railway conventions at St. Louis, and will be pleased to see its friends there and any one interested in carbon brushes.

THE BUTLER BROS. CONTRACTING CO., of St. Paul, Minn., has been awarded the contract for building at Yonkers, N. Y., one of the five electric power plants which the New Haven road is building for the operation of its Hudson river road for 100 miles north of New York.

THE RUSSELL ENGINE CO., of Massillon, O., reports that it on August 26th received a cablegram from Japan for two tandem compound direct connected engines for electric railway service. The Russell company reports that it has shipped ten large engines to that country within the last year for use in railway and electric light service.

THE CANADIAN WESTINGHOUSE CO., Limited, of Hamilton, Canada, has opened offices in Winnipeg, Manitoba. The offices are located in the Union Bank Building. The representative in charge of the district covered by this office is Mr. W. E. Skinner, who was formerly associated with the Westinghouse Electric & Manufacturing Company of Pittsburg, Pa.

THE FEDERAL MANUFACTURING CO. of Cleveland, Ohio, advises us that hereafter the sale of Shelby trolley poles, for which the company is general agent in the United States and Canada, will be direct from the company's Garford factory located at Elyria, O., instead of from the Cleveland factory as heretofore. This change has been made in order to concentrate all of the railway equipment work in one office.

THE AMERICAN CONDUIT CO., Manhattan Bldg., Chicago, has been awarded a contract by the Electrical Commission of Baltimore to furnish that city with 200,000 feet of bituminized fiber conduit. This contract was awarded after a series of exhaustive tests and investigations, and thus forms another important link in the strong chain of evidence favorable to bituminized fiber conduit for underground construction.

THE WESTERN ELECTRICAL SUPPLY CO. will commence work on the Blue Island, Riverside & Hammond Railway Co's. line about October 1st. This line runs through West Pullman, Blue Island, Riverdale, Dalton, West Hammond, South Hammond, Harvey, South Holland, Thornton, Glenwood, Chicago Heights and other rural territory near Chicago. The railway company is capitalized at $1,200,000, and franchises have been granted in the above territory.

THE HOOVEN-OWENS-RENTSCHLER CO., through its eastern office, has just secured several orders for Hamilton-Corliss engines. These include a 1,000 h. p. cross compound condensing en-

gine for the Hoosac Valley Street Railway Co., a 1000-h. p. cross compound condensing unit to be installed in Alaska by the Treadwell Gold Mining Co., a 500-h. p. engine sold to the Colemanville Water & Power Co., of Colemanville, Pa.; and a 500-h. p. engine purchased by the Excelsior Powder Co., of Kansas City, Mo.

THE JAMES G. WILSON MANUFACTURING CO., West 29th St., New York City, maker of steel rolling doors of all descriptions, reports many orders in hand for rolling doors for electric railway car houses. Among these may be mentioned the following: Seven doors for the Citizens' Electric Street Railway Co., of Newburyport, Mass.; eight doors for the Fairhaven & Westville Railroad Co., of New Haven, Conn.; seven doors for the Cedar Rapids & Marion City Railway Co., of Cedar Rapids, Iowa; eight doors for the Topeka Railway Co., of Topeka, Kansas.

THE GOULD STORAGE BATTERY CO. reports the following as among recent contracts received by it: City & Suburban Ry. Co., Portland, Ore., 280 cells O-515 and regulating booster; Edison Electrical Illuminating Co., Topeka, Kas., 280 cells S-617 and regulating booster; Leominster, Shirley & Ayer Street Ry. Co., Shirley, Mass., 224 cells O-511; Corporation of the Town of Port Arthur, Port Arthur, Canada, 240 cells O-507. Also the following isolated plants: Dr. A. White, Palmyra, Mo.; F. Parks, Westfield, Mass.; Kent County Home, Grand Rapids, Mich.; F. Wesel Manufacturing Co., Brooklyn, N. Y.; Thos. W. Byrne, Plymouth, Mass.

THE INGERSOLL-SERGEANT DRILL CO., of New York, has been awarded the contract for two complete compressed air power plants by S. Pearson & Son, Inc., which is building the Pennsylvania R. R. tunnels under the East River and Long Island City. The order includes eight low pressure corliss compressors and four high pressure compressors, with the necessary boilers, condensers, pumps and an elaborate system of piping. The same company recently obtained an order from the O'Rourke Engineering & Construction Co. for two compressed air power plants, to be used in building the Pennsylvania R. R. tunnel under the Hudson River.

THE UNITED RAILWAYS & ELECTRIC CO., of Baltimore, has recently placed an order with the Mayer & Englund Co., Philadelphia, for 300 "International" single type fare registers, which are to be used in the new cars recently ordered of the Brill company. This makes a total of 1,100 "International" registers purchased by the United Railways; so that nearly all the regular scheduled cars in Baltimore are equipped with International registers. The Mayer & Englund Co. has in addition secured numerous smaller orders for "International" registers recently, including 75 for the Coney Island & Brooklyn Railroad, 75 for the Brooklyn Heights Railroad, 50 for the Capital Traction Co., Washington, D. C., and 50 for the Conestoga Traction Co., Lancaster, Pa.

THE POWER SPECIALTY CO., 126 Liberty St., New York City, reports the following contracts closed for the installation of Foster superheaters, and the fact that several of these are duplicate orders shows that this type of superheater is thoroughly recognized by the engineering profession: John Spencer, Wauconda, Ill., 65 h. p.; Cortland County Traction Co., Cortland, N. Y., 528 h. p.; Utica Gas & Electric Co., 1300 h. p.; International Light & Power Co., El Paso, Texas, 344 h. p.; Hackensack Water Co., 3120 h. p.; Hartford Electric Light Co., 2600 h. p.; Portland General Electric Co., 3120 h. p.; Chihuahua & Pacific Railway Co., 100 h. p.; Pfister & Vogel Leather Co., Milwaukee, Wis., 1500 h. p.; U. S. Naval Gun Factory, Washington, D. C., 1500 h. p.; Union Electric Light & Power Co., St. Louis, Mo., 20000 h. p.; Chicago & Western Indiana Railroad, 1800 h. p.

H. W. JOHNS-MANVILLE CO. advises us that Mr. R. C. Routledge, formerly of Thomas F. Smith & Co., New York, has taken charge of its contract department, with headquarters at 100 William St., New York City.

Deficit in New York City Railways.

The report of the New York City Railway Co. for the year ended June 30, 1904, shows a larger deficit for the consolidated properties than was developed in the preceding year. The gross earnings for the entire system were $21,485,006 and the operating expenses $12,127,855. The Third Avenue lines are reported to have earned a surplus of $16,747, but the deficit for all of the controlled companies is $1,396,770. The deficit for the New York City Railway Co. is $1,748,043.

DAILY STREET RAILWAY REVIEW

6TH YEAR, No. 1 | OCTOBER 11, 1904. | SERIAL NO. VOL. XIV, NO. 9 A

OFFICERS OF THE AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION.

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First Vice-President—Alfred Green.

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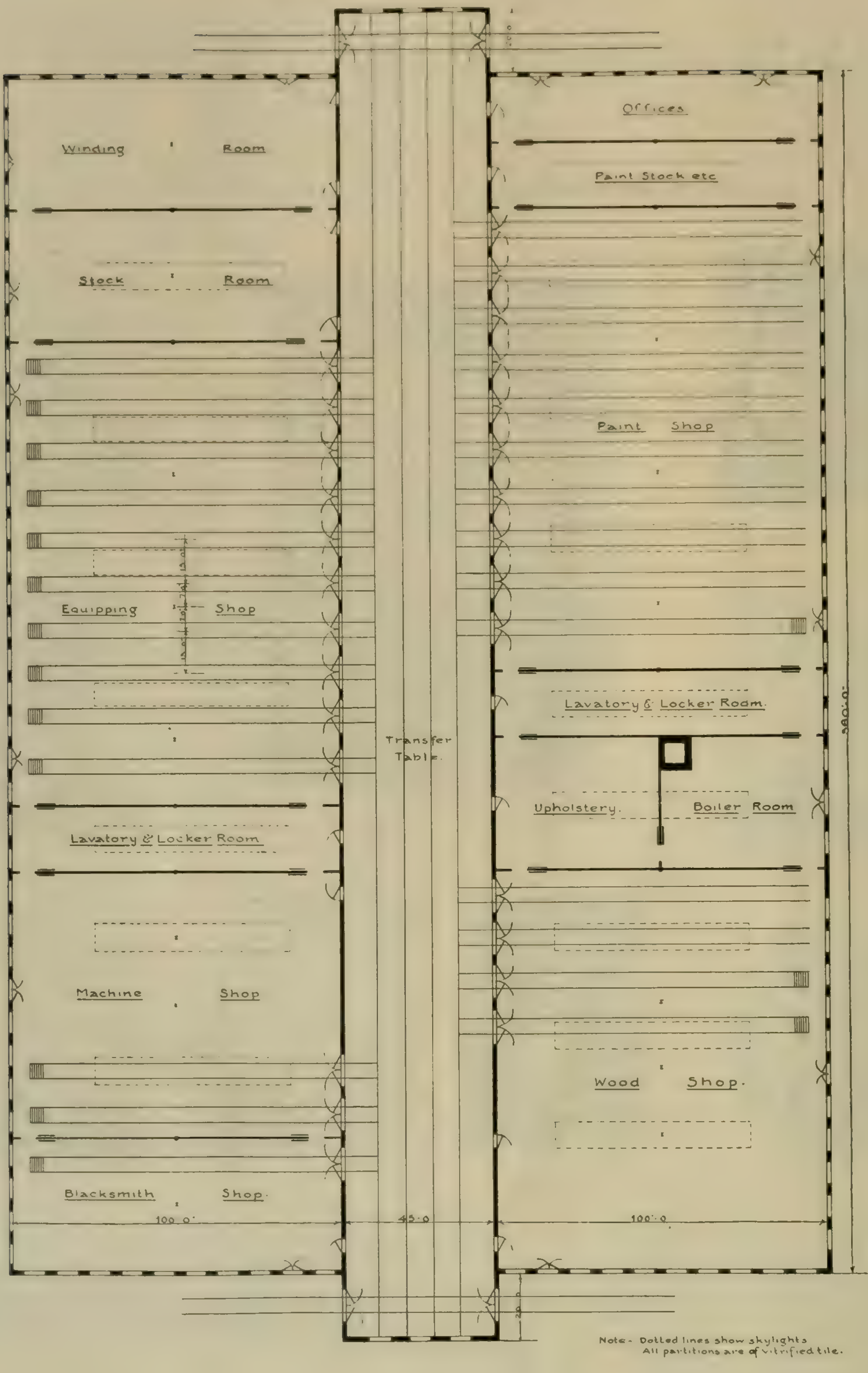
Executive Committee—The president, the vice-president and T. J. Mullen, master mechanic Scranton Railway Co., Scranton, Pa.; H. H. Adams, superintendent of shops The United Railways & Electric Co., Baltimore, Md.; D. F. Carver, chief engineer Public Service Corporation of New Jersey, Jersey City, N. J.; H. J. Lake, master mechanic Muncie, Hartford & Fort Wayne Railway Co., Muncie, Ind.


Winding Room
Stock Room
Equipping Shop
Lavatory & Locker Room
Machine Shop
Blacksmith Shop
Offices
Paint Stock etc
Paint Shop
Lavatory & Locker Room
Upholstery.
Boiler Room
Wood Shop.
Transfer Table.
100' 0"
45' 0"
100' 0"
580' 0"
Note - Dotted lines show skylights
All partitions are of vitrified tile.

THE IDEAL SHOP.

READ BEFORE THE AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION, OCT. 10, 1904.

BY W. D. WRIGHT, SUPERINTENDENT OF EQUIPMENT, THE RHODE ISLAND CO., PROVIDENCE, R. I.

The writer wonders if it would ever be possible to build an ideal shop for street railway work to meet all conditions. Local surroundings must necessarily govern to a certain extent the plans and construction of such a building, and the details of arrangement for the various departments and the necessary apparatus and fittings, must vary according to the different methods employed in doing the work on different roads. So it appears that in the face of these varying conditions, we can only consider under the head of "The Ideal Shop" a general plan for its layout, subject to changes which the local conditions would make necessary. In fact, the subject of this article might have been more properly: "A Few Suggestions for an Ideal Shop."

In the first place, "Let there be light," as it was in the beginning. This matter should have due consideration from the beginning to the end of the plans. Daylight is one of the greatest blessings we enjoy. Why shut it out? It costs nothing and we cannot have too much of it in our shop if it is of the right quality. Men can do more work and better work because of it, and any extra expense incurred to obtain abundance of good light in a workshop is money well spent.

To this end, I think all will agree, that the ideal shop should consist of a building or buildings one-story high.

As shown in the accompanying general plan and section of an arrangement of buildings which appeals to me as one that would be convenient, light and reasonable in cost, and which I submit for your consideration and criticism, the shop consists of two one-story buildings on either side of a transfer track. This plan is laid out regardless of size or shape of lot, although this condition we will probably never enjoy in actual practice. I should prefer a depth of building sufficient to accommodate two double-truck, or three single truck cars on a track, which would permit of shifting a car without disturbing more than one or two others.

For the main buildings, I would advise brick construction, with a plank roof, covered with tar and gravel. The roof covering the transfer track can be built entirely of metal, in which case the two main shop buildings would not be connected by any inflammable material.

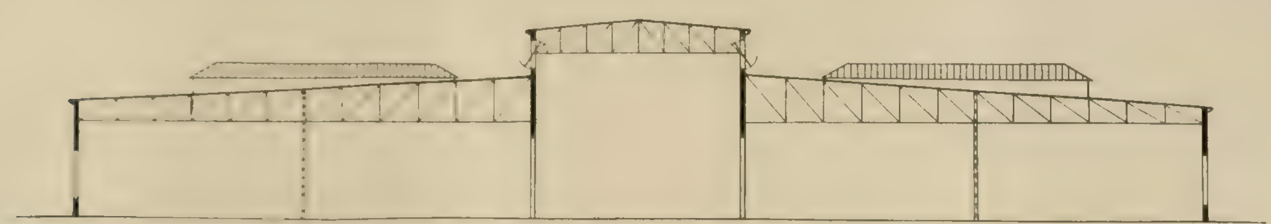
Granolithic cement makes a good, clean and durable floor. The only objection that I know of is that workmen, when obliged to stand on it all day, complain that it affects their feet and legs. Grooved rails should be used with this floor to prevent chipping by the wheel flanges. Tracks should be well spread, to give plenty of room between cars. I have found 13-ft. centers to be very comfortable.

Partitions separating the different departments can be built of a single layer of four compartment vitrified building tile, which can be taken down easily, as changes and extensions become necessary, and used over again.

Swing windows, operated from the ground floor by a system of rods and gears, as shown in the plan, will give both light and ventilation to that portion of the building. I find swing doors with two truss rods to be most serviceable and durable. They take up room when open, however, and no doubt for this reason many would prefer the metal shutter.

Heating, I think, can best be accomplished by steam, unless the climate is mild, when a hot air circulating system might be preferable. A good sprinkler system should be installed in the shop buildings, with a hydrant system for hose in addition.

Of course our ideal shop would be fitted with the most approved types of cranes, air hoists and general machinery for doing good work expeditiously, and a storage yard adjoining will be found quite necessary for wheels, scrap iron, etc., and should contain a good platform scale.



SOME ST. LOUIS TRANSIT SHOP NOTES.

Since Mr. M. O'Brien assumed charge as master mechanic on April 1st he has made a few changes in the shops of the St. Louis Transit Co., one of the principal ones being the installation of a brass foundry in which are a 42-in. Schwartz metal furnace and two babbitt kettles for melting the babbitt metal for bearings. Another change is the adoption of the Chicago City Railway method of making sweeper brooms, in which the rattan is cut in single lengths and set in the broom head instead of being cut to double lengths and drawn through two holes in the broom head. The bamboo is split in order to fix the maximum size, which experience has demonstrated to best meet the conditions of service. The bamboo is fitted to a hole similar to those in the broom head, being packed as closely as can be done by hand, then this bundle is removed and the ends wrapped with twine. In fixing the bamboo wisps in the head, hot tar tempered with rosin is poured into the bottom of the hole, then the wisps of bamboo are one by one dipped into the tar mixture and thrust into the broom head. This gives adhesion which is in every way satisfactory, the bamboo never falling out in service.

Practically the only mileage record now kept in the shops is to give the service of the cars so that the car house repair foreman may be notified as to when it is necessary to look after motor bearings. The mileage record of each car is kept up from data furnished by the auditor's office and when a certain number of miles have been made by a given car, the car house foreman on the division where the car operates is notified and has the car inspected for defective bearings. The permissible mileage varies with the type of motor, being as follows:

Motor.	Bearing.	Miles.
G. E. 54	Grease	12,000
G. E. 57	Grease	5,000
West. 49	Grease	6,000
West. 56, old type	Grease	5,000
West. 56, bored out	Grease	7,000
West. 95	Oil	40,000

On the Westinghouse 56 motors of the old type the mileage limit between inspections is placed at 5,000 miles because of the very slight clearance between the armature and the pole pieces. A number of the motors of this type have been bored out and on these the limit is placed at 7,000 miles between inspections.

The Westinghouse 95 is a new motor and the mileage given (40,000) is only approximate. Several bearings inspected after making 33,000 miles show very little wear so that the limit of 40,000 miles has been adopted temporarily.

The notice received by the car foreman is to the effect that the bearings on a certain car will need attention on or before a certain date and at the earliest opportunity the car is held in the barns and the bearings inspected. If, in the opinion of the inspector, these bearings do not require immediate renewal, a further mileage is allowed.

WHEEL MATTERS.

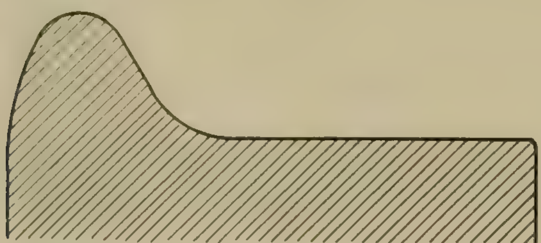
READ BEFORE THE AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION, OCT. 10, 1904.

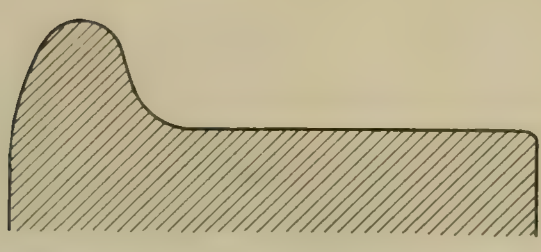
BY J. MILLAR, SUPERINTENDENT ROLLING STOCK, INTERNATIONAL RAILWAY CO., BUFFALO, N. Y.

The question of the proper type and maintenance of wheels used under interurban cars which are operated over city streets for any considerable distance, also over more or less special work, has developed into a problem of great importance to the master mechanic.

The ordinary chilled iron wheel with 1-in. flange is ruinous to special work in the city. We formerly used a 500-lb. chilled iron wheel with 2½-in. tread and ¾-in. flange on our Lockport division, and a 460-lb. wheel with the same tread and flange on the Niagara Falls division. With both of these wheels we had an unlimited amount of trouble with chipped flanges, having to remove many of them for this reason before they were half worn out, and in several instances, after making but a few trips. As a matter of precaution, I found it necessary to have all wheels carefully examined each trip at both ends of the lines.

We are now using two types of wheels under our interurban cars, steel tired and rolled steel wheels, with 2½-inch tread and ⅞-in. flange. The rolled steel wheels have given very fair results, with the exception of a few which have had to be removed on account of defective plates. As to flange wear, the results with both have been very good. The rolled steel wheels made an average of 35,000 miles before they were taken out to be turned up for the first time, and a few have been turned up the second time with an average of 25,000 miles for the second run. We have only one car equipped with steel tired wheels that has been in service long enough to get any definite data as to wear of flange and tread. These wheels have been in service about 5½ months and have made 34,960 miles. The flange wear is very satisfactory, as can be seen by the accompanying sketches showing section of tread and flange when new and after making the above mileage.





You will notice that the flange is lower after having been in service than it was originally, although I use a brake shoe that does not wear on the flange. This I attribute to the special work inside the city limits, the depth of the groove not being enough to maintain a ⅞-in. flange. However, we now have no more broken or chipped flanges, and, as a factor of safety, they are far better than the chilled wheels. The only examination necessary now is for flange wear, which is done in the car stations, whereas, as is stated above, chilled wheels had to be examined each trip at both ends of the lines.

With both the steel tired and rolled steel wheels, I find that the flanges wear thin on one side of the car, while on the opposite side they are in good condition, necessitating their removal to be turned up sooner than the natural wear would warrant; this I attribute, to a large extent, to the constant running of the car from the same end, which is well known to cause irregular wear.

There are two arguments strongly in favor of the steel tired and rolled steel wheels, first, the factor of safety; second, their freedom from flat spots. During the 14 months we have had them in use I have not had to remove a single pair on account of being flat.

In summing up steel tired and rolled steel wheels, I will say that the additional safety obtained from their use is of itself enough to warrant their adoption by all roads using high speed interurban cars.

As to "chilled wheels," in following up the evolutions of cast iron chilled wheels from the time of the old horse car days when with many "a wheel was a wheel," it has been very interesting to note the changes in size, shape and weight, and it has convinced me that the changes have been a betterment to all matters pertaining to rolling stock. We are today using far better wheels than ever before; the mileage derived from cast iron chilled wheels has in the past few years, more than doubled itself. This is evident from the fact that the manufacturers have, during the past decade, raised their guaranteed mileage from 20,000 to 40,000 miles, which in itself indicates that progress in wheel manufacture has kept pace with other improvements pertinent to electric railroading.

I have had the mileage taken of 1,458 cast iron wheels (of the 400-lb. type, standard for our city cars) which were removed during the past two years. These wheels made a total of 58,340,478 miles, or an average of 40,014 miles per wheel. Of this number 24 were removed on account of having been broken, 186 for chipped flanges and the balance, 1,248 were worn out.

In regard to flat wheels, if, when first noticed, a good wheel truing shoe is applied, much trouble can be warded off, but if too flat for a wheel truing shoe, grinding down on a grinding machine is the only remedy.

My experience with the grinding of chilled wheels, and after considerable study, prompts me to state that I strongly advocate their being reground, providing the regrinding is done in time, though I am aware that quite a number of heads of mechanical departments are of an adverse opinion. It is impossible for me to give accurate figures here as to the length of time required to grind flat spots out, owing to the variance in the flats themselves, however, on averaging the time, I can safely say that to regrind a pair of wheels on account of "slid flat" with a spot about 1½ in. long, it will take about 30 minutes, actual grinding.

In pressing wheels on axles a competent man is an absolute necessity, as the result of carelessness is obvious to all acquainted with the work. He must be accurate in the mating of wheels applied to an axle, and as nearly so as possible the four wheels in a truck.

The pressure required to press wheels on the axle depends entirely on the quality of metal used in the wheels, also on the axles. The average pressure I use, however, is 30 tons.

In the above I have set forth a few matters which have developed in my experience, and hope that they will provoke comment and discussion which will of themselves be of material benefit to all interested.

BALDWIN LOCOMOTIVE WORKS EXHIBIT.

The Baldwin Locomotive Works, of Philadelphia, exhibits its new electric trucks which have been designed and constructed to successfully fulfill the severe requirements of modern electric traction service in all its branches. The long experience of the Baldwin Locomotive Works in building locomotives gives it special facilities for the construction of trucks, each of which, under modern conditions and requirements, becomes itself a locomotive. The trucks are built of materials selected under locomotive specifications. All parts are machined to templets and held together by turned bolts and holes drilled to gages and taper reamed. Not only is the necessity for repairs or replacement of parts rendered infrequent, but when either is required the fact that all parts of trucks built from the same drawing are interchangeable permits the work to be done at a minimum expenditure of time and labor.

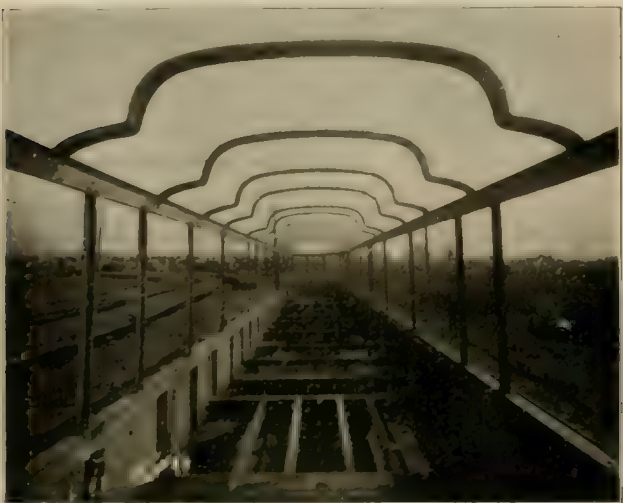
AN ALL-STEEL CAR FRAME.

The accompanying illustrations show the new steel frame car now being built by the St. Louis Car Co. for Mr. H. E. Huntington, president of the Pacific Electric Co., Los Angeles, Cal. The dimensions of the car are as follows: Length over bumpers, 63 ft. 1 in.; length over ends, 62 ft. 7 in.; total width, 9 ft. 6 in.; height from underside of framing to top of roof, 9 ft. 11 in.

The entire framing of this car is composed of a steel skeleton framing. The side construction consists of a girder from the under side of the sill to the window sill and is made of ¼-in. steel plates 36 in. wide, stiffened by channels at top and bottom, placed on the inside and outside of the plates. The side posts are made of T-bars riveted to the top of the girder and extending to the steel channel sill.

STEEL CAR FOR HUNTINGTON ELECTRIC SYSTEM, LOS ANGELES—ST. LOUIS CAR CO.

The roof carlins are made of steel. The channels are continuous, being bent to suit the shape of the roof, and the ends the riveted to the channel sills, which are made continuous around the entire car. The entire roof and sides are filled with wood so as to provide fastening for the outside and inside finish. The bottom framing consists of steel I-beams, riveted to the side girder plates with angles and gusset plates. There are five



INTERIOR OF STEEL FRAME CAR

cross sills of 9-in. I-beams and six cross sills of 5-in. I-beams, all connected with angles and gusset plates. The bolsters are made of 12x1-in. plates and are re-enforced by cast steel fillers. Large anti-telescoping plates are provided at each end, riveted to the under side of the girder and intermediate I-beams, of which there are four 5-in. and four 4-in. at each end to support the ends of the car. The 4-in. intermediate I-beams extend from the first cross sill back of the bolster and through the bolster to the ends of the car, while the 5-in. I-beams extend from the end sills to the ends of the car.

KELLOGG SWITCHBOARD & SUPPLY CO.

The Kellogg Switchboard & Supply Co., of Chicago, has installed in block 24, aisles F, D, Y and Z, Electricity Building, a complete operating telephone central station for the Kinloch Telephone Co., the independent telephone system of St. Louis. In connection with this central station the Kellogg company exhibits a complete line of its telephone instruments and supplies, including the types suitable for telephone systems in connection with electric railway operation.

The Kellogg harmonic four-party system is especially recommended for railway dispatching and this system has been installed on the Intramural Ry. for operating purposes. In this system, acting upon the principle that every reed has a natural period of vibration and can be made to take up this vibration by applying to it a succession of comparatively small impulses of force occurring in the same period as that of the reed, four different reeds or armatures were designed and given different rates of vibration by placing at their ends metal balls of different sizes which were to serve also as tappers, striking the gong direct.

A ringing machine gives ringing current of four different frequencies, and a ringing key is provided for throwing any one of the four frequencies out on the line. The four instruments are bridged across the line, each with a condenser in series. When current of a given frequency is impressed on the line the armature having the proper period of vibration takes up its swing, striking its tapper against the gong, while the reeds at the other three stations will not be affected.

THE HALE & KILBURN MANUFACTURING CO.

The exhibit of the Hale & Kilburn Manufacturing Co., of Philadelphia, is located at aisles G, H and 2, Transportation Building, and the treatment of the booth design makes it exceptionally attractive. The various types of car seats made by this company are well displayed and include about 20 distinct styles in rattan, plush and imitation leather.

In addition to seats for steam cars the following are shown for electric cars: No. 3 stationary seat in rattan, for cross seat in car always running head-on; No. 80¾ seat with spring edge cushion and upholstered in carpet, the supporting frame being under the seat, while the cushion tilts, but does not slide; No. 80¾ seat in rattan; No. 80¾ seat in quartered oak, slot cushion; No. 84 seat in rattan, a modification of No. 80¾; No. 84 seat in plush of standard gold shade; No. 88 seat with wall casting, the cushion sliding forward, giving more seat room than the No. 80¾; No. 99-A seat with pedestal base and metal rails; seats Nos. 99-B, 99-C, 99-D, 99-E, 99-F, modifications of No. 99; No. 199 seat, which has new steel pedestal and aisle plate at both ends.

At the back of the booth is an attractive screen showing the fine cabinet work turned out by the Hale & Kilburn company. On top of the screen are two reversible back seats which are operated at intervals by a small electric motor.

FORMER ST. LOUIS CONVENTIONS.

The fourth annual meeting of the American Street Railway Association was held at the Southern, St. Louis, October 21-23, 1885, just as the street railways were recovering from the strike of that year. Mr. Calvin A. Richards, since deceased, president of the Metropolitan Railroad Co. of Boston, was president of the association then and presided at the meeting. There were 93 delegates of members in attendance, the total membership being 125 companies. During the convention 14 new members were admitted. The report of the treasurer showed receipts during the year of $3,264.66, and a balance in the treasury of $792.70.

The subjects discussed at this meeting were as follows:

Diseases Common to Car Horses and Their Treatment.

Progress of Electricity as a Motive Power.

Repairs of Track.

Progress of the Cable System of Motive Power.

Rules Governing Conductors and Drivers.

Taxation and License.

This was the first meeting to which newspaper reporters were admitted.

The entertainment features included visits to the Exposition then in progress; drives, lunch at the Fair Grounds, inspection of the park system and the customary banquet Friday evening.

Among the entertainments provided were a visit to the Exposition, where Gilmore's band was one of the great attractions, and a visit to the Fair Grounds, where a luncheon was served. On the night of October 23rd, the annual banquet of the association was held at the Southern Hotel. Mr. Julius S. Walsh, who was then president of the Citizens' Railway Co., was elected president of the association.

CALVIN A. RICHARDS,
President A. S. R. A., 1885.

The 15th annual convention of the American Street Railway Association was also held in St. Louis, October 20-23, 1896, that being the second meeting in that city. At this 1896 meeting Mr. H. M. Littell, president of the association, presided. Seventy-five companies were represented at the meeting.

At this meeting a proposal for consolidation in one body of the American Street Railway Association and the National Electric Light Association was voted down.

The papers read and discussed during the convention were as follows:

Track and Track Joints; Construction, Maintenance and Bonding. By M. K. Bowen, superintendent Chicago City Ry.

Street Railway Trucks. By John Akarman, superintendent Worcester Consolidated Street Ry.

The Modern Power House. By Richard McCulloch, civil and electrical engineer, National Railway lines, St. Louis.

How Can the Revenues of Street Railways Be Increased, Taking Into Consideration the Collection of Fares, Methods of Registry, Transfers, Use of Tickets or Cash Fares, Attractions Along the Line of Road, etc. By C. D. Wyman, general manager Milwaukee Electric Ry.

Modern Overhead Construction. Read by B. Willard, general superintendent New Orleans Traction Co.

The Selection and Management of Employes. By W. F. Kelly, superintendent Columbus Street R. R.

The social features of the 1896 convention excelled those of previous meetings. The diversions included an excursion to Forest Park; a Tuesday evening reception; an excursion to the Fair grounds Wednesday, where the association was guest of the Jockey Club, followed by a theater party in the evening; excursion Thursday to the Anheuser-Busch brewery; banquet at the Southern Friday evening.

The 1896 convention exhibit was called "stupendous" and space was at a premium. In addition to the 30,000 square feet in the Auditorium, 15,000 more could have been sold, if available. It was estimated that the value of the exhibits was between $150,000 and $200,000, and the supplymen were accredited with having spent upwards of $60,000 in making the displays.

The sessions of the convention were held at the Auditorium, which had been erected at Twelfth street and Clark avenue for the accommodation of the Republican National Convention, which nominated Mr. McKinley.

H. M. LITTELL,
President A. S. R. A., 1896.

Capt. Robert McCulloch, vice-president and general manager of the National Electric Railway properties, was elected president of the association for the ensuing year.

LUNCH ROOMS FOR STREET CAR MEN.

The St. Louis Transit Co. has established a street-car lunch room for the convenience of its employes on the Olive St. line at the Olive loop at the World's Fair. The lunch room was established as an experiment, with the idea that if it is a success (and it seems to be) other lunch rooms will be provided on all through lines where the men have to work very long hours to handle the heavy traffic.

Old timers feel very much at home while viewing the St. Louis Car Co. exhibit. Standing before the old cable and Topeka cars they grow reminiscent, this old style equipment taking them back many years—to the days when electricity, as a motive power, was in swaddling clothes; and before the wonders of present day achievement and progress were even dreamed of. The general public realizes what car builders have done for them when they contrast the convenience, comforts and ease of modern day travel with the hardships of years ago.

CONVERTIBLE CARS FOR WASHINGTON, D. C.

Convertible cars of the type shown in the engraving were recently placed on the lines of the Capital Traction Co., of Washington, D. C. These cars are the first of this type to be used in Washington, and it is believed that they will be very popular on account of their easy conversion and the protection which they afford in rainy and unseasonable weather. The lines upon which the cars are operated extend through the northern part of the city and serve a large population. The railway company controls a large amusement park at Chevy Chase, which is the terminus of a suburban section of a system a few miles to the north of the city. This park has for a number of years been a popular resort and is considered one of the finest of its kind in the country. The cars are the patented convertible type of the builder, the J. G. Brill Co.

CONVERTIBLE CAR FOR WASHINGTON, D. C.—J. G. BRILL CO.

The cars are finished in cherry, with birch ceilings neatly decorated. The seats are of the step-over style, and are 35 in. long, leaving the aisles 20 in. wide; the seating capacity of the car is 44 persons. Besides the usual grab-handles on the outside of the posts, handles are formed by the brackets connecting the backs of the seats with the posts, which, by offering a convenient handle, encourage passengers to face in the right direction when leaving the car. The length of the cars over end panels is 28 ft. 4 in. and over crown pieces, 27 ft. 4 in.; from end panels over crown pieces, 4 ft. 6 in. The width over the sills and the panels is 6 ft. 11¼ in. and over posts at the belt, 7 ft. 9 in. The sweep of the posts is 5 in. The side and end sills are 4¾x7 in. The sill plates are 7 in. by ⅝ in.; thickness of corner posts, 3¾ in. and side posts, 3⅜ in. The equipment includes a number of the manufacturer's specialities, such as folding gates, "Dumpl." sand boxes, "Dedenda" gongs, ratchet brake handles, round-corner seat-end panels and angle-iron bumpers. The cars are mounted on "Eureka" maximum traction trucks having 4-ft. wheel base, 30-in. wheels, and equipped with motors of 50 h. p. capacity. The weight of a single car including trucks, is 21,500 lb.

NEW BRAKE SHOE CATALOG.

The American Brake Shoe & Foundry Co. has issued a 16-page catalog, illustrated, treating of its brake shoe specialties under the title, "The Development of the Brake Shoe." In the introduction it is stated that the product of the American Brake Shoe & Foundry Co. represents the development of the railway brake shoe from the time when the wooden brake block was supplanted by the metal shoe to the present. Previous to 1850 wooden blocks were in general use; from 1850 to 1860 cast and wrought iron shoes were used in connection with wooden brake heads, and it was not until about 1870 that metal shoes and brake heads were in general use.

The brake shoes described in the new catalog are divided into two general sections of two groups each, as follows: Section 1, unflanged shoes—Group 1, illustrating the development of the wearing face of the brake shoe to secure durability and efficiency; Group 2, illustrating the means employed to reinforce the shoe against failure by reason of the body metal cracking. Section 2, flanged shoes—Group 1, illustrating the development of the wearing face to prolong the life of the shoe, and the design of the bearing surface to wear the wheel tread where it is not acted upon by the rail; Group 2, illustrating the means of reinforcing the body metal to continue the shoe in service in event of the body metal cracking.

The brake shoes specifically treated of in the catalog include the following: Congdon, Lappin, Corning, Diamond "S," Streeter, "U," Herron, Ross-Meehan, Dehart, Perfecto, and various plain, reinforced, skeleton, steel back, wire-back and other types made by this company. These represent the various types in common use not only on locomotives and steam cars, but also upon electric equipment, and the company makes a specialty of furnishing brake shoes that fully meet the heavy demands of modern practice.

The American Brake Shoe & Foundry Co. also makes steel castings by the well-known Tropenas process, as well as gray iron castings.

AN IMPROVED HOT-WATER CAR HEATER.

The water-jacket car heater made by the Franklin Railway Supply Co., of Franklin, Pa., has notably impressed practical street railway officials during the past year. Up to the advent of this company in the car-heating business the type of heater used had been the air-jacket heater, which is practically the same as was used years ago by steam railroads for passenger cars. It is estimated by the Franklin company representatives that fully 75 per cent of the hot-water heaters installed for this winter's use are of the water-jacket type.

This type of heater is exhibited in the Franklin company's exhibit at post 52, aisle D, Transportation Building, and will well repay investigation. This company, which is said to have been the first to exploit this idea, claims to have been allowed by the U. S. Patent Office several claims on the improvements that make this idea practicable. The large amount of heating surface, coupled with the small diameter of the heater and the automatic coal feed, are the improvements that impress one favorably with the Western car heater.

Some of the recent installations of the Western car heater are 23 equipments on the new cars of the Metropolitan Elevated Ry., of Chicago; 30 equipments on the Milwaukee electric railway; 60 equipments on the Rochester railway; 26 equipments for the Syracuse Rapid Transit Co.; 6 on The Chicago & Milwaukee electric railway; 8 on the Decatur, Springfield & St. Louis Ry.; 10 on the South Chicago City Ry.; 4 for the Green Bay Traction Co., besides some on the Scranton electric railway, Slate Belt electric railway, the Schenectady railway, the Peoria & Pekin Ry., the Sheboygan railway, the Mississippi Valley Traction system and the Indianapolis & Cincinnati Ry.

On all sides can be heard laudatory expressions referring to the "Sectional" car shown by the St. Louis Car Co. The manner in which it is exhibited gives mechanics the rare opportunity of seeing just how the work is done on a modern car.

DAILY STREET RAILWAY REVIEW

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6th Year, No. 1. TUESDAY, OCT. 11, 1904. Serial No. Vol. XIV, No. 9 A

SAVE THE "DAILY REVIEW."

Special attention is called to the fact that the "Daily Street Railway Review," published at St. Louis October 11th to 14th inclusive, this being the sixth successive year, is in its nature supplementary to the "Street Railway Review" published monthly. Notwithstanding the "Daily" is a separate publication it should be bound with the monthly for convenient reference and in order to facilitate this, the pages of the "Daily" are given numbers consecutive with those of the next preceding monthly issue. Reference is again made to this fact for the reason that very frequently the "Daily" is entirely overlooked by subscribers when sending the "Review" to be bound, and as soon as the binder discovers that 150 pages or so are missing, we receive a request to furnish the missing numbers, which unfortunately we are not always able to do.

THE STREET RAILWAYS OF ST. LOUIS.

One of the particularly agreeable features of the convention this year is found in the presence at St. Louis, as the heads of the two companies, old friends who have twice before been in a position to serve as hosts of the convention. Mr. Julius S. Walsh, president of the St. Louis & Suburban company, was on the occasion of the first St. Louis meeting in 1885 chosen president of the American Street Railway Association, and Capt. Robert McCulloch, vice-president and general manager of the St. Louis Transit Co., was chosen president of the association when it met in St. Louis for the second time in 1896.

The brief history of the St. Louis roads, which appeared in the "Review" for September, is strikingly illustrative of the fact that the street railways were promoted by the prominent men of the community and were rather subsidiary undertakings for the purpose of developing the city. The list of the incorporators of the St. Louis horse car companies includes many names that are not only household words in St. Louis, but widely known throughout the country as those of leaders in the commercial and engineering world.

EDWIN W. OLDS.

Mr. Edwin W. Olds, president of the American Railway Mechanical and Electrical Association, was born in Franklin County, Vermont. He was educated in the common schools and local academy. As a boy Mr. Olds was interested in mechanical pursuits and while attending school he was also working in the general shop, of which his father was proprietor, and was intrusted with charge of work that developed in the youth an executive ability that has contributed largely to his success as a shop manager.

In 1890 Mr. Olds became associated with the Denver Tramway Co., of Denver, Colo., that being his first connection with street railway work. Since 1896 he has been with the Milwaukee Electric Railway & Light Co., for which he is superintendent of rolling stock.

Mr. Olds has been untiring in his efforts to secure the success of the Mechanical and Electrical Association, in effecting the organization of which he was most active.

FORMER CONVENTIONS.

Following is a list of the meeting places of the American Street Railway Association, together with the presiding officers:

Boston	*Moody Merrill, Chairman	1882
Chicago	H. H. Littell, President	1883
New York	William H. Hazzard, President	1884
St. Louis	*Calvin S. Richards, President	1885
Cincinnati	Julius S. Walsh, President	1886
Philadelphia	*Thomas W. Ackley, President	1887
Washington	Charles B. Holmes, President	1888
Minneapolis	George B. Kerper, President	1889
Buffalo	Thomas Lowry, President	1890
Pittsburg	Henry M. Watson, President	1891
Cleveland	John G. Holmes, President	1892
Milwaukee	D. F. Longstreet, President	1893
Atlanta	Henry C. Payne, President	1894
Montreal	Joel Hurt, President	1895
St. Louis	H. M. Littell, President	1896
Niagara Falls	Robert McCulloch, President	1897
Boston	Albion E. Lang, President	1898
Chicago	C. S. Sergeant, President	1899
Kansas City	J. M. Roach, President	1900
New York	Walton H. Holmes, President	1901
Detroit	H. H. Vreeland, President	1902
Saratoga Springs	W. Caryl Ely, Vice-President	1903
St. Louis	W. Caryl Ely, President	1904

*Deceased.

A list of the cities where the Street Railway Accountants' Association has appointed meetings and of the presiding officers is as follows:

Cleveland	*Morris W. Hall, Chairman	1897
Niagara Falls	C. N. Duffy, Vice-President	1897
Boston	H. L. Wilson, President	1898
Chicago	J. F. Calderwood, President	1899
Kansas City	C. N. Duffy, President	1900
New York	W. F. Ham, President	1901
Detroit	H. C. Mackay, President	1902
Saratoga Springs	Henry J. Davies, President	1903
St. Louis	F. E. Smith, President	1904

*Deceased.

The meetings of the American Railway Mechanical and Electrical Association, and the presiding officers, are as follows:

Saratoga Springs	Thomas Farmer, President	1903
St. Louis	E. W. Olds, President	1904

The St. Louis Car Co. was too busy building cars on contracts to construct any special equipment for World's Fair purposes only. Every modern car found in the exhibit is one belonging to a bona fide order and they will, after the World's Fair closes, be added to the equipment of the respective roads for which they were built.

TODAY'S PROGRAM.

9.15 a. m. Band Concert. Transportation Building.

9:30 a. m. Convention of Mechanical and Electrical Association, Transportation Building.

Paper by John Lindall, Boston Elevated Ry., on "Maintenance and Inspection of Electrical Equipment.

Question Box.

Special and Unfinished Business.

Committee Reports.

10 a. m. Meeting of Executive Committee A. S. R. A., Southern Hotel.

2:30 p. m. to 4 p. m. Band Concert at Louisiana State Building.

8:00 p. m. to 10:30 p. m. Informal reception by Manufacturers' Committee to Delegates in Electricity Building.

THE DAILY STREET RAILWAY REVIEW.

In 1899, on the occasion of the A. S. R. A. meeting at Chicago, the "Street Railway Review," in order to give better service to its subscribers, undertook the publication of daily reports of the conventions. This resulted in the "Daily Street Railway Review," which is now being issued for the sixth successive year.

The growth of the "Daily" is an excellent index of the estimate put upon the paper as an advertising medium by those most interested in reaching the street railway world. In the matter of advertising patronage the "Daily Review" has grown from a thin paper with an average of 22 pages per issue in 1899, to its present magnitude. The space we had to devote to reading matter has increased in the same proportions—from the average of 21 pages per issue in 1899 to an average of 41 pags in 1903. What we shall publish in 1904 will depend upon the associations—not upon us. We are here to cover the field, be it large or small.

Some dozens of letters received in 1900, after the Kansas City convention, all highly commending the enterprise of the "Review" in publishing the "Daily," let us to feel that our efforts to give the most prompt service were well worth all the labor involved. This year the special conditions resulting from the conventions being at the World's Fair City, we considered, would have warranted us in omitting the publication. But when it became known that we were even remotely contemplating such a backward step, our friends wrote to tell us what they thought. Some of these letters we published in a pamphlet entitled, "Competent Opinions.'

What these opinions of the "Daily Review" are will interest all convention delegates:

C. S. Sergeant—"Has appealed to me as of a special value."

J. C. Hutchins—"Has been particularly valuable to me, my whole staff, and to the Association generally."

G. Tracy Rogers—"Its worth to the Association has been inestimable."

G. F. Chapman—"Of value to those who attend and to those at home."

E. G. Connette—"Appreciated by all street railway men."

R. E. Danforth—"Valuable in determining the business tranacted."

T. E. Mitten—"Valuable to all street railway men in that it gives a minute account of the proceedings."

H. F. Grant—"Great value to all who stay at home."

C. L. S. Tingley—"I always preserve it to refresh my memory concerning the convention."

John W. Ogden—"A step in advance."

S. F. Hazelrigg—"Appreciate it very much."

E. R. Gilbert—"Of great service to our officers."

Warren Bicknell—"I have been an interested reader from the first."

W. P. Reed—"I cannot speak too highly of it."

Howard Fravel—"It is full of 'pay dirt.'"

E. L. Kirk—"The best medium to bring street railway men into touch with each other."

Geo. O. Nagle—"Has a very wide influence."

T. F. Grover—"My employes who cannot go to the convention are always well posted when I return."

James F. Lardner—"Valuable for the men at home."

REGISTRATIONS.

The "Daily Review" has heretofore always made a feature of the list of persons registered at the conventions. Each morning we published an accurate and complete list of all delegates and supplymen, who had registered the day before. In 1903, these lists comprised seven pages of nonpariel solid, of which four-fifths was for the first day's registration.

This year we did not take up this work because the Manufacturers' Committee determined to publish daily alphabetical and numerical lists of all those in attendance, and it appeared to us that a duplication of the work of the committee would be a waste of time and space on our part. Accordingly we shall publish lists of the delegates to the several associations, only.

BADGES.

Delegates to the Conventions of the American Street Railway Association, American Railway Mechanical and Electrical Association, and Street Railway Accountants' Association will obtain badges for themselves and their guests and ladies accompanying them from the secretaries of their respective associations.

Headquarters of Secretary PPenington of the A. S. R. A. wil be at the Southern Hotel today and on the 12th and thereafter, at the Transportation Building, Worlds Fair Grounds, second floor.

The official Badges of the Convention are numbered by means of celluloid tags for the purpose of protection against abuse by persons not entitled to wear them. Delegates and guests are especially requested and urged not to remove the numbers but to wear them in plain sight.

Where the delegate attends two conventions duplicate ribbons of the proper color are delivered.

Members of the Manufacturers' Committee and their representatives will obtain badges for themselves, their guests and ladies accompanying them from Mr. Edwin H. Baker, Chairman Finance Committee, Lobby Southern Hotel, today. After that Transportation Building, World's Fair Grounds.

THE FUTURE OF THE ASSOCIATIONS.

Everyone interested in any of the three existing electric railway associations should carefully read the opening address of Mr. Beggs before the Mechanical and Electrical Association yesterday and the remarks of Mr. Ely, who followed him. The demands of the railway departments not already represented in separate associations must be met, yet it is impossible to contemplate with satisfaction an equally large number of associations. No step is to be more heartily recommended than that proposed by Mr. Ely for a representation of the Accountants' end of the Mechanical and Electrical associations at the meeting of the Executive Committee of the A. S. R. A. to be held today.

This conference will undoubtedly result in action looking to the formulation of a plan that will secure co-operation among all, and at the same time not curtail the usefulness of the two existing allied associations.

The "Review" would like to see the Mechanical and Electrical Association include civil engineers also, and all engineering departments, the Accountants' Association left to further pursue its successful career, and the A. S. R. A. made a body for the discussion. of operating and managerial matters.

Whatever may be recommended at today's meeting cannot be consummated until next year. In the meantime the Mechanical and Electrical Association has opened its doors to the maintenance of way men.

Mr. R. B. Kent, who has been Vice President and Secretary of the Atlas Railway Supply Co., Chicago, has recently consumated a deal with Eastern capitalists by which he becomes the head of an organization to manufacture and deol in railway supplies and expects to begin operation shortly when fuller particulars will be mentioned in these columns.

FOR ANNOUNCEMENTS SEE PAGE 682.

SECOND REGULAR ANNUAL MEETING

American Railway Mechanical and Electrical Association

St. Louis, Mo.—Oct. 10-14, 1904.

The second annual convention of the American Railway Mechanical and Electrical Association convened in the Transportation Building, World's Fair, St. Louis, Mo., Oct. 10, 1904. About 100 members and guests were present at the opening session and the registration commenced at 10 o'clock. After some musical selections furnished by a band, and the ringing of chimes, the meeting was called to order by Mr. E. W. Olds, of Milwaukee, president of the Association, and Mr. Caryle Ely, president of the American Street Railway Association, and Mr. F. E. Smith, president of the Accountants' Association, were invited to take seats upon the platform.

At the invitation of President Olds, Mr. John I. Beggs, president and general manager of the Milwaukee Electric Railway & Light Co., addressed the meeting as follows:

ADDRESS OF MR. BEGGS.

Your president has referred to me in very flattering terms—I may say the most flattering terms that could be applied to me; he has, however, fallen into an error in one of the statements made, and that was that I would make an address. That you will not be tortured with, gentlemen, because I have never prepared an address in my life—I have never had time. I propose to say a few practical words from a practical man to practical men, and as one mechanic to another. I am fortunate enough to have been required by stern necessity in my boyhood to serve an indentured apprenticeship of four years, never dreaming that when going through these years of toil, during the early years of the Rebellion, when I indentured myself for the first year at $2.50 a week and the second year at $3.50 a week, that I should be more than a mechanic. I look back at it with pride as the years go on, and I am one of those who have much more to look back upon than I have to look forward to, unlike many of you here today, because this is a field requiring young men. It is a great field for young men today, and upon that degree of fidelity with which the younger men are coming into our various companies, recognizing the responsibility that devolve upon them and must continue to devolve upon them, will depend the future prosperity of the great industry of which we are a part, in which we are all engaged, and in which I have been absorbed for 20 years. I am becoming one of the Old Guard as it were, and soon, I presume, we will be entitled to be retired and put on the honorary list.

But, gentlemen, I have permitted myself to be prevailed upon by your president, with whom I have been associated for several years, to address you. Your president is one of the assistant managers of the corporation whose capital I am charged with safe-guarding. Each one of you here who occupies the position of master mechanic on any one of the various roads, be it ever so small, be it ever so large, is practically an assistant manager of that property, and as such I believe he should be treated by the executive officers of these various companies, because much of the success of these properties, which are destined to be much greater than many of you today have any conception of, much of their prosperity, much of their advancement, is in your hands; and according to the degree of fidelity which you recognize and assume in these responsibilities, will these properties go ahead.

I well recall in the early days of this business I was one of the original stockholders in the Sprague Electric Railway Co. when it was organized in 1885 or 1886. I have followed down the lines ever since, as one of the men not only in front, but one of those in the pits, and in every branch of the work. Consequently, I try to look at things connected with a railway company from the broad point of view, not only from the point of view of the manager, but I try to keep all the ends together, coordinating them all into one homeogenous organization, everyone pulling together, no one pulling apart. That is one of the great things, gentlemen, that it is necessary for you to do.

I propose to refer, before closing these remarks, to the necessity of the various branches of this industry being more closely meshed together like a well geared machine. You cannot stand apart, gentlemen; you must work together with every department of the companies, or we will not have that success which is necessary and which we are entitled to bring about. The time will come, gentlemen, when there will be some crowding out; when it is going to be a question of the survival of the fittest in the railroading industry of this country, and I speak with respect to what has up to the present time been considered the only railroading of the country, our steam railroad interest. The time is fast approaching, gentlemen, when there will be a combining of the two, and it is going to be a question which will become the more important, the electric railroad or the steam railroad, and those of you who are keeping abreast of the times can see the movement being made in certain directions. It is being made particularly in the state of New York, where the great New York Central and Hudson River R. R. Co., is beginning to absorb and bring around itself certain of the profitable lines operated near its steam railroad system, and the same thing is going on in other parts of the country. It devolves upon you gentlemen whether, when these properties come together, the dominant element in the mechanical departments shall come from the electrical branch of the business or from the steam branch of the business. Now, you are much the better equipped. There is as much difference between the necessary equipment of a master mechanic on an electric railway and a master mechanic for a steam road, without intending any disrespect to the latter, as there is between a man who constructs a fine Swiss or American watch and the man who builds a corn husker. Yours is a highly technical industry.

I have read with a great deal of interest the paper prepared by Mr. Lindall, of the Boston Elevated Ry., to be read at this convention, and I ask for it an earnest perusal and study by every member of this Association, and by every man interested in the welfare and the profitableness of electric railroading in general. There is a great deal of meat in that paper, and I think it should be published in large numbers and put in the hands of every foreman, of every division foreman, of every division superintendent, and in the hands of the inspectors and supervisors, or whatever title they may be known by, of every electric railway in this country, because the paper goes to the very essence of much that pertains to the mechanical branch of the business; and I here desire to thank Mr. Lindall for the care and thought shown in the preparation of the paper. I do not know the gentleman.

Gentlemen, your particular position has much to do with the welfare, with the broader administration of the affairs of the company, concerning points that are not touched upon in Mr. Lindall's paper, points which he does not bring out. While he shows the necessity of systematic, frequent and intelligent inspection of your apparatus, I desire to add another reason for that, which comes up to the manager of these properties every day in the year and sometimes many times in the day, either to the manager or to the man having charge of that branch of the company's affairs, relating to the settlement of suits for injuries to persons and damages to property. These cases come up to me very frequently, because I possibly keep that branch of the business more closely under my personal supervision than many managers and presidents of similar corporations do; and I very frequently call upon our superintendent of rolling stock, Mr. Olds, to know just what he could testify to—he, or those un-

der him—regarding a certain car, upon which a certain class of accident has occurred; and my instructions to the lawyers or the claim department taking care of that business depend many times upon what he is able to testify to, or the men under him are able to testify to. In many instances in connection with a certain class of cases, if you can prove that a car was carefully inspected before it left the shop or car house in the morning, that it was in proper condition when it started out, that will absolve you from liability. If you are not able to prove careful and intelligent inspection on behalf of the mechanical branch of the company, many times it is better to settle the case on the best terms possible. I frequently give instructions to that effect. That is a point not touched upon in these papers which are presented here, but it is vital, gentlemen, to know whether your brake rigging was in proper condition, to know whether your controller fingers had been properly inspected and were in proper condition, and so on in regard to other features of the equipment. The laws governing these matters are such that if you can prove that all the care that was possible had been taken before you put out the equipment the law will absolve you; whereas, if you are not able to prove that, then there comes against you the charge of a lack of that proper care which is necessary. You then become liable because of the charge of negligence, which you may not be able to disprove, and we know, as a matter of fact, that the attorneys who take up these cases against our roads are very resourceful and they are willing and ready at times to prove almost anything. Therefore, you gentlemen who are charged with the daily inspection, with the general condition of the equipment under your charge, are among the most important factors in our organization, and I cannot too strongly impress upon you the care and labor that is necessary in these matters. Your work is not easy; it is labor, continuous, never any rest. There never can be rest in the electric railway business. When other people are having their time of recreation, that is our time of stress. Sundays and holidays are our busy days, and the busy times between them require your entire force on frequent occasions to be worked over-time to take care of the undue strain to which your equipment is put. The degree of intelligence and careful attention which the heads of departments of this very important branch of the business give to the careful inspection and repair of the equipment will have more than anything else to do with the success of the companies. Every other employee down the line, almost, is dependent upon the care which you give to your branch of the business. The superintendent of transportation is absolutely dependent upon you and unless you give him the equipment in proper condition, no matter how well disciplined his force may be, he cannot give the results or keep up the schedules and the time as he should do. At the end of the month, when the financial affairs of the company are gone over, it will be very gratifying to the officials of the company to find that the expenses have been kept down as they should be, by a proper inspection and repair of the equipment, as true economy always lies in keeping the equipment in first class condition.

You are the assistant managers of these properties, gentlemen, and no manager, no matter what his executive ability, can make a success of his property unless his lieutenants are equally enthusiastic, equally industrious, and recognize the weight of the responsibility which rests upon them. I have, in the administration of a large property, a very efficient corps, and I call each one of my heads of departments assistant managers. They do not have that title, but I treat them as such. The success of my administration almost entirely depends upon them and I respect them as such. They are more important to me than a board of directors. A board of directors is of no assistance to me in the operation of the road, with all due respect to them. Of course it is very essential that they should meet occasionally and declare dividends if we earn them, but for the actual success of the road in its operation, I am dependent upon the men in the pit—in other words, the men behind the guns, and that is what you men are.

Another point touched up in Mr. Lindall's paper, and you'll excuse me, gentlemen, for referring to it so often, but I would be willing to substitute it for my address as he has gone into this matter quite freely, is that many of your organizations today are weak and becoming weaker because you are not training the force to follow you and keep pace with the increase in this great business. You are not training the young men who are coming up as your understudies as you should do. Every foreman ought to have in him the elements of becoming the head of the mechanical department. The master mechanic of an electric railway company is very different from the master mechanic of a steam railroad company, who simply must look after the trucks, etc., of a steam road. You have the most sensitive type of apparatus to deal with and there are some features concerning it that the best expert hardly knows how to cope with. We have been for the last two or three years in serious trouble in every large city in the country with controllers. The best skill in the business and the best technical knowledge has been applied to try to correct these troubles. By degrees we are eliminating all the troubles incident to the business and we have been going ahead.

It is interesting to me to compare the different subjects that occupy our attention today and those that received our attention seven or eight years ago. I remember about eight years ago I stood almost alone, and received some ridicule, because I at that time made the prediction that the double truck car would displace all the single truck cars in this country inside of ten years. I believe I have lived to see that prediction almost verified. Today we are running double-truck cars, weighing empty about twenty tons. We are putting under these cars four motors, with a nominal rating of 40 h. p. each, for city service; these motors upon a curve exert three times their nominal power. We have expanded the capacity of the motors beyond the other ordinate elements, which operate with them. We are attempting to run with the same trolley wheel; we are attempting (we have not kept pace with the controller at all) to control this great impulse of current with inadequate apparatus.

I go into a power plant today and look at it with perfect amazement. My first power plant was built about 21 years ago and it is still running and I sometimes go to look at it. It is a good example of engineering of that day, but it has become one of the antiquities. We then built a power plant with a few bars of bare copper and few plug switches, and without any methods of measuring our current we were ready at that time to light the world. The switch board was considered a very insignificant part of the plant, and it was not taken account of in the capitalization. Today go into a modern power plant, and the most important part of the plant is the switch board, which serves almost the same purpose as does the controller, the circuit breaker or the fuse box on your car. These have not kept pace with the increased capacity of equipments and improvements in this apparatus will not be provided until you men in the pit compel the manufacturers to make them and then they will do it under compulsion. That is my experience. I have possibly contended, as few men in this country have contended, to have our apparatus brought to what I claim are the commercial requirements. My men frequently say to me, "Mr. Beggs, that is impracticable." I say, "don't tell me anything like that; it is a commercial necessity and must be produced. We have to do it." My experience is that that which is absolutely necessary will be provided, but it will not be provided in the draughting rooms or in the technical departments of our manufacturers, and I say that with all due respect. I say it again, because I have said it much more plainly to the high priests of this organization.

Gentlemen, I wish to touch upon another matter, which my friend Mr. Ely and I have been discussing this morning. I have been discussing it for a year or two. I feel a certain sense of responsibility for this organization. I believe I was among the early managers who felt it was essential to have the practical heads of mechanical departments get together that they might relate experiences, exchange ideas, and each stimulate the other to better results. Consequently I feel deeply interested in the success of your organization. A year or two ago I suggested that it was quite as important that the superintendents of construction and maintenance of way should likewise be brought together to discuss the best methods of track and overhead line construction, and a move was made in that direction after the last convention, in Saratoga. It was then I began, with some others vitally interested in the success of these properties, to feel that in creating so many organizations we might lose, to a

certain extent, their effectiveness and they would defeat what we were hoping to accomplish. It is well enough for the managers of some of these larger properties to feel that their department heads, the superintendents of construction and maintenance of way, and their electricians and auditors should become members of separate organizations, but we must not lose sight of the fact that where there is one of these large corporations with this comprehensive organization holding up the hands of the management there are scores of small roads where the executive head of the company must be the master mechanic. He is the superintendent of construction and maintenance of way, and may have under him a $50 or $60 a month clerk, and he is the only man in actual authority, and to a certain extent, it is impossible for that man to devide himself between the various organizations. Furthermore, I feel that if I had to neglect the meetings of the American Street Railway Association, which is to convene in this hall on Wednesday of this week or to neglect the session of your association, I would feel under present conditions it was more important for me to attend the meetings you are holding here today and tomorrow, because these meetings are of more vital interest to me. You are the men who are spending the money, and without a certain degree of economy, which you practice we would not be able to make a satisfactory showing to the investment holders of the company.

That brings me to another thought. You have on your program certain proposed amendments to your constitution intended to bring in the superintendents of construction and maintenance of way. That is good as far as it goes, but I think you require in your case, just as the executive heads of this great industry require in their case, that we should get together, and that our meetings should be united, and have a certain time set aside in which the American Street Railway Association may discuss and consider matters of more general importance, questions of larger policy, etc. Then when the mechanical division, as I will call it, of the American Street Railway Association assembles, it should meet as an aggregation of companies, in which would be represented the executive heads as well as the other heads of departments of these various companies. On another day the superintendents of construction and maintenance of way division would have the floor, and matters pertaining to that branch of the business could be discussed. Another time could be set apart for the accountants, whose work is largely done, I am thankful to say. They have labored for six or seven years and the results are very gratifying indeed.

Therefore, I would suggest that it might not be inadvisable to have a committee from your organization appointed to act in conjunction with a committee from the American Street Railway Association and a committee from the Street Railway Accountants' Association of America, both of which associations now have regular organizations, and with representatives of the construction and maintenance of way department that we might bring this organization into one homogenous body. I desire to add further that the time is coming when we must have a more concrete organization of the entire body. We are not mendicants anymore. We should be able to pay our way and have proper officers to take charge of the affairs of this great industry.

There is an article on car wheels prepared for your consideration by Mr. Millar, of the Buffalo company. That brings up a thought and it emphasizes what I have been saying to some extent. Mr. Millar sees one phase of this industry in discussing car wheels. He writes this paper as the master mechanic and he has gotten up to a ⅞-in. flange on a car wheel. I say that the time is coming when you must have a different class of construction of track in your cities and you cannot continue to run these high speed interurbans, in trains of cars, around sharper curves than any steam road would attempt to operate, and to run them at speeds equal to the best steam road practice in the United States, with a flange seven-eighths of an inch in depth. That brings up the question of a different class of track construction in your cities. It is going to require persistent, intelligent work to have the municipal authorities recognize that we are up against a difficult condition of that kind now.

You will find by reading Mr. Millar's paper that one of the troubles with the wheel is that when he gets into grooved rail construction, the flanges are worn by running on the bottom of the groove, and the flanges will continue to wear from time to time. Some of you gentlemen are not taking into account how much of the head of the rail we expect to wear off in the course of the life of the rail. Where will that groove be after twelve or fifteen years' use, which we must get out of the rail if we are to secure a proper economy in our investment?

The time is coming when these broad questions of policy must be taken up. One question is in connection with character of wheel you should use. Of course, to many roads having only metropolitan service, this question is not so important, but take a property such as I am administering in the City of Milwaukee, where we control every thing electrically in that section of the State of Wisconsin, where we are radiating our interurban lines in all directions, keeping up average speeds, including stops, of twenty miles an hour on regular schedules, and the cars coming to the center of the city, it becomes a very important element to the city itself. We are bringing the people in and doing more to expand the city than all other agencies combined, and the public must recognize that something must be sacrificed in order to obtain these advantages. For that reason I say that it is important that when these matters are being discussed that there should be some of us on the floor of this convention that can present these things before the meeting, and get the members of the association to think about them. The master mechanic sometimes forgets. The superintendent of transportation is the man who receives all the denunciation from the public. The public does not realize that the master mechanic is the man behind the gun and that if there is a misshot he is responsible. It rests upon the responsible head of the company, after all. I give instructions that every complaint is to centralize at the manager's desk. I am the man who is responsible. The public has the right to look to me and to Mr. Ely in these matters because we are supposed to possess that element of administrative ability, that element of management, which has the capacity to select proper men for these different heads of departments, just as the master mechanic should be able to select good men. It is well enough to have a good master mechanic at the main shop, but it is more important to have quite as good a master mechanic at every car house, where supervision and inspection of the rolling stock takes place. And no matter how good the master mechanic may be as a master mechanic, he must have administrative qualities, which will enable him to select proper foremen for distant points of the system. These points are becoming widely spread year by year as the boundaries of the territory in which your properties are located expand, and as it is necessary to have these men further away from headquarters, it is essential that the master mechanic of the road should be capable of selecting efficient men for these outlying places. As I say to my associates, I intend to cover the most of the state of Wisconsin with interurban railways, and in such a case it is important to feel that the master mechanic has such an organization under him, that if it is necessary to send him away for a week, the work at headquarters will not suffer.

I trust, gentlemen, you will not ignore what I have said about my belief as to the necessity of amalgamating the various branches of our industry. The master mechanic, the superintendents of way, the accountants, and the claim department men should all be in one organization in conjunction with the association of managers, all of whom will work together in harmony. I thank you, gentlemen, for the kind attention you have given me.

President Olds: We also have with us today another practical street railway man, one who holds the highest office in the gift of the American Street Railway Association. I refer to Mr. W. Caryl Ely, of Buffalo, N. Y.

ADDRESS OF MR. ELY.

I am very glad indeed to be with you this morning. I feel that it has been a privilege as well as a pleasure to be here to listen to the remarks of Mr. Beggs, which were most able, instructive, and abounding in truth and wise suggestions from beginning to end. As I remarked to him when he took his seat, of course he thought I was flattering him, it was worth the trip to St. Louis to hear that plain statement of truth with reference to our business. Just such statements as these are the very best proof of the wisdom and value of having these organizations. Many a man who works in the many departments of the railroad business has vexatious problems over which he works and toils, and sometimes

when things are going wrong his mind gets to running in a groove or channel and he gets the blues. He is in the woods and he cannot see the way. Now, the meetings of these associations are the places where a man's mind can be relieved of all these situations by the interchange of thought, the interchange of experiences and the interchange of light that comes from the mind as it gropes its way forward into the future of these great problems. It is here where a man gets real comfort and instruction, and I believe that these associations are worth fostering by the companies whose men are represented in them. I believe that when we get through the efforts toward rorganizing that Mr. Beggs has briefly alluded to, that we will have a concrete organization with certain co-ordinate and co-operative branches, all working together, with the work properly apportioned. When we have finally reached the outcome of it it will be so valuable to the companies whose officers and men are represented that the expenses of the organization will be cheerfully paid by the companies. I, for one, acting in an executive capacity in a large corporation feel that it is almost the salvation of the business that there should be a coming together in the right way of the men who work in the various corporations, from the presidents down

I believe thoroughly in organization and co-operation. It is the spirit of modern life. Nowhere could it be exemplified on a grander scale than in the grounds of this magnificent exposition. It is the biggest exposition, without doubt, that has ever been held. It has larger buildings, it covers more ground space than the Chicago World's Fair or the Paris World's Fair or any other that has ever been held, and it represents and typifies in the highest degree the value of co-operative work.

For some years past it has been evident to all that a change was coming in the affairs and the management and the scope of the work and operations of the American Street Railway Association. Eight years ago the first secession was brought about by the accountants who organized an association which has done excellent work. A year ago at Saratoga the first meeting of this Mechanical and Electrical Association, as an organization, was held, and that was the result of several years' agitation. Now, the superintendents of way, or the engineers of way, or the superintendents of way and construction, as they are variously intitled, are knocking upon your doors for admission, after having contemplated the formation of a separate organization for themselves. Now the question arises where will it all end? It seems to me that the parent association is in much the same situation that the mistress was who had a cook for a good many years, and was informed that the cook was about to leave her. She said, "Why, Bridget, what is the matter that you are going to leave me after all these years? Have I not treated you like one of the family?" "Indeed, you have," was the reply. "But I have stood it as long as I can." Now it seems to me that there is something wrong in our family and it ought to be fixed up in such a way that you could stand it a little longer; and I suppose that it must take the form of an organization of some kind, independent in someway, but connected with the other associations and the parent organization, so far as it looks to me, upon a re-examination of all the facts in the case has really never been entered upon by the parent organization. It has called itself together once a year and listened to the reading of papers that should be read in the meetings of your Association and the meetings of the Accountants' Associations, and only the policies which spring from these discussions should be considered in the parent organization. Its work should be confined more particularly to matters of national importance and managerial importance. I believe in the utmost tolerance and in the widest agitation and discussion of all these matters. Let us be rather sure than sorry, let us make haste slowly so that when we finally do the thing it shall be such a finished product, such a working organization, that it will accomplish the results and we will all feel that it is of value and all be proud of our work.

Upon that branch of the case which is brought up by the question presented by the superintendents of way and construction, whether they shall be permitted to join this association or whether action shall be deferred upon that matter until there have been conferences between committees of the differnt organizations, I tak it that it does not matter much. If you take them in they can go to work and be doing something while the other broader matter is under discussion. Therefore, it seems to me that it makes but little difference what you do. I am sure there going to be the broadest spirit of tolerance and the widest scope of intelligent action, and that we are all going to meet together and not be jealous of prerogatives but are going to yield where yielding is necessary and stand firm in a decent and dignified way where we think that things belong to us, but in the end I feel no doubt whatever that we will be able to get together.

I do not know that I have any more to say except to emphasize the importance of your work. You are, indeed, as Mr. Beggs has said, the men behind the guns. Your work is so important that it goes to the very root of everything, and when the balance sheet expressing the result of the year's operation is made up, perhaps the most important part of the whole thing are those figures which tell of the things in which you have played a part.

The injuries and damages account is swollen if the apparatus is not properly attended to in your shops and your car houses by the men who are under your control. The quality of the service, carrying with it that most important factor, the good-will or the ill-will of the public, the public officials and the press, is dependent largely upon the equipment and its condition of repair. All of these things are of the most vital importance. They are up to you, to a very great degree, and you have an entirely different work committed to you than is committed to the master mechanic of the steam road and it differs just as much from theirs as was expressed the example of Mr. Beggs. I thank you very much for the opportunity of coming here and seeing you.

Mr. Ely then paid a glowing tribute to the splendors of the Louisiana Purchase Exposition.

Mr. F. E. Smith, president of the Street Railway Accountants' Association of America, was next called upon and very briefly expressed his pleasure at being present at the meeting of the Mechanical and Electrical Association.

President Olds then delivered his presidential address as folfollows:

PRESIDENT OLDS' ADDRESS.

The importance and magnitude of the interests represented by our Association impels me to briefly present for your consideration a number of the more important matters. Our meetings being limited to but two days, let us make them interesting and profitable.

A glance at the exhibits in this building must impress you with the rapid progress that has been made in the development of transportation facilities. Not only do we see wonderful development in the steam locomotive, but the street cars of to-day compared with those of but a few years ago are certainly palaces on wheels. Every day we see evidence of progress in the line of more perfect and reliable equipment; there is, however, still room for improvement.

When this Association was first organized, it was thought best to confine the membership entirely to mechanical and electrical men. I think this a mistake. It is of equal importance to those having the way and transportation departments in their charge that they be well informed regarding the equipment, and its care and maintenance. We find that other departments need to be represented and are knocking at the door for admission to our Association; we must realize that our interests are nearly identical with those of other departments.

The object of this Association is to treat of mechanical and electrical subjects and exchange views and ideas upon the best methods of maintenance and operation. To do so intelligently, we must be well informed regarding the work required of our cars and motors.

There is also an agitation upon the part of some of the other departments for reorganization of the parent association, to be so arranged that each department will have its own sub-organization, under the control and direction of the parent body.

I can but feebly voice the feelings of every member of this Association when I say that our meeting in this grand old city of St. Louis, surrounded by exhibits from all parts of the world, will be most enjoyable and profitable to us. Our meetings being called upon the first two days of the week, the temptation will be very strong to put in our time sight-seeing rather than attending the meetings. I would personally request each one to take

hold of the matter in an earnest manner, and not only be present himself, but use his influence to have others attend and take an active part in the meetings, remembering that we are here in the interests of the companies we represent. Our meeting at Saratoga last year was a grand success, and under the conditions I have mentioned, why should not this be even better."

The public demands and is entitled to the best possible service we can give them, and to a certain extent our companies and the public are partners, for the better we please the people the better they will patronize the companies. The proper discharge of our work requires thought and vigilance to keep the rolling stock in as near perfect condition as possible, so that it will be safe and attractive and give reliable service. We must act and work as though we were not ashamed of the business in which we are engaged, it being one which concerns the business and private life of nearly every citizen in the United States and the world.

We all recognize that the work of the Accountants' Association has been and is now of great importance to our companies in making the classification of accounts and reports nearly uniform. This classification has been recognized as standard by the Railroad Commissioners. The joint paper up "Shop Accounts and Records" prepared by a committee of the Accountants' and our Association, we believe is a step in the right direction, not only looking to a uniform system of records and accounts, but to a more uniform system of doing the work. By referring to the records and accounts of the steam road master car builders and master mechanics, we find them very complete, the same rules governing the repairs upon cars in all parts of the country; and it is gratifying to note that a large number of electric roads are following more or less closely their methods.

I wish particularly to urge every member present to carefully consider the report to be submitted to you this morning, each constituting himself a committee to push the interests of our Association among those you meet, whether they are members or not. Personal work is what counts in any organization. The man in charge of any branch of railway work who does not give it his earnest individual attention cannot be a success; the same rule holds true with us. We must also realize that to make our Association effective it must be placed upon a sound financial basis.

What rapid progress the interurban railways have made! We need only look around to see them branching out in every direction, very many of them being operated upon private rights of way, running at high speed and doing freight as well as passenger business. This rapid progress is calling forth the best talent of our manufacturers as well as of those in charge of the maintenance and operation, to design and construct equipments to meet the ever changing conditions.

As yet but little has been done regarding the exchange of freight between steam and electric railways. I fully believe that the time is not far distant when freight will be received by electric roads and delivered to the steam roads in car load lots, the same as is now practiced by all steam roads. This would necessitate the construction of our roadway and track in such a manner that steam cars can be as successfully operated on the electric lines as on the steam railways.

It is also very important that the motormen operating the cars should be well posted and thoroughly understand their equipment. To be successful, there should be a uniform method in their instruction and examination. But a short time ago, should a locomotive engineer wish to change from one road to another, his examination as to ability would have been different in a great many respects from that of the road he was leaving. At the present time, if he be able to pass an examination upon a road operating in Maine and should he apply for a position in California, the examination would be practically the same, the qualifications for a locomotive engineer being the same in all parts of the country.

Our program is a good one and those who have had the subjects under consideration have done well. The papers should bring forth good discussions, which will be of great importance to each of our members. We realize that the majority of active members cannot be present at the meetings. For them to receive the benefits they should, the discussions must be full and to the point. The "Question Box" feature should also prove a very interesting and profitable part of our program.

The paper by Mr. Wright, of Providence, "The Ideal Shop," is a good one and I believe will be of great value in bringing out the views of our members. Shop construction and arrangement of departments and tools is of very great importance, making it possible to reduce the cost of maintenance to the very lowest figure. To be effective, the departments must be compact, well lighted and as nearly fire-proof as possible, so that the burning out of any one department would not seriously injure any of the others.

Mr. Millar, of Buffalo, will present a paper on "Wheel Matters" that is very complete and instructive. I am fully aware that it is a very perplexing question, requiring a great deal of thought and care, to design a wheel that will meet the very severe conditions of street railway service.

The paper on "Maintenance and Inspection of Electric Equipment", presented by Mr. Lindall, of Boston, treats of a subject of vital importance to each one of us and I bespeak for it your careful consideration.

There are, however, a great many other matters than those previously mentioned that call for our earnest individual attention. The method of conveying the current from the trolley wire to our motors by the use of the present trolley wheel, pole and base is but a make-shift and very unsatisfactory. I realize that it is a very hard problem but at the same time "Where there is a will, there is a way", and I believe that you will be able, in some manner in the not very distant future, to overcome the troubles with it that we now experience.

All of us are more or less troubled with short circuits and the reducing of the number is of very great importance. The present method of protecting motors by a circuit breaker or single fuse is one that I do not consider at all sufficient, and believe that each motor should be protected by an individual fuse. Very often a short circuit is the cause of a serious accident, and money spent for this purpose to perfect our equipment and reduce the number of short circuits to the very least possible number is well invested and will be the means of preventing a great many serious accidents.

The construction and installation of wiring and cables is also of very great importance. The insurance underwriters have taken hold of this matter and are doing good work, at the same time, I believe that we who are in the actual work are better able to see and know what is required.

The emergency brake is a matter that has received but very little attention from street railway operators and is one of great importance.

The design and construction of street railway cars and trucks is more or less crude and they should be changed to have a maximum amount of strength with minimum weight; at the same time we must not overlook the fact that they are to be attractive, safe and comfortable for our patrons.

The stock and bond holders of our companies are looking to us to reduce to a minimum the expense of maintenance and operation, and the sooner we arrive at and adopt methods looking that end the better it will be for ourselves as well as our companies.

Let me again call your attention to the fact that the interests of all are nearly identical, and as success is the goal for which we are striving, it is essential that we become familiar with the work and requirements of all other departments of street railway work.

Before closing, I wish to thank you for the high honor you have conferred upon me, and I shall ever consider my term of office as president of your Association as one of the brightest spots in my career as a street railway man.

I bespeak for my successor the same generous support that you have given me. Let us ever be aggressive, fair minded and ready to fight for what is just.

At the close of President Olds' address the meeting adjourned to reconvene at 2 o'cluock.

AFTERNOON SESSION.

President Olds called the meeting to order at 2:20 p. m. and stated that it was very gratifying to nd such a large attendance of the delegates at the meeting so promptly. He asked that all of the members would attend all the sessions promptly.

The next item of business on the programme was the report of the executive committee.

Secretary S. W. Mower presented the report of the executive committee. He stated that during the past year the following number of new members had been acquired by the association: Seven companies, thirty-six active members, and four junior members, making a total of forty-seven new members during the year.

The total membership at the present time is as follows: active members, 81, associate members, 39; junior members, 35; honorary members, 5; total 150.

During the year four active members and three junior members resigned.

The total receipts for the year are $1,704.85, expenses, $1301.30, balance, $403.05.

On motion of Mr. Baker, the report of the executive committee was accepted as read.

President Olds announced that new business would be taken up next and under this head the amendments to the constitution and by-laws, to provide for the admission of superintendents of the way department to membership in the organization were considered.

Mr. F. G. Simmons, of the Milwaukee Railway and Electric Company, who had been active in the formation of the proposed association of superintendents of maintenance of way, stated that for the past two years he had been very anxious to effect the organization of the way men of the country. When the association of Electrical and Mechanical Engineers had been formed the way men of the country felt that they had been left behind in the running. Mr. Simmons immediately began to undertake the formation of an association of way men. He had written to 130 or 140 heads of way departments and the great majority of the answers indicated that there was a decided feeling against a separate organization. The general concensus of opinion was that through the fact that the various societies were separating themselves from the main body, the dues to the companies were multiplying and the amount of time necessary to attend the varous conventions was greatly increased. If the formation of separate associations continued the transportation men would naturally form an association, who would probably be followed by the claim agents, and there would be such a multiplicity of associations that they would tend to strip the main organization of its effectiveness. Many of the managers of the smaller roads, especially, favored a reorganization within the main association. Mr. Simmons further stated that the idea of forming a separate association of way men had for the present been abandoned and the way men were ready to enter the American Railway Mechanical and Electrical Association if they would be received, and as members of such association they could take up some of the more pressing subjects connected with the way department pending the decision of the questions now before the parent organization. A large number of the heads of the way department had signified their willingness to become members of the Mechanical and Electrical Association, so that they might proceed to work upon some of the subjects which were of pressing interest. He thought that the committee suggested by Mr. Beggs and Mr. Ely, comprising members from the main Association, the Accountants' Association, and the Mechanics Association, was a good idea, and that there should also be on this committee some members representing the way department. It was his opinion that such a committee could proceed to work and that in the course of a year or two some result would follow along the lines indicated by Mr. Beggs and Mr. Ely, and in the meantime the way men could accomplish something in the Mechanical Association, in threshing out some of the questions in which they were interested.

Mr. C. F. Baker, of Boston moved that the Chair appoint a committee of three, selecting one from the way men, to attend the meeting of the executive committee of the American Street Railway Association, to be held on Tuesday morning. Carried.

Mr W O Mundy suggested that as some of the present officers of the Mechanical Association had become independent consulting engineers, or engaged in pursuits other than that of engineers for member companies of the association, that the precedent should be established that no member of the association, who was not in the employ of a member company, should hold office after the expiration of his term.

Messrs. D. F. Carver, Alfred Green, William Pestell and C. F. Baker made remarks in which they agreed in the position taken by Mr. Mundy.

President Olds called attention to the fact that at the last meeting of the association, held at Saratoga Springs, the matter under discussion was fully covered. The president doubted that any member of the association, who might become a supply man would care to accupy an official position, in view of the fact of his being a supply man. It would not be a proper thing for a supply man to be an officer of the association.

The president stated that he did not wish to appoint the committee provided for in the motion of Mr. Baker without an opportunity to consider the matter and consult with some other members; and that he would appoint the committee later and announce to the association the names of the gentlemen appointed.

The following amendments to the constitution and by-laws were then adopted:

MEMBERS—Article III, Section I.

The heads of mechanical, electrical and way departments of railway companies may be elected Active Members, and shall be entitled to one vote each, and all privileges of the Association.

MEMBERS—Article III, Section 3.

Employes of mechanical, electrical and way departments, not eligible as Active Members, may become eligible to Junior Membership upon the written recommendation of at least one member, and shall be entitled to all privileges except that of voting.

On motion of Mr. Alfred Green, it was voted to have the name of the association remain as it is until the meeting next year.

The president announced the next order of business would be the reading of papers.

MEMBERSHIP OF THE MECHANICAL AND ELECTRICAL ASSOCIATION.

The active members of the association when the convention was called to order Monday were 79 in number, the junior members were 36, and the associate members (railway companies) were 29 in number.

Yesterday the New York City Railway Co. and the Ottawa Railway Co., Ottawa, Canada, were added as associate members and the following as active members:

J. Murray Africa, chief engineer Lewiston & Reedsville Ry.

Norman Berry, superintendent car repairs, Sao Paulo (Brazil) Tramways Co.

Z. T. Daniels, chief engineer and superintendent of construction, Kansas Southern & Iowa Electric Ry., Iola, Kan.

J. S. Doyle, master mechanic Interborough Rapid Transit Co., New York.

N. H. Heft, general manager Stamford & New York Ry., Bridgeport, Conn.

J. A. Kreis, Jr., superintendent of pawer and master mechanic, St. Louis & Suburban Ry.

Lee Massengale, master mechanic East St. Louis & Suburban Ry.

A. B. Metcalfe, assistant master mechanic, Brooklyn Heights R. R.

The companies that are associate members in addition to those joining the association yesterday are:

Augusta Railway & Electric Co., Augusta, Ga.
Birmingham Railway, Light & Power Co., Birmingham, Ala.
Boston Elevated Ry., Boston Mass.
Boston & Northern Street Ry., Boston, Mass.
Chicago City Ry., Chicago, Ill.
Cincinnati, Dayton & Toledo Traction Co., Cincinnati, O.
Cincinnati Traction Co., Cincinnati, Ohio.
Cleveland Electric Railway Company, Cleveland, Ohio.
Denver City Tramway Co., Denver Col.
Detroit United Ry., Detroit, Mich.
Grand Rapids Railway Co., Buffalo, N. Y.
International Railway Co., Buffalo, N. Y.
Louisville Railway Co., Louisville, Ky.
Milwaukee Electric Railway & Light Co., Milwaukee, Wis.
Mobile Light & Railroad Co., Mobile, Ala.
Nashville Railway & Light Co., Nashville, Tenn.
New Orleans Railways Co., New Orleans, La.

North Jersey Street Railway Co., Jersey City, N. J.
Rhode Island Co., Providence, R. I.
Rochester Railway Company, Rochester, N. Y.
San Juan Light & Transit Co., Schenectady, N. Y.
Scranton Railway Co., Scranton, Pa.
St. Louis Transit Co., St. Louis, Mo.
Toledo Railways & Light Co., Toledo, Ohio.
Topeka Railway Co., Topeka, Kas.
United Railways & Electric Co., Baltimore, Md.
Indiana Union Traction Co., Anderson, Ind.
Washington Railway & Electric Co., Washington, D. C.

The fact that it is the leading companies that are supporting the association with influence and financial aid speaks eloquently for the work the association has done.

LOCAL COMMITTEE.

The local committee for the American Railway Mechanical & Electrical Association is to be congratulated on the excellent arrangements made by it, which did so much to make the first day's meeting pass off without a hitch of any kind.

This committee comprises:

Michael O'Brien, master mechanic, St. Louis Transit Co.

J. A. Kreis, jr., master mechanic and superintendent of power, St. Louis & Suburban Railway Co.

Lee Messengale, master mechanic, East St. Louis & Suburban Railway Co.

J. E. Burgess, superintendent of wire, St. Louis Transit Co. Louis Transit Co.

L. P. Crecelius, chief electrician, St. Louis Transit Co.

Merle R. Griffeth, St. Louis Transit Co.

CLAIM AGENTS TO MEET.

A meeting of the representatives of the claim departments has been called for this morning, at Room No. 10 on the second floor of the Transportation Building. This is a step in the right direction and those planning to secure a better forum for discussing matters of interest to this department have our hearty sympathy.

MANUFACTURERS ASSOCIATION.

The Manufacturer's Association held a meeting last evening and appointed an executive committee for the ensuing year as follows, one appointment being left vacant:

Daniel H. Brady, chairman, president Brady Brass Co.

John A. Brill, vice-president, J. G. Brill Co.

Calvert Townley, general agent, New York, Westinghouse Electric & Manufacturing Co.

E. P. Williams, Sherwin-Williams Paint Co.

Fred S. Kenfield, president, Street Railway Review.

George J. Kobusch, president St. Louis Car Co.

J. R. Lovejoy, manager railway department, General Electric Co.

James H. McGraw, president McGraw Publishing Co.

Wm. J. Cooke, vice-president McGuire-Cummings Manufacturing Co.

Richard H. Meade, secretary, 621 Broadway, New York.

C. C. Pierce, General Electric Co., Boston, Mass.

Frank Randall, general manager, National Electric Co.

C. K. King, manager, Ohio Brass Co.

William Wharton, Wm. Wharton, Jr. & Co.

The St. Louis Car Co. scored a big hit by presenting visiting electric railway men, and the supplymen, beautiful silk flags, appropriately inscribed, in honor of this meeting of the A. S. R. A.

Mr. D. B. Dean and wife, with Mrs. Henry Dreher, who will be their guest during the convention, arrived Monday on the Cleveland special.

Mr. H. M. Ransom and Mr. Riley, of the National Electric Co., arrived in St. Louis Monday from Cleveland.

TRANSIT COMPANY EXTENDS HOSPITALITY.

The St. Louis Transit Co., in extending hospitality to the American Street Railway Association this year, adopted a pleasing innovation. Instead of wearers of Association badges being entitled to ride free on the cars, as has been the custom, the Transit company has issued books of 28 tickets each to members of the Association and their friends. Each ticket coupon will be received by the conductor on Transit cars in payment of fare during the week, commencing October 10th and ending October 15th. The covers of the book are embossed and are very ornate. The front cover is adorned with a raised half-tone, showing a female figure symbolic of the prosperity arising from the World's Fair, while on the back cover is a half-tone reproduction of the famed sculpture, "Signing Transfer of the Louisiana Purchase."

NEAT AND USEFUL SOUVENIRS.

A neat and useful souvenir is being distributed by the British Westinghouse Electric & Manufacturing Co., Ltd., in the form of a "Westinghouse diary and note book." It contains items of interest to English visitors, such as the object of the Exposition, locomotion facilities, cab rates, tables of money, weights and measures, etc., together with data concerning the Westinghouse exhibits and products, machinery and tool tables, electric apparatus tables and valuable statistics of various sorts, all carefully indexed. The major part of the book, which is vest pocket size, is given over to diary and note-book purposes.

Tickets are being distributed, entitling holders to admission to the moving picture display in Machinery Hall, where, at 10:30, 2:30 and 4:30 o'clock daily, are shown biograph, panoramic and interior views of the shops, forges and foundries of the Westinghouse Companies.

It is with great regret that we have to announce that Mr. John A. Brill will not be present at the conventions. He has been ill for two months.

Mr. C. H. Weeks, vice-president of the Buckeye Engine Co., Salem, Ohio, is in St. Louis to attend the Street Railway conventions. Mr. Weeks is very much gratified over the attention which has been given to the Buckeye engines, which furnish power for the operation of the Intramural railway.

Mr. Richard H. Pierce, of Pierce, Richardson & Neiler, Chicago and Boston, who is in St. Louis as chief engineer of the Exhibitor's Power Plant, was among those present at the first session of the Mechanical and Electrical Association.

Mr. W. L. Cook will shortly assume the management of the Pittsburg office for the Cahall Sales Department. Mr. Cook is well known among street railway men, having been superintendent of power for the St. Louis Transit Co. from January, 1901, until April last. Before coming to St. Louis, Mr. Cook was with the Louisville Railway Co. in the same capacity. During the convention Mr. Cook is assisting Messrs. Darley and Gardner at the exhibit of the Cahall boilers.

The National Brake Co., of Buffalo, is repreesnted by Mr. G. S. Ackley, president and general manager, and Mr. Wm. D. Brewster, secretary, and either of the gentlemen will be found ready at all times to tell of the merits of the "Peacock" brake in case they are driven into a corner and have to talk business.

Maj. H. C. Evans, of the Lorain Steel Co., is attending the conventions as a delegate to the A. S. R. A., representing the Johnstown (Pa.) Passenger Ry.

Among the early arrivals is Mr. E. J. Lawless of the John Stephenson Co.

Mr. Maurice W. Thomas, New Orleans representative of the Westinghouse Electric & Manufacturing Co., is in attendance.

THE REGISTRATION OF THE MECHANICAL & ELECTRICAL ASSOCIATION.

The following members and visitors of the American Railway Mechanical and Electrical Association had registered up to 6 o'clock last evening.

MEMBERS.

Edwin W. Olds, Supt. Rolling Stock Milwaukee Electric Railway & Light Co.

Alfred Green, Brooklyn, N. Y.

H. H. Adams, Supt. of Shops United Railways & Electric Co., Baltimore, Md.

A. B. Metcalfe, Assistant Master Mechanic, Brooklyn Heights Railroad Co., Brooklyn, N. Y.

W. H. McAloney, Supt. of Shops Denver City Tramway Co., Denver, Col.

Fred'k G. Simmons,, Supt. of Construction and Maintenance of Way Milwaukee Electric Railway & Light Co.

H. J. Lake, Master Mechanic Muncie, Hartford & Ft. Wayne Ry.

C. H. Robinson, Master Mechanic Bloomington & Normal Railway Electric & Heating Co.

J. H. Eastwood, Master Mechanic Colorado Springs & Interurban Railroad Co.

J. Millar, Supt. Rolling Stock International Ry., Buffalo, N. Y.

P. J. Connor, General Master Mechanic Public Service Corporation of New Jersey.

E. J. Wilcoxen, Superintendent Rochester & Sodus Bay R. R.

D. F. Carver, Chief Engineer Public Service Corporation of New Jersey.

W. K. Evans, Master Mechanic Twin City Rapid Transit Co.

W. D. Wright, Supt. of Equipment The Rhode Island Co.

C. F. Baker, Supt. Motive Power and Machinery, Boston Elevated Ry.

J. S. Doyle, Master Mechanic Interborough Rapid Transit CoC.

WWilliam Pestell, Chief Engineer San Juan Light & Transit Co.

Norman Berry, Master Mechanic Sao Paulo Street & Power Co., Sao Paulo, Brazil.

W. O. Mundy, Commercial Engineer, Westinghouse Electric & Manufacturing Co.

John F. Knowles, Superintendent North Alabama Traction Co.

John I. Beggs, President Milwaukee Electric Railway & Light Co.

M. O Brien, Master Mechanic St. Louis Transit Co.

W. G. Matthews, Supt. of Line Denver City Tramway Co.

Albert R. Olds, Division Civil Engineer Milwaukee Electric Railway & Light Co.

M. R. Griffeth, Electrician St. Louis Transit Co.

S. W. Mower, Secretary A. R. M. and E. A., Detroit, Mich.

R. E. Danforth, General Manager Rochester Railway Co.

F. E. Raven, Chicago.

M. P. Boylan, General Auditor Public Service Corporation.

Charles T. Herrick, Chief Inspector Williamsport Passenger Ry.

N. H. Heft, Vice President and General Manager New York & Stamford & Greenwich Tramway.

H. A. Johnson, Public Service Corporation.

H. B. Noyes, Chief Electrician and Master Mechanic Omaha & Council Bluffs Street Railway Co.

G. J. Smith, Master Mechanic Metropolitan Street Railway Co, Kansas City, Mo.

A. M. Patten, General Superintendent Topeka Railway Co., Topeka, Kan.

C. K. Morrell, General Superintendent Lexington Railway Co.

Lee Massengale, Master Mechanic East St. Louis & Suburban Ry.

Z. T. Daniel, Chief Engineer and Supt. of Construction Kansas Southern Electric R. R.

E. D. Smith, Assistant Supt. of Power St. Louis Transit Co.

Charles H. Cox, Manager Lincoln Traction Co.

W. E. Harrington, General Superintendent South Jersey Division Public Service Corporation.

L. P. Crecelius, Chief Electrician St. Louis Transit Co.

NON-MEMBERS.

W. S. Jackson, Line Supt. Public Service Corporation of New Jersey.

Geo. E. Lawson, Chief Mechanical Engineer Metropolitan Street Railway Co., Kansas City, Mo.

B. E. Wilson, Passenger Agent Rochester Railway Co.

C. W. Cobb, Western Electric Co., Chicago.

J. R. Hickey, Jersey City, N. J.

Takejiro Shima, Railway Engineer Imperial Government Ry., Japan.

C. H. Baker, Boston, Mass.

H. Baylis, Roadmaster Public Service Corporation of New Jersey.

H. G. Paro, Purchasing Agent East St. Louis & Suburban Ry.

David S. Caree, Chief Engineer and Superintendent Capital Traction Co.

H. D. Crampton, Secretary to President Capital Traction Co.

H. Griffin, Bayonet Trolley Harp Co., Springfield, O.

V. S. Olinger, Secretary and Treasurer Bayonet Trolley Supply Co.

OTHER GUESTS.

Mrs. Edwin W. Olds and two sons, Detroit, Mich.

Mrs. Frederick G. Simmons and son, Milwaukee, Wis.

Mrs. E. J. Wilcoxen, Rochester, N. Y.

Mrs. W. K. Evans, Minneapolis, Minn.

Mrs. C. W. Cobb, Chicago.

Mrs. S. W. Mower, Detroit, Mich.

Mrs. H. A. Johnson, Newark, N. J.

Miss Cora Baker, Iola, Kan.

Miss Maide Seibert, Iola, Kan.

Mrs. Charles H. Cox, Lincoln, Neb.

FOR INDICATING STATION STOPS.

Giles S. Allison, of 45 Broadway, New York City, has secured control of a device for visually indicating in a car the names of the stations or streets, in rotation, at which the car will stop. The idea is particularly applicable to elevated or subway lines but it can be applied to any suburban or interurban road having regular stopping points.

The device consists of a box located either at the end of the car over the door or in the center of the car. The box contains a system of metal indicating signs, which by means of an ingenious releasing device are made to drop into view one at a time whenever a lever is pulled. The lever can be actuated by any movement that will give a direct pull. The simplest form would be a cord or strap, passing from the end of the lever on the box to the platform so that the guard or conductor could pull the lever, indicating the next station at which the train or car would stop. It is possible also to have an arrangement by which the closing of the platform gate would automatically actuate the lever and cause the name of the next station to be displayed. Other automatic or semi-automatic devices for actuating the lever can be devised to meet special conditions.

The indicating signs in the box drop into view, one at a time, by gravity when the car is going in one direction, and when the signs are to be displayed in the reverse order they are raised in rotation by a simple lifting arrangement actuated by the operating lever. The order of rotation can be reversed at will, and if it becomes necessary to shunt the car back before it has reached the end of the line, the box will immediately begin to indicate the stations in the new order.

Mr. J. DeSmet Maguire has resigned his position as special representative of the National Electric Co., of Milwaukee, to assume the presidency of the American Electric & Controller Co., with headquarters at No. 12 Dey St., New York.

A large party representing the Cleveland Electric Ry. arrived yesterday afternoon, including J. J. Stanley and wife, George Radcliffe and wife, Abbey Duty and wife, John Erhardt, W. G. McDole.

The Cleveland Frog & Crossing Co. is represented by Mr. Lucas, who reached St. Louis on the Cleveland special Monday.

ECONOMY OF GOULD REGULATING BATTERIES.

The installations of Gould Storage Battery Co's regulating batteries at the power plants of the Easton (Pa.) Power Co. afford a striking illustration of the economy effected by storage batteries in connection with loads of a fluctuating character. The Easton Power Co. supplies current for both lighting and railway circuits and has two stations, one being equipped with steam units and synchronous motors driving 550-volt railway generators, the current for these motors being supplied by two-phase alternators from the second station which is a water power plant distant 1½ miles. The fluctuations on the railway circuits were so great that in 1902 a battery of 255 cells of the Gould type S-611 was installed at the main power house station, having a capacity of 400 ampere-hours. In connection is a regulating booster. After this installation was made the average and fluctuating loads increased so that very often 1,500 h. p. is required, the current varying from zero up to the maximum, 2,000 amperes at 550 volts. To supply this current required, in addition to the battery, an 800 h. p. engine driving a 500-kw. generator, and the synchronous motor units supplied with current from the water power plant.

In the early part of 1904 a second battery was installed consisting of 255 cells of the Gould type S-617 in S-625 tanks, the capacity being 640 amperes for one hour with a tank capacity of 960 amperes. This battery is used in parallel with the first battery and since its installation the 800-h. p. steam unit has been shut down, with a resultant economy which in a short time will more than offset the cost of the battery installation. The only current now used is that derived from the water power, the water wheels running at a practically constant load and trouble with the wheel gate being reduced to a minimum. A secondary but important gain is found in the steadier operation of the lighting circuits, the generators for which are operated by the water power from the same plant.

ST. LOUIS CAR WHEEL CO.

Everyone interested in car wheels should visit the exhibit of the St. Louis Car Wheel Co., at post 17, aisle C, Transportation Building. It is, in effect, a joint exhibit of the St. Louis Car Wheel Co., St. Louis; the Decatur Car Wheel & Manufacturing Co., Birmingham, Ala., and the Atlanta (Ga.) Car Wheel & Manufacturing Co.

The St. Louis Car Wheel Co. displays wheels loose and wheels on axles, embracing all styles of chilled cast iron wheels for steam railroad service, as well as the St. Louis Car Wheel Co's. channel spoke "Twentieth Century" street car wheel. The wheels are not painted or polished, the idea being to show them in their original state after coming from the foundry. Each wheel is upright and supported in such manner as to afford easy access for careful examination of the chill and quality of the metal, as well as the mechanical design.

The street car wheels on axles show two forms of equipment. Those for interurban service weigh 550 lb. each and were especially designed for the Milwaukee Electric Railway & Light Co. The lighter weight wheels shown are such as are furnished for city service. A double-plate wheel is shown with a section cut out to show the depth and quality of the chill and to afford a minute inspection of the quality of the iron.

THE JOHN STEPHENSON CO.

The exhibit of the John Stephenson Co., of Elizabeth, N. J., is located on aisles D and 3, Transportation Building. It consists of a new high speed interurban car 46 ft. long, designed to run at the highest rate of speed with entire safety. The seating capacity of the car is 52 passengers. The company has designed a special truck for high-speed cars of this character. These trucks have six wheels each, it being reasoned that with a six-wheel truck defects in the roadbed will not be noticed, whereas a four-wheel truck will register them. These trucks are heavier than ordinary six-wheel trucks, also.

There has been no attempt at fancy work or elaborate finish in the construction of the car exhibited and only standard woods and plain bronze trimmings have been used. The car is vestibuled and is divided into smoker, passenger and private compartments.

WEBER RAILWAY JOINT MANUFACTURING CO.

The Weber Railway Joint Manufacturing Co., of New York City, has an especially attractive and interesting exhibit in aisle C, post 4, Transportation Building. Here are shown the various styles of joints manufactured by this company, together with a collection of photographs illustrating the Weber joints in track. In addition to views on different railroads where these joints are in use, there are several interesting views and prints giving details of the joints, and a large picture of the medal which was awarded this company for first premiums at the Paris Exposition.

Among the samples of railway joints shown by the Weber company are step joints joining 100-lb. A. S. C. E. and smaller rail sections as employed by the Pennsylvania R. R.; step joints joining 80-lb. and 70-lb. rails as used by the Chicago & Alton, and the Weber standard insulated joint for electric railroad use. Among the last-named is a sample of the joint adopted for the subway of the Interborough Rapid Transit Co., New York City. These joints are 24 in. long, fitting 100-lb. A. S. C. E. rail, and are laid on all of the subway express tracks.

Cars exhibited by the St. Louis Car Co. are samples of equipment as turned out all year around. No attempt at adding frills, with a view to catch the spectator's eye, were made.

ST. LOUIS CAR WHEEL CO. EXHIBIT.

THE PITTSBURG VACUUM EXHAUST HEAD.

The Pittsburgh Gage & Supply Co., of Pittsburgh, Pa., is exhibiting the well and favorably known Pittsburgh vacuum exhaust head which it manufactures and which it claims will positively remove grease and water from the escaping vapor, leaving it dry and free. The exhaust to the air is free and noiseless, with no back pressure on the engine. The case and pipes are of heavy galvanized iron, 14 to 20 gage, according to size; all joints are close riveted and brazed, the internal pipes being double braced, and sizes above 6-in. are flanged. The size of the exhaust pipe in the Pittsburgh head ranges from 1 in. to 36 in.

SIXTY YEARS OF CAR BUILDING.

A truly remarkable record is that of the Wason Manufacturing Co., of Springfield, Mass. For over 60 years, this establishment has been building steam railroad cars, and for over 10 years it has been building electric railway cars, and we believe there has never been anyone willing to state that the company ever built a poor car of either kind. Thomas Whitridge Wason, to whom the present Wason Manufacturing Co. owes its creation and much of its prominence, was a carpenter, and, at the age of thirty was a foreman in the repair shops of the Cabotville cotton mills. In 1845, Thomas Wason and his brother, Charles, foreseeing the future development of steam railroads, conceived the idea of going into the car building business. They located in Springfield, Mass., and started business in a shop so small that only half of a car could be kept under cover. Their first year's output consisted of six box cars and several platform cars for the Connecticut River Railroad, the entire year's output amounting in value to about one-third the average cost of a single car such as the company now builds. The establishment soon gained a wide reputation for the excellence of its work and grew rapidly from year to year. In 1881, the capital was increased to $300,000 and a new

DIRECTORS OF THE WASON MANUFACTURING CO.

Geo. C. Fisk, C. A. Fisk, L. C. Hyde, Henry Pearson, H. S. Hyde,
President, Deceased, Vice Pres., Treasurer.

board was chosen, consisting of George C. Fisk, H. S. Hyde, G. T. M. Davis, Lewis J. Powers, Charles A. Fisk. In 1889, the death of Mr. Davis necessitated a new board of directors. Mr. Powers withdrew and the two men brought in were Henry Pearson and L. C. Hyde. This board continued until July 30, 1904, when occurred the death of Charles A. Fisk.

In 1893, the company began building cars for electric railway service, and this is now an important branch of the business. Last year the output of the shops included 51 steam railroad cars, 453 cars for the Manhattan Elevated, 15 cars for the Rapid Transit Co. of New York, 64 closed and 49 open electric railway cars, 4 freight cars and 50 snow plows.

NERNST LAMP CO'S. EXHIBIT.

The main exhibit of the Nernst Lamp Co. is located in a corner of the Westinghouse block, No. 7, aisle T, Electricity Building, with a subsidiary exhibit in Machinery Hall, next to the Westinghouse auditorium. The main exhibit is in an attractive covered booth, where a special switchboard allows all varieties of electric illuminants to be thrown off and on, and a direct comparison of current consumption to be made by plugging in a wattmeter on any desired circuit. There are also cabinets and dissected lamps in operation, the former showing to advantage the value of the Nernst lamp in the determination of colors, while the latter shows the best features of lamp manufacture as embodied in the Nernst, and the reliability of operation.

Other exhibits of this company will be found in the mining exhibits of Texas, North Carolina and Wisconsin. These consist of the ores and steps in manufacture of the glower. Some of the ores from the Barringer mine in Texas belonging to the Nernst Lamp Co. have shown marked radiographic properties. The most effective displays of the Nernst lamp, however, are to be found in the lighting of the Fine Arts Building and many of the concessions and minor buildings.

BROWN-CORLISS ENGINE CO.

The Brown-Corliss Engine Co., of Corliss, Wis., has installed at block 45, aisle G, Machinery Hall, the engines for two of the generating units for the Intramural Ry. plant. This company makes a specialty of engines for electric railway service, building heavy duty and girder frame corliss engines in all sizes. The two engines in question are 750-h. p. vertical cross-compound engines, 18 and 36 in. by 36 in., direct connected to Crocker-Wheeler generators. They are of the company's standard type for railway work, with double eccentrics and guaranteed to work with continuous cut-off as late as 15-16 of the stroke. The units operate at 138 r. p. m., steam being supplied to the engine at about 150 h. p.

THE LAGONDA MANUFACTURING CO. EXHIBIT.

The accompanying illustration shows the exhibit of the Lagonda Manufacturing Co., of Springfield, O., manufacturer of Weinland tube cleaners, boiler room and steam specialties. The exhibit is in the Steam, Gas and Fuels Building, among the boilers which are used for furnishing the steam for the entire Exposition plant.

In this display may be seen the mechanical cleaner, which is driven by electric motor or other suitable power. Also the direct motor cleaner, which is something new in this line. This is a 12-in. water wheel which drives a very powerful cleaning head and which, with water at 150 lb. pressure, develops about 5 h. p. The power driven cleaner with horizontal drums at the top is used for cleaning bent tubes. A very interesting machine is the large turbine cleaner, which stands on top of the pyramid.

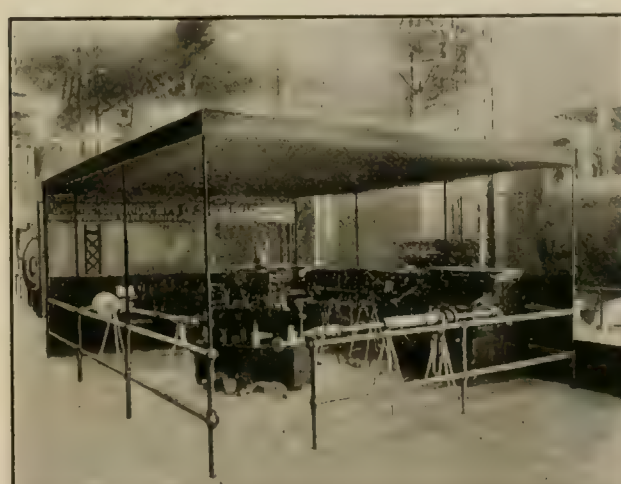


EXHIBIT OF LAGONDA MANUFACTURING CO.

This is an 8-in. machine, while the smallest on exhibition is but $1\frac{1}{2}$ in. in diameter. The display also includes reseating machines, tube cutter, blow-off valve and damper regulator. The cleaners may be seen in actual operation, as well as the damper regulator, these being used in the boilers in use at the Exposition. The tube cutters, and, in fact, all of the machines, will be demonstrated upon request.

The exhibit is in charge of Mr. J. W. Dunn, treasurer of the company, who will be glad to meet any engineers or others who may be interested in this line of machinery. The company has also issued a very attractive little souvenir in the shape of a watch charm, which it is distributing among its callers.

A. S. R. A. DELEGATES REGISTERED MONDAY.

Asbury Park, N. J.—Atlantic Coast Electric R. R. Co. Chas. E. Heutt, Geo. B. Cade, (Southern).

Augusta, Ga.—Augusta Ry. & Electric Co. R. E. Hunt, Charles L. Furbay (Southern).

Atlanta, Ga.—Georgia Ry. & Electric Co. Geo. B. Graves, A. M. Moore (Planters).

Allentown, Pa.—Lehigh Valley Traction Co. C. B. Easty (Inside Inn.)

Binghamton, N. Y.—Binghamton Ry. Co. G. Tracy Rogers (Jefferson).

Birmingham, Ala.—Birmingham Ry. Light & Power Co. W. A. McWhorter (Planters).

Boston, Mass.—Boston Elevated Ry. Co. C. S. Sergeant, H. L. Wilson (Jefferson).

Boston, Mass.—Boston & Northern St. Ry. Co. Frank Wilkenson (Mo. Athletic Club), Frank J. Ladd (Hamilton), H. Grover (Mo. Athletic Club).

Boston, Mass.—Boston & Worcester St. Ry. Co. J. F. Slean, A. E. Child, H. F. Eldredge, W. O. Jenkins, C. C. Pearce.

Beaumont, Tex.—Beaumont Traction Co. Geo. J. Kobusch, Frank J. Duffy, W. S. McCall.

Buffalo, N. Y.—International Ry. Co. W. Caryl Ely, H. M. Pease, Van Horn Ely, J. H. Beisen, C. A. Coons, T. L. Kemsilla.

Chicago, Ill.—Calumet Electric St. Ry. H. M. Sloan (Jefferson).

Chicago, Ill.—Chicago City Ry. Co. M. B. Starring, L. S. Menzesheimer, T. C. Penington, C. N. Duffy, L. Jewell, W. H. Leland, Geo. I. Bergen, D. A. Sant, H. B. Fleming, C. R. Manger, Robert Grinnell, E. R. Gilbert, J. E. Burgee (Southern).

Chicago, Ill.—South Chicago City Ry. Co. W. Wampler.

Camden, N. J.—Camden & Suburban Ry. Co. W. E. Harrington, H. H. Norris (5096 McPherson Ave.).

Cincinnati, O.—Cincinnati Traction Co. Thomas Elliott.

Cleveland, O.—Eastern Ohio Traction Co. R. L. Andrews, (4549 Westminster Pl.), J. J. Doyle (Southern).

Cleveland, O.—Cleveland & Southwestern Traction Co. H. A. Nicholl (Washington), W. H. Abbott.

Dubuque, Ia.—Union Electric Co. L. D. Mathes (Planters).

~~East St. Louis, Ill.~~—East St. Louis & Suburban Ry. Co. H. S. Clark (Jefferson), L. C. Haynes, J. M. Bramlett, C. E. Wilson, Lee Massengale, W. A. Bennett.

Galveston, Tex.—Galveston City Ry. Co. H. H. Cooper.

Grand Rapids, Mich.—Grand Rapids, Grand Haven & Muskegon Ry. Wallace Franklin, Carl M. Vail.

Hartford, Conn.—Hartford St. Ry. Co. E. S. Goodrich (Inside Inn).

Jackson, Miss.—Jackson Electric Ry., Light & Power Co. F. G. Jones, John Lorenz.

Johnstown, Pa.—Johnstown Passenger Ry. Co. H. C. Evans (Southern).

Jersey City, N. J.—Public Service Corporation. J. N. Akarman, W. Bayles, M. R. Boglan, Dudley Farrand, H. A. Johnson, Jno. R. Whitehead.

Kansas City, Mo.—Metropolitan St. Ry. Co. G. J. Smith (Washington).

Kenosha, Wis.—Kenosha Electric Ry. Co. W. L. Arnold.

Lynchburg, Va.—Lynchburg Traction & Light Co. R. D. Apperson, C. C. Hogshead, T. J. Carter (5653 Cates Ave.), J. A. Garrett (Franklin).

Louisville, Ky.—Louisville & Eastern R. R. Co. Percival Moore (Jefferson), H. H. Bechtel (Fielding).

Maynard, Mass.—Concord, Maynard & Hudson St. Ry. Co. J. W. Ogden.

Memphis, Tenn.—Memphis St. Ry. Co. F. G. Jones, R. G. Stewart.

Milwaukee, Wis.—Milwaukee Electric Ry. & Light Co. John I. Beggs, E. W. Olds, O. M. Rau, G. H. Atkin, C. J. Davidson, H. C. Mackay, F. G. Simmons, M. M. Austin, W. V. N. Powelson, E. G. Cowdrey, W. F. White.

Montreal, Canada—Montreal St. Ry. Co. W. G. Ross, D. M. Donald.

Merrimac, Mass.—Haverhill & Amesbury St. Ry. Co. Winfield Smith (2068 Taylor Ave.).

Nashville, Tenn.—Nashville Ry. & Light Co. H. A. Davis (Hamilton).

New Orleans, La.—New Orleans Railways Co. W. H. Renaud, Jr.

Norfolk, Va.—Norfolk, Portsmouth & Newport News Co. E. A. Langmire.

North Adams, Mass.—Hoosac Valley St. Ry. Co. W. Nary.

New York, N. Y.—New York City Ry. Co. W. A. Diaas, T. Millen, H. H. Vreeland, S. Young, Henry Sanderson, R. W. Meade.

New York, N. Y.—Interborough Rapid Transit Co. J. S. ——— (Southern).

Plymouth, Mass.—Brockton & Plymouth St. Ry. Co. A. J. Bemis (Southern).

Pittsburg, Pa.—Pittsburg, McKeesport & Connelsville Ry. Co. W. E. Moore, J. W. Bidge (Southern).

Port Chester, N. Y.—New York & Stamford Ry. Co. N. H. Heft, P. J. Allyn (Southern).

Providence, R. I.—Rhode Island Co. W. D. Wright, F. N. Bushnell (Inside Inn).

Rochester, N. Y.—Rochester Ry. Co. R. E. Danforth (Southern), E. J. Wilcoxen, B. E. Wilson, T. P. Maize (Inside Inn).

Richmond, Ind.—Richmond Street & Interurban Ry. Co. Daniel Royse (St. James).

Saginaw, Mich.—G. F. Chapman, G. F. Chapman, Jr., Palmer Hewlett (Washington).

San Juan, Porto Rico—San Juan Light & Transit Co. Wm. Pestell (Mo. Athletic Club), C. G. Young.

Savannah, Ga.—Savannah Electric Co. W. C. De Vane (3814 Delmar Ave.).

Seattle, Wash.—Seattle Electric Co. A. L. Campbell.

Schenectady, N. Y.—Schenectady Ry. Co. Edward F. Peck, F. E. Payne (Monticello).

St. Louis, Mo.—St. Louis Transit Co. Robert McCulloch, James Adkins, Richard McCulloch, J. F. Davison, E. O. W. Johnson, J. D. Crafton, J. B. Price, Frank Betts, James Larkins, L. W. Harper.

St. Louis, Mo.—St. Louis & Suburban Ry. Co. John Mahoney, J. S. Walsh, J. S. Walsh, Jr., E. B. Simmons, Breck. Jones, S. M. Kennard, C. H. Huttig, Benjamin Altheimer, H. I. Drummond, C. M. Foster, W. S. Orthheim, W. F. Nolker, J. A. Kreis, Jr., J. G. Johnson, Nathan Smith.

St. Joseph, Mich.—Benton Harbor & St. Joseph Electric Ry. & Light Co. W. Worth Bean, W. Worth Bean, Jr. (4926 Forest Park Bl.).

Sheboygan, Wis.—Sheboygan Light & Ry. Co. H. A. Strauss.

Terre Haute, Ind.—Terre Haute Electric Co. G. F. Wells (Inside Inn).

Toronto, Canada—Toronto Ry. Co. E. H. Keating (New St. James).

Topeka, Kan.—Topeka Ry. Co. Albert W. Patton (Planters).

Utica, N. Y.—Utica & Mohawk Valley Ry. Co. A. L. Linn, Jr., J. N. Shannahay, E. H. Stichel, C. Loomis Allen, M. J. Brayton.

Venice, Ill.—Granite City & St. Louis Ry. Co. F. E. Allen, E. L. McFadden, G. D. Rosenthal, G. F. Miller.

Washington, D. C.—Capital Traction Co. David S. Carll, H. D. Crompton (Southern).

Webb City, Mo.—Southwest Missouri Electric Ry. Co. W. E. McMechan, H. C. Rogers, J. M. Maret.

Williamsport, Pa.—Williamsport Passenger Ry. Co. C. T. Herrick (Metropolitan).

Worcester, Mass.—Worcester St. Ry. Co. J. W. Lester, F. A. Huntress (Hamilton).

LADIES.

Mrs. A. L. Campbell, Seattle, Wash.
Mrs. E. F. Peck.
Mrs. James Adkins.
Mrs. Frank Betts.
Mrs. L. W. Harper.
Mrs. A. W. Patton, Topeka, Kan.
Mrs. A. L. Linn, Utica, N. Y.
Mrs. J. A. Shannahan, Utica, N. Y.

Mrs. C. L. Allen, Utica, N. Y.
Mrs. M. J. Brayton, Utica, N. Y.
Mrs. E. H. Stichel, Utica, N. Y.
Mrs. F. E. Allen, Venice, Ill.
Miss A. L. Evans.
Mrs. Wallace Franklin, Grand Rapids, Mich.
Miss Grace E. Franklin, Grand Rapids, Mich.
Mrs. C. M. Vail, Grand Rapids, Mich.
Miss Goodrich, Hartford, Conn.
Mrs. M. R. Boglan, Jersey City.
Mrs. H. A. Johnson, Jersey City.
Mrs. J. R. Whitehead, Jersey City.
Mrs. G. J. Smith, Kansas City, Mo.
Mrs. W. L. Arnold, Chicago.
Miss Moore, Louisville, Ky.
Miss Moore, Louisville, Ky.
Mrs. H. H. Bechtel, Louisville, Ky.
Miss Bechtal, Louisville, Ky.
Mrs. E. H. Ogden, Maynard, Mass.
Miss Lillian Ogden, Maynard, Mass.
Miss Mary Grace Beggs, Milwaukee, Wis.
Mrs. W. V. N. Powelson, Milwaukee, Wis.
Mrs. E. G. Cowdrey, Milwaukee, Wis.
Mrs. H. A. Davis, Nashville, Tenn.
Mrs. W. H. Renand, Jr., New Orleans, La.
Mrs. E. A. Langmire, Norfolk, Va.
Mrs. Thomas Millen, New York, N. Y.
Mrs. H. H. Vreeland, New York, N. Y.
Mrs. Henry Sanderson, New York, N. Y.
Mrs. C. B. Easty, Allentown, Pa.
Mrs. F. J. Ladd, Boston, Mass.
Mrs. C. C. Pearce, Boston, Mass.
Mrs. Geo. J. Kobusch, St. Louis.
Mrs. W. S. McCall, St. Louis.
Mrs. W. Caryl Ely, Buffalo, N. Y.
Miss Adams, Buffalo, N. Y.
Mrs. Van Horn Ely, Buffalo, N. Y.
Mrs. C. A. Coons, Buffalo, N. Y.
Mrs. M. B. Starring, Chicago, Ill.
Mrs. L. S. Minzesheimer, Chicago, Ill.
Mrs. T. C. Penington, Chicago, Ill.
Mrs. L. Jewell, Chicago, Ill.
Mrs. W. H. Leland, Chicago, Ill.
Mrs. G. I. Bergen, Chicago, Ill.
Miss Thompkins, Chicago, Ill.
Mrs. E. R. Gilbert, Chicago, Ill.
Mrs. J. E. Burgee, Chicago, Ill.
Mrs. W. E. Harrington, Camden N. J.
Mrs. H. H. Norris.
Mrs. R. L. Andrews, Cleveland, O.
Mrs. H. A. Nicholl, Cleveland, O.
Mrs. W. H. Abbott, Cleveland, O.
Mrs. H. S. Clark.
Mrs. L. C. Haynes, E. St. Louis, Ill.
Mrs. J. M. Bramlett, E. St. Louis, Ill.
Mrs. C. E. Wilson, E. St. Louis, Ill.
Mrs. Lee Massengale, E. St. Louis, Ill.
Mrs. W. A. Bennett, E. St. Louis, Ill.

Mr. Arthur Hartwell has resigned as sales manager of the Westinghouse Electric & Manufacturing Co. to become manager of the Sterling Varnish Co., of Pittsburg. Mr. Hartwell assumed his new duties on September 20th.

THE WABASH CUTS THE SCHEDULE TO 7 HOURS.

Commencing Sunday, October 2nd, the Wabash Banner Blue Limited, which leaves Chicago at 11:03 a. m. daily, will make the run from Chicago to St. Louis in seven hours—one hour faster time than has heretofore ever been made between Chicago and St. Louis. On the return trip, this train leaves St. Louis at 2:00 p. m. and reaches Chicago at 9:00 p. m.

The Banner Blue Limited is one of the finest day trains in the world. The equipment, which is all new, consists of high-back coaches, free reclining chair cars, dining car and parlor observation car.

ENTERTAINMENT COMMITTEE OF THE MANUFACTURERS.

C. C. Pierce, General Electric Co., Chairman.
S. W. Trawick, General Electric Co.
J. T. McMurray, Niles Bement Pond Co.
F. G. Tallman, Brown Hoisting Co.
R. E. Moore, General Electric Co.
N. H. Powers, American Automatic Sw. Co.
F. C. Randall, National Electric Co.
Jos. Cunningham, National Electric Co.
S. I. Wales, National Electric Co.
A. H. Metzlaar, National Electric Co.
W. H. Powers, National Electric Co.
F. B. Degrass, Crocker-Wheeler Co.
Julian Roe, Crocker-Wheeler Co.
W. F. Sullivan, Crocker-Wheeler Co.
W. F. Fowler, Westinghouse Co.
M. W. Thomas, Westinghouse Co.
W. R. Dunlap, Westinghouse Co.
Frank S. Smith, Westinghouse Co.
T. P. Gaylord, Westinghouse Co.
J. R. Gordon, Westinghouse Co.
W. H. Heulings, Jr., J. G. Brill Co.
J. M. Haskell, J. G. Brill Co.
F. A. Estep, R. D. Nutall Co.
J. M. Gallagher, R. D. Natall Co.
Daniel Royse, St. Ry. Review.
Jos. Liedinger, Dayton Mfg Co.
Theo. P. Bailey, General Electric Co.
J. C. Calish, General Electric Co.
Geo. Bailey, Roehling Wire Co.
G. E. Kohler, Kohler Bros.
Harry Bigelow, Hale & Kilburn Mfg. Co.
A. S. Littlefield, Littlefield Construction Co.
Chas. K. Knickerbocker, Griffin Wheel Co.
H. C. Wells, Babcock & Wilcox Co.
George Knox,, Knox Engineering Co.
Robert Dunning, Cincinnati Car Co.
G. S. Clark, Pennsylvania Steel Co.
Otis Cutler, American Brake Shoe and Foundry Co.
T. A. McGiniey, Duff Mfg. Co.
J. M. Wakeman, Street Railway Journal.
Wm. Wampler,, Peckham Truck Co.
J. H. Stedman, Stedman Transfer Co.
E. J. Lawless, John Stephenson Co.
E. H. Abadie, Abadie & Co., St. Louis.
A. L. Whipple, Curtain Supply Co.
G. D. Rosenthal, General Electric Co.
Harry W. Frost, Berry Bros.
Edward A. Record, Vacuum Oil Co.
Samuel A. Megath, Galena Oil Co.
W. H. Whitesides, Allis-Chalmers Co.
Arthur Warren, Allis-Chalmers Co.
W. H. Kirshner, Columbia Machine Works.
Cornell S. Hawley, Consolidated Car Heating Co.
Roger W. Conant, Roger W. Conant Co.
J. Howard Yardley, National Car Wheel Co.
John Murphy, Heine Safety Boiler Co.
F. Garland, Ohio Brass Co.
Frank MacGovern, Rossiter-MacGovern Co.
J. M. Barr, Weber Rail Joint Manufacturing Co.

TROLLEY ACCIDENT AT SPRING VALLEY, ILL.

A car of the Illinois Valley Traction Co. was wrecked near Spring Valley, Ill., Oct. 9th, and nearly all of the 50 passengers were more or less injured. The car was running at a high rate of speed and as it reached a curve near the city limits of Spring Valley it left the track, plunged over an embankment and fell to the bottom of the ditch with terrific force.

The conductor of the car was fatally injured and the motorman was removed from under the car with several severe injuries. Fortunately none of the passengers were killed, although several had to be removed in ambulances. The cause of the accident is ascribed to the carelessness of the motorman.

WILL SELL THEIR EXHIBITS.

The National Electric Co., of Milwaukee, and the Hooven-Owens-Rentschler Co., of Hamilton, O., offer an opportunity to purchase their exhibit at block 46, Machinery Building. This unit consists of a National revolving field alternator of 1,500-kw. capacity, direct connected to the new Hamilton-Corliss vertical cross compound condensing engine, running at 83 r. p. m. The entire equipment represents the latest development of engineering design, and may be seen in operation until the close of the Exposition.

A detailed description, with illustrations, will be mailed upon request, and the representatives of the above companies may be found at block 46, Machinery Building. The National Electric Co. may also be interviewed at section 6, Electricity Building, where a number of other direct and alternating units of smaller capacities are to be disposed of.

BUCKEYE ENGINE CO.

The Buckeye Engine Co., of Salem, O., shows at block 45, aisles G and 9, Machinery Building, a 1,500 h. p. cross compound engine direct connected to a 950-kw. Crocker-Wheeler generator, this unit being part of the plant for operating the Intramural Ry., and it is one of the largest units for this service. The engine has 26½-in. high pressure cylinder, 50-in. low pressure cylinder and 48-in. stroke. It operates at 100 r. p. m. It is of the heavy duty type, such as the company makes a specialty of building for electric railway service.

O. M. EDWARDS CO.

The O. M. Edwards Co., of Syracuse, N. Y., furnished the window fixtures for the Missouri Pacific train exhibit in the Transportation Building. The fixtures are the company's latest improved pattern and are worth an inspection. The Edwards company makes window and curtain fixtures for electric cars and its products have become widely and favorably known.

THE CURTAIN SUPPLY CO.

Although the Curtain Supply Co., of Chicago, has no exhibit of its own, its products are very much in evidence at the Exposition, for nearly every electric car exhibited in the Transportation Building is provided with Curtain Supply Co. curtains or curtain fixtures, or both. The fixtures of this company also form a part of the equipment of the Intramural Ry.

The Curtain Supply Co. is prepared to furnish on short notice curtains and curtain fixtures of any required style and type for all kinds and descriptions of city, suburban and interurban cars. The company's representative states that the Curtain Supply Co. is selling its specialties in one form or another to practically every electric railway company and car builder in the country.

ELLIOT FROG & SWITCH CO.

The Elliot Frog & Switch Co., of East St. Louis, displays its specialties in an attractive manner at its booth in aisle C, post 11, Transportation Building, everything being laid out so as to be easily demonstrated. The exhibit includes the following: Three-throw switch with Hasty stand; "Eureka" spring rail frog, anchor block pattern; switch stand with semaphore target; split switch, wedge adjustable pattern; "Eureka" spring frog, plate pattern; high main line ladder stand; swing rail frog for yards; automatic parallel target ground throw; switch attachments; high main line switch stand; "Eureka" spring frog, anchor block pattern; three-throw stand for slip switch crossings and three-throw split switch; stiff frog, bolted pattern, solid welded filling; stiff frog, steel clamp pattern.

The Elliot Frog & Switch Co's. devices are widely and favorably known and its exhibit deserves attention from the visiting railway men.

Street railway men in attendance at the convention should not fail to look up the exhibit of the Galena-Signal Oil Co., of Franklin, Pa. They will find something of interest there.

DAILY STREET RAILWAY REVIEW

6TH YEAR, No. 2 | OCTOBER 12, 1904. | SERIAL NO. VOL. XIV, No. 9 B

THE ST. LOUIS CONVENTIONS OF THE AMERICAN STREET RAILWAY ASSOCIATION.

SOME PERSONAL RECOLLECTIONS OF CAPT. ROBERT M'CULLOCH, VICE-PRESIDENT AND GENERAL MANAGER ST. LOUIS TRANSIT CO.*

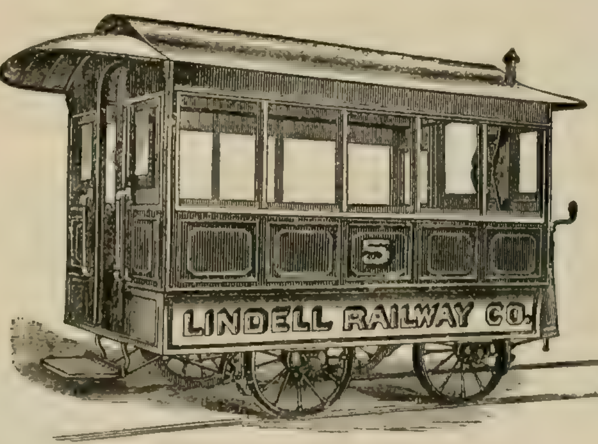
When the convention met in 1885, Julius S. Walsh was president of the Citizens' R. R.; Christian Peper, president of the St. Louis R. R.; Erastus Wells, president of the Missouri R. R.; J. H. Maxom, president of the Lindell R. R.; John Scullin, president of the Union Depot R. R. Charles Green was also prominent. Mr. Walsh took active charge of the local side of the entertaining and we held our meetings at the Southern Hotel. So far as I know there were no papers especially prepared, but there were various questions discussed; one of the very important subjects was the feeding and care of horses, as in those days there were only horse cars. The cure for diseases, the best way of feeding, how many miles horses could best stand for a day's work and things of that kind were of greatest interest. The weight of the cars and the weight of the rail was

ROBERT M'CULLOCH,
Vice-President and General Manager St. Louis Transit Co.

not discussed for the reason that there was only one style of rail in use and that was a flat tram rail laid on a wooden stringer, which was notched into the ties; the ties were laid 4 ft. apart. We had cars as light as we could get them. The heaviest cars weighed 5,500 lb., and the majority of cars in this city were what we termed the "bobtail," a car only 10 ft. long, drawn by one horse or two small mules. The preference at that time was for mules, as they could endure more than a horse, could stand the hot weather, and their average service was 10 to 15 years, while the horse lasted not more than half so long. Our great trouble in the operation of cars then was the motive power. That was the most serious question, especially when we had snow to contend with. The plowing and cleaning of snow from the tracks was extremely hard work with the crude appliances we had and the fact that we could only move them with our regular horses that were needed to pull the cars cut down our service very much as we could not use them for both.

Our work was very hard in those days. The hours of our men were long, but they did their work well and did it uncomplainingly. While the work was very hard for us who were then in business, we do not regret having done it and are glad we had the experience, although we would not care to do it again. Of course, we would be unable to perform the duties of city transportation today with those appliances. It could not be done, and the city today would not have developed without improvements in transportation.

There were no roads in St. Louis at that time that were longer than four miles in any direction, except the Broadway line, which was 7½, and it let their horses make a half-trip. The distance that people then rode on street cars was limited to, perhaps, 3 or 4 miles.



CAR IN SERVICE IN ST. LOUIS IN 1885.

There were no transfers; the fare was 5 cents. For quite a while after the war there were no 5-cent pieces and it was almost a necessity to have car tickets. While there were a few 5-cent "shinplasters," they were not abundant. The Legislature of the State passed an act legalizing the street car tickets of the city, each company being authorized to issue tickets, which were to be sold in strips of five adult tickets for 25 cents and ten children's tickets for 25 cents. These tickets were interchangeable and had to be accepted in payment of the fare on any of the roads, no matter who had issued them. Every month the secretaries of the roads had a clearing day, on which they exchanged tickets, paying the difference in cash. These tickets were accepted by grocers, butchers, dry goods stores, and, in fact, by everybody in change, and were just as good as a piece of silver is today. The advent of the nickel and the silver dime did away with the tickets, and although the same authority exists today, they are very seldom used. This act of the Legislature encouraged the use of tickets, and, in fact, almost compelled it for the act authorized a fare of 7 cents if it were paid in money. The companies in many instances did collect 7 cents, but they gradually quit the practice when the 5-cent piece came into use.

*Capt. McCulloch was vice-president, treasurer, manager and secretary of the Bellefontaine Railroad Co. at the time of the first meeting in St. Louis, in 1885. At the time of the second St. Louis convention he was vice-president and general manager of the combination of roads owned by the National Railway Co.

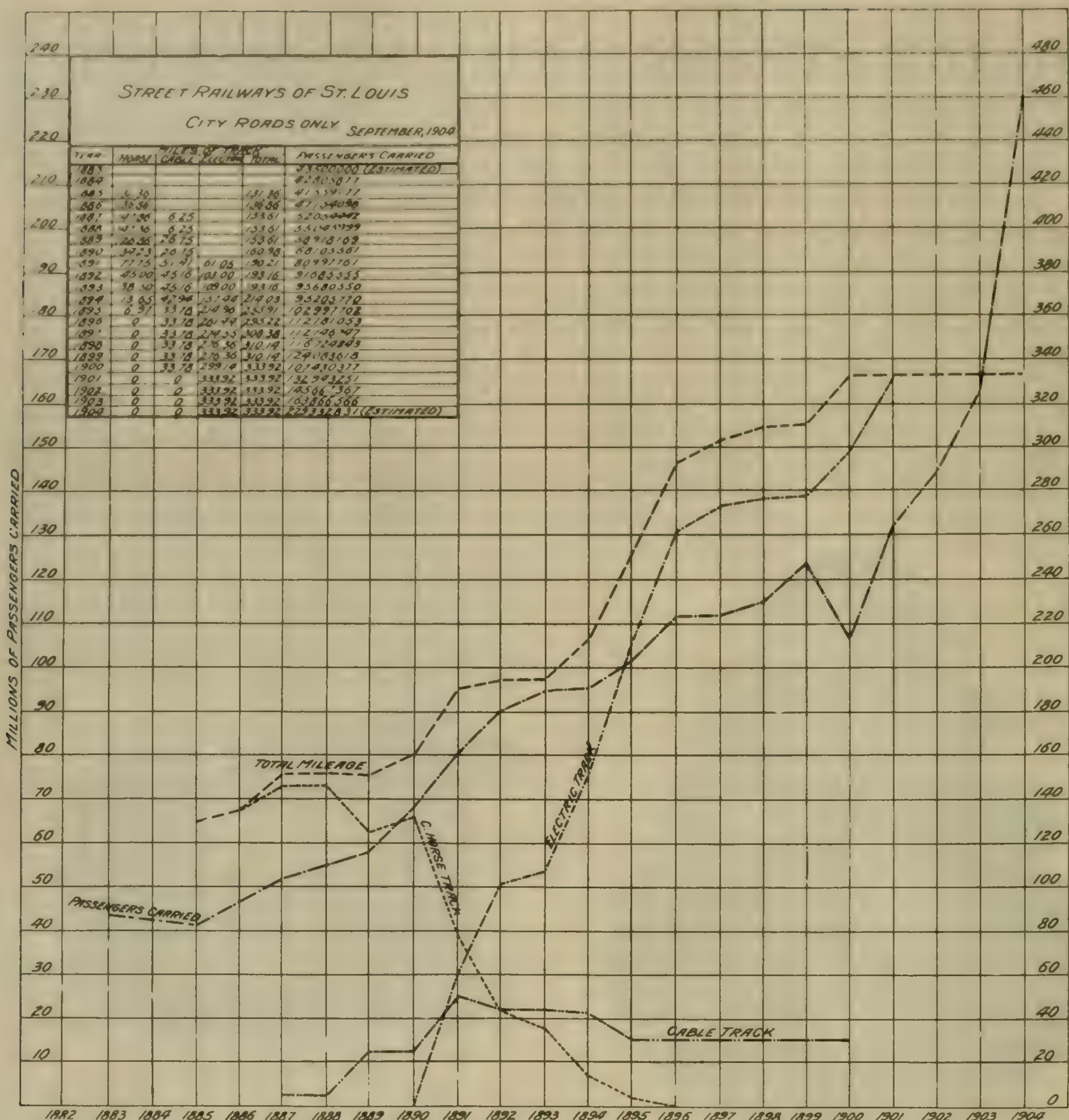


DIAGRAM SHOWING GROWTH OF ST LOUIS STREET RAILWAYS

This act of the Legislature has never been repealed, although some provision may have been made in the city ordinance regarding the 5-cent fare.

There were no exhibits at the conventions in those days, not even the suggestion of an exhibit. The convention was in session three days, as I remember. We had a banquet at the Southern Hotel, which, as compared with our dinners in recent years was not largely attended. The association then was more like a club of street car owners. The practical affairs of street railways were not so generally understood nor were they so important.

In the beginning of the street railway work, going back to the organization of the street railway association, persons who knew how to take care of horses and what was the best way of feeding them, the best method of working, the kind of a car to use and how fast to run them, held those things as trade secrets. The railroad man in one city did not know or care what railroad men were doing in other cities.

The American Street Railway Association has accomplished its greatest good in bringing about an acquaintance between the different railway men all over the country and getting them to exchange ideas about their work, a thing that had never been done before; in fact, it had been avoided previously.

While there were no exhibits in 1885 they appeared the next year when the association met in Cincinnati. Placed on a writing table, as I remember them, they consisted of a short piece of Johnson girder rail and a miniature railroad track, which was, perhaps, 6 ft. long and 6 in. gage, with a car on it. By some method there was an electric current produced, I do not remember how, and one end of this track was elevated, and it was undertaken to demonstrate that there was a greater adhesion between the wheels and the rail when there was current in them than when there was no current. This to show that it might be possible to get a car to propel itself on a track that was not absolutely level, it was thought at that time that a street car that was self propelled could not run on a grade.

WRECK OF UNION DEPOT POWER HOUSE BY TORNADO, MAY, 1896

At the time of the 1896 convention in St. Louis John Scullin was at the head of the Union Depot road; Mr. Maffitt at the head of the Missouri R. R.; Mr. Whitaker at the head of what was known as the Lindell road. Then there was a new road about to enter the field, the Suburban road, which is still in existence; that road was built after the convention of 1885, and Charles H. Turner was at its head in 1896.

By 1896 the horse had disappeared. The flat tram rail had given way to the girder. In many instances the flat rail was as light as 28 lb. to the yard; it gave place to a girder rail of about 85 lb. The 10 ft. car had been gradually enlarged until it became 20 to 25 ft. long. The horse car with a maximum speed of perhaps something less than 6 miles per hour, had been replaced by the cable and electric cars with a maximum speed of 10 to 12 miles.

[illegible]

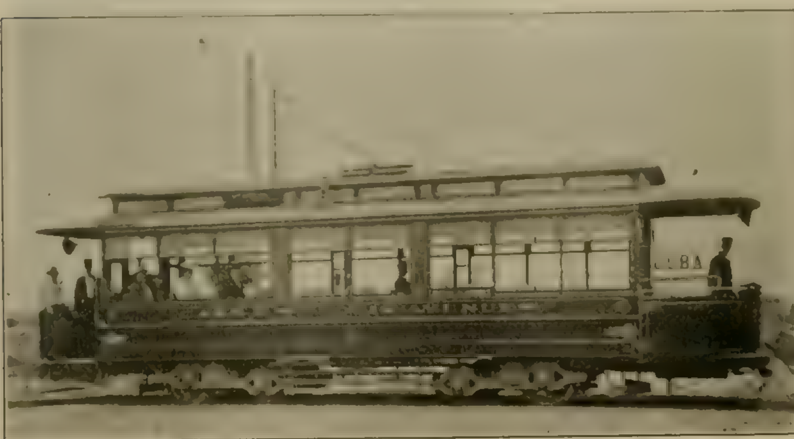
I think the insistence of the National Railway lines (with which I was then connected) on having the 60-ft. rail was the beginning of the use of that length for rails. The object of long rails was to reduce the number of joints. Mr. Daniel Coolidge, now president of the Lorain Steel Co., was in 1893, a salesman for the Johnson Co., now the Lorain Steel Co., and we wanted to build quite a lot of new track in carrying out the changes we were about to make from cable to electric power. Mr. Coolidge came to solicit an order and in an unguarded moment he agreed to a proposition that I made him and said he would give us a rail 60 ft. long. That was in October, 1893. Later he tried to have that requirement set aside, saying that it would be impossible for us to get the steam railroads to transport the rail and that we would be unable to handle them in the streets except at great disadvantage, but we declined to release him from his promise. We could not get the 60-ft. rail until 1895, and were obliged to wait until the company moved the plant from Johnstown, Pa., to Lorain, Ohio, so that it could have facilities to straighten so long a rail. We got the first 60-ft. rails that were made.

We made a contract with the General Electric Co. in the summer of 1892 to furnish us direct connected units and I believe we got that contract by reason of the fact that the General Electric Co. had said that if we could get a large engine that would allow a speed of from 90 to 100 r. p. m., it could build us a direct connected generator of 750 kw. capacity. The only builder of large engines of the corliss type who would agree to give us an engine that would run at that speed was Mr. Reynolds, of the E. P. Allis Co. When we accepted the proposition of the General Electric Co., it also undertook to have it set aside and get us to take the old style of generator, but we stuck to it and insisted on having the machine ordered. The first one the company ever built is running today and is now running as perfectly as any machine it can build now. It was started on July 4, 1893, in the Cass Avenue power house.

One day, I think sometime in September, 1891, a man came into the office with a little black bag in his hand and said he had something he wanted to show me. He was Mr. Hoffman, representing Mr. Falk. He opened the bag and took out a joint that he had made by some process of molding. The whole thing was, perhaps, 10 in. long with two pieces of girder rail, each one about 5 in., with a lump of cast iron holding them together. He started to tell me what it was and as he spoke with some hesitation, I remarked to him that it was not necessary for him to exert himself. Then I asked him if he thought that the joint would hold the two ends together. He insisted that it would and was much pleased that I would discuss the matter wih him at all, as he said that everybody he had showed it to had laughed at him and the idea that a little piece of "pot metal," as they expressed it, would hold two rails together. He was from Milwaukee, and before he left it was agreed that he would construct a cupola that could be used on the street and get it to St. Louis as soon as possible, and that he would weld the joints for two miles of track that we were building on Chippewa St. He went back to build the cupola and came down in the latter

part of October, 1894 and the 1st of November we welded this two miles of track. The track is still in use, and so far as I know of the 744 joints put in this track only three have broken; these broke the first winter.

The convention in 1896 met in a building that had been put up for the convention that nominated Mr. McKinley for president; it was on a lot opposite the city hall. The exhibits were in this building and were both good in quality and great in number.



CAR IN USE IN 1896 ON THE CASS AVE & FAIR GROUNDS RY.

This year the air brake was discussed but there were so many defects in the air brake in 1896 that it was not safe. The Suburban road in St. Louis had made a great many experiments with the air brake and would get an outfit of air brakes on a car and try them, and when the management would begin to think the brakes were about right, they would fail and some right ugly accidents resulted by reason of brakes failing to operate at the proper time. The air brake is all right now and we have them on all our cars.

In 1904 our power houses are not what might be termed modern, the car has grown larger, the track is necessarily heavier, the cable has disappeared and the volume of business has made the requirements of street railways greater than ever before.

It is a source of pride to us all that St. Louis is the only city to be honored by three meetings of the American Street Railway Association, and a most hearty welcome is extended to both delegates and supplymen.

THE TELEPHONE IN INTERURBAN WORK.

Editor "Review:"

It affords me pleasure to comply with the request of a few interested parties and state my experience in the use of telephones in electric cars, giving the many advantages of its use and service to the management. In the year of 1895 I promoted and managed for the following three years the first interurban electric road out of St. Louis, known as the St. Louis & Kirkwood Railroad. I used a portable telephone system with a jack terminal on poles three-quarters of a mile apart. I found many objections to this system owing to the jack construction affording a fine target for cat rifles, and during wet weather, and because of rust, it was very hard to make proper contact with the use of a plug; consequently, it became necessary to abandon this system and adopt the one commonly used today, namely, the telephone placed in a lock box and attached to a pole. The expense of this system had the effect to lessen the number of stations, hence making the service less convenient, and taking up too much time in case of trouble or accident.

In 1899 I commenced the construction of the St. Louis, St. Charles & Western Railroad, which I operated until July 7th of this year. In October, 1900, I conceived the idea of placing telephones in the cars. This was done in a very simple and economical manner. The telephone was placed to the side over the window in one end of the car. Concealed wires connected the dry battery placed under the seat, and also two jack connections placed on the side of the telephone. Two jointed bamboo fishing poles with wires attached in the same manner as a fishing line afforded a means of making connection with the telephone wires strung on the poles and the telephone in the car, constructed in this manner: Cutting off the small end of the pole in order to strengthen it, I fastened a flexible covered wire to which was fastened a bare copper hook, and at the large end of the pole, the wire was again fastened leaving enough wire projecting therefrom to reach into the car, and to this end of the wire was attached a plug. The length of the wire from the large end of the pole to the plug, and the length of the jointed pole, depends entirely upon whether the railroad is constructed with center or side poles. The poles were placed when not in use on the top of the car under the running board. When requiring the use of the telephone the motorman brings his car to a stop and climbing to the top of the car taking the poles passes the plug ends of the wires through the transom into the car, and while placing the hooks on the small ends of the poles on the two telephone wires, the conductor inserts the plugs into the jacks and the connection is made and the telephone is now ready for use. This means of connection requires not longer than one minute.

I found in the use of this system that in case of trouble or accident the location and information were given immediately. The value of this instant information cannot be estimated. In case of trouble it enables the management to send prompt relief, also to dispatch orders to the other crews who are delayed on switches. In case of accident, from a humanitarian and financial interest, its value in prompt information is better appreciated by those who have had experience as passenger as well as manager. In other instances, the conductor would inform me by code of a passenger on the car whom he had reason to believe had stolen property, consequently, on the arrival of the car at the end of the line a constable would be on hand to arrest him. It was one of the rules of our company that cars delayed on switches for five minutes should tlephone for orders and in this way cars were moved up that otherwise would have been delayed longer.

I attribute the reputation I had for prompt schedule service to the convenience of the telephone in the car, and I am at a loss to know why all electric interurban roads have not adopted this system. The manner of construction and making connection can be done in many ways and the telephones can be of any make, therefore, no patent controls this idea. The difference between the old system and that of telephones in the cars may be compared to a wheel-barrow and automobile race.

JAMES D. HOUSEMAN, Gen. Mgr.,
The Suburban Telephone Co., Clayton, Mo.

Sept., 1904.

AMERICAN BRAKE SHOE & FOUNDRY CO.

In the Transportation Building, aisle E, post 54, the American Brake Shoe & Foundry Co., of Mahway, N. J., exhibits a full line of its well-known brake shoes, together with an assortment of steel castings selected with a view of displaying in a comprehensive and interesting manner the different degrees of hardness in which these castings are made, according to the uses for which they are intended. For instance, there are samples of dynamo steel, in which there are as little carbon and manganese as possible, this product being unsurpassed for dynamo and motor field frames, pole-pieces, etc. Machinery steel is the second classification, this being soft and easily machined, though tough and strong, and is suitable for parts of locomotive, cars, mining machinery, etc., as well as for gears, pinions, sprockets, levers, cams, flanges, grease cups and other devices and machine parts. Then there is a display of high carbon steel to be used in such castings as wrenches, hammers, picks, plowpoints, die blocks, etc. Castings made from high carbon steel may be readily tempered in oil or water. Altogether this exhibit is the best the company has made and is well worth inspection.

DISCUSSION BEFORE THE AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION ON "THE IDEAL SHOP," BY W. D. WRIGHT, AND "WHEEL MATTERS," BY J. MILLAR.

THESE PAPERS WERE PUBLISHED IN THE "DAILY REVIEW" FOR OCT. 11, 1904, AT PAGES 669 AND 670.

DISCUSSION OF MR. WRIGHT'S PAPER.

Mr. W. O. Mundy stated that he took exception to one thing in the paper. He did not agree with the policy of putting two or three cars on a single track. The way he read the paper there were pits running clear to the back end of the shop apparently for working on the cars. In his opinion it depended on the location and style of equipment whether it was advantageous or not to do this. The question of having a shop built on this plan with a number of tracks going to a transfer table, with provisions for two or three cars on each track, or whether a single car should be placed on each track, was one which should be fully considered. With only a single car on the track it meant when the car was repaired it could be taken out and another one substituted in its place and the amount of shifting would be reduced to a minimum. In this way the cost of shifting would be materially reduced. Another point was whether the equipment should be handled from the pit or not. Many of the roads, especially the smaller roads, have been handling all their equipments from the pit. His personal opinion was that this was a mistake, especially when you come to double truck cars. He did not think that the equipment would receive as close attention, if handled from the pit, as if the men were above looking down. This brought up the question of either raising the car or working from the inside. Working from the inside of the car was hardly satisfactory as in doing this grease and dirt is deposited upon the floor and the seats and the interior of the car are soiled. He simply suggested this to bring up discussion to develop the merits of getting at the equipment from the different points.

Mr. H. J. Lake, of Muncie, reminded the meeting that a year ago the same question in regard to working at cars and trucks from above, or in the pit, had been discussed. It appeared to him as though that before a standard could be adopted as to where a mechanic could work on a truck the manufacturers would have to adopt a standard truck that would allow the mechanic to work either above or below, which ever was desired. On the G. E. 57 motors which his road had adopted as standard, simply because their equipment are all of that make, they had to work from the pit. The general overhauling of the trucks was done entirely from the floor. As to Mr. Mundy's suggestion of working from the inside of the car that method causes more or less grease and dirt in the car which in turn causes a lot of unnecessary cleaning that can be done away with if the work is done from the outside of the car. His opinion was that the method of working above the floor or below the floor must be governed by the character of trucks and motors in use.

Mr. Wright agreed with Mr. Mundy that better work can be done above the floor level wherever possible to do it; but it was necessary to meet existing conditions. The lead of one car on a track was an ideal method of arrangement. With only one car on a track, in the case of a large equipment, it would mean a tremendous housing capacity and the length of the house would be quite an important item.

Mr. H. H. Adams, of Baltimore, criticised the arrangement of Mr. Wright's plan in regard to the location of the winding room. He considered the position of the winding room as shown on the plan not desirable; that it should be near the machine shop, as more or less work has to be done on the armatures, and if the winding room is separated from the machine shop it is necessary to have lathes in the winding room or take the armatures to the machine shop. He thought the armature room in the layout under consideration should be next to the machine shop. In addition to that, the position of the stock room was a little further away from the center of the group of shops than was desirable. The stock room should be as near the center of the rooms or shops as possible, to require a minimum amount of traveling back and forth to get stock. He believed tuat it would make a better arrangement to put the winding room and stockroom in the center of the building, moving the erecting shop up into the space which is laid out for the winding room and the stock room.

Mr. J. S. Doyle noticed that the space occupied by the transfer table is about 33 per cent of the entire equipment. He thought in a thickly congested district that would be rather prohibitive.

Mr. Mundy said that Mr. Adams had brought out the point he was expecting would be criticised, and that was the location of the various departments. As to his criticisms, in which he spoke of the undesirability of having two or three cars on a track and his preference for a single car on a track, he had reference to that part of the track used for repairing trucks and motors and not necessarily used for painting and varnishing the cars, because in these cases the car remains in the shop longer and it is not necessary for it to be shifted so frequently. In his opinion, if it is necessary to have the winding room, stock room, and machine room closer together it is also essential to have them near the erecting floor so that parts may be taken to and from the stock room readily. To afford room for having these shops close together he suggested a design of a shop in which the main incoming track would run parallel with one wall of the building and close to same, from which, by means of switches, spur tracks would extend back at an angle of 45° to a longitudinal track; the advantage being that the space required for the cars on the through track to clear this siding on the spurs would be much less than is the case where the spurs are at right angles; also if the trucks are run out from under the car, the trucks would not come opposite each other, thus keeping the workmen from interfering when working on adjacent tracks.

Mr. Wright remarked that in laying out these different departments some study must be given to each particular case; the partitions can be placed in any suitable location to meet the local requirements for doing the work. The details of arrangement in the various departments and the necessary apparatus must vary according to the different methods employed in doing work on different roads. One advantage of putting the winding room in the corner at the end of the building was to get good light as windows would be on two sides of the room. The method of winding employed by the Rhode Island Co. was such that they do most of the lathe work in the winding room. It is part of that department and would only necessitate carrying material to the iron shop once in a while.

Mr. Lake brought up the point that there is another element quite essential in the ideal shop in regard to double truck equipments, and that is a transfer table in the shop for each truck so as to take the truck out at the side of the car instead of taking it out at the end of the car, as he had found it is very inconvenient in overhauling a car to get at both trucks at a time from underneath the car. If the trucks are taken out from the side they can be taken out at the same time, otherwise each end has to be jacked up high enough to get the truck out. He said that in the case of a forward truck they always have to take the pilot off to take the truck out, whereas with a transfer table with each track, the truck can come out at the side of the car with a lift of eight or ten inches.

Mr. William Pestell heartily agreed with Mr. Lake upon the question of side transfer tables; he thought it a very good thing and for all heavy work, for motor equipment and double truck cars, there ought to be provided a side transfer table.

Mr. McAloney, of Denver, asked whether it would be feasible on account of fire insurance risks in case of a shop being designed on the plan proposed to have the transfer table as a part of the enclosure. It would seem on account of the insurance, it might be entirely open, if the transfer system is employed.

Mr. C. F. Baker, of Boston, believed it depended on local conditions. A great deal can be taken into consideration in arranging for any special shop. In the shops of his company,

for instance, they did a great deal of work in the car house. Another point which occurred to him was how long a 45-ft. transfer table would be suitable, in view of the fact that fifty foot cars will be in use, and a little clearance is desirable. He remarked that he saw no provision for carrying small supplies on a track down the center or the side. His idea of a shop was to not make a shop as long as proposed in this plan, but build the machine shop and wood working shop at right angles, so that the erecting shop and all pits, the paint shop, etc., can be at right angles to the main shop. If we have a transfer way, why not leave it open so as to have the benefit of a side light. Mr. Adams suggested that the closed transfer way would be a desirable advantage where snow had to be contended with. He had been confronted with that condition and it is a rather nasty thing to contend with.

President Olds remarked that he would like to hear further discussion brought out by Mr. McAloney regarding fire protection. As the members would recall in his address of the forenoon session he stated that the shop should be so constructed that any one of the departments could be burned out without serious injury to the others.

Mr. D. F. Carver, of Jersey City, stated that the company with which he is connected is building a shop on that principle; quite a ground space is left between the shops. That has very decided advantages. It particularly gives each shop plenty of light. It decreases the fire risks. If you have a space between your different buildings and you lose one building, you stand a chance of not losing anything else. It also has the advantage that you have track storage room around each shop. If you have a congestion in the paint shop, you have tracks around the paint shop on which you can put the cars and get them out of the way.

Mr. H. A. Johnson suggested that the triangular shop offered something entirely new from what is generally adopted, and the method of laying out track surface and the advantages to be derived from the triangular shop should be more thoroughly discussed.

Mr. McAloney said that if he was not mistaken Minneapolis had a part of its shop arranged on the railroad turntable idea. It covered the idea Mr. Mundy spoke of in regard to the arrangement of the track. Mr. McAloney suggested that perhaps Mr. Evans might give the meeting an idea of how it worked.

Mr. W. H. Evans stated that they have the turn table in connection with their round house where they do all of their overhauling. The turn table was left over from the steam motor days. The more he considered the shop layout the more he appreciated the advantage of having the width of turn table. The turn table or round house only accommodates fifteen cars, but getting one car out without disturbing the others is frequently quite a saving in time. In the plan laid out he thought it a mistake to only provide 45 ft. for transfer tables between walls, as there are cars in use as long as that if not longer, and during the life of such a house cars would probably be in use longer than 45 ft., and for a company to build a shop on that plan would lead to the same trouble which is now experienced by the short transfer tables for the single truck cars. Another matter he would criticise was having only 13-ft. centers. He thought that the experience had been that the tracks had been laid out on too close track centers. That is especially important if it is intended to do the repairs above the truck as there must be room between the tracks so that the workmen can get around. With the more recently development in trucks and motors it looked as if that was the coming method. He was not, however, of the opinion that we can do away altogether with the pit, as it will be necessary to have the pit for the purposes of inspection even though it is not used extensively for repairs. The pit, however, in a large shop adds considerably to the expense and if it could be avoided by having 50 per cent or 75 per cent of the tracks without pits it would very much reduce the first cost in the shop.

Vice-President Green, in the chair requested some member to take up the question of the construction of the building itself as regards the fire risks; whether the mill construction or steel construction of the shop would be better. He would like to hear from Mr. Adams on that question.

Mr. H. H. Adams, of Baltimore, said that he was rather partial to the new construction; he saw no great objection to the post construction for the repair shop. It can be worked out very nicely and has one advantage, that if you desire to have hoisting apparatus overhead for the cars, you have a good arrangement of posts on which you can carry a good system of hoisting apparatus and do away with it below as he presumed Mr. Mundy would suggest in this shop. He thought slow burning mill construction was more to be desired from the standpoint of fire risk.

Mr. Patton stated that his company had just completed quite extensive shops, having built a new car barn, a new carpenter shop and paint shop, emergency building and office all on one site. The company already had on the site a stone machine shop, which was remodeled, and it put up the separate buildings as the best fire risk. The buildings were constructed of monolithic cement blocks, 12x12x24 in., one part cement and three parts sand; there was no crushed rock used. Construction was started about a year ago and was finished on the heels of freezing weather. The shop went through a very severe winter without a crack in any cement block and the company feels that it has a pretty good building. The roofs were built on a light steel truss with an inch layer of sheathing and composition roof. There is a total car barn area of 4,000 sq. ft. and a standard division fire wall, 12 in. thick, running down the middle and enclosed with double fire doors. The barn has two openings, enclosed by double standard fire doors. On that building the basis rate is $1 and the only differentiation of charge was 5 cents per $100 on the wooden sheathing under the roof; there was no differentiation for the steel truss. The rate on the carpenter and paint shop had not yet been given, but it will probably be the same thing. The machine shop fronts south and there is an open space of sixty feet. The carpenter and paint shops are in one building, but are separated by a standard fire wall running up to the roof and enclosed by double standard fire doors.

Mr. C. F. Baker, of Boston, remarked that mill construction as used in New England is employed on buildings three and four stories high with the floors three and four inches thick. He did not understand mill construction in connection with the subject under discussion; it might be a brick wall, a concrete wall, or a concrete building. He understood that insurance men did not like steel columns, as they are liable to buckle in case of a fire; they prefer wood or cast iron. It is very difficult to repair the steel columns when they buckle.

Mr. H. A. Johnson suggested that it would be a good plan for the members to have photographs made of the various structures they know of, and to bring them to the next meeting with a statement of the experiences they had met with in regard to these structures and with a statement of the troubles that they had met in them. This suggestion was adopted.

President Olds then announced that the next business was the reading of the paper by Mr. J. Millar, Superintendent of Rolling Stock, International Railway Company, Buffalo, N. Y., on "Wheel Matters." This paper will be found on page 670.

DISCUSSION OF MR. MILLAR'S PAPER.

Mr. William Pestell remarked that the question of steel tired or cast iron wheels is one of great importance at this time, not only on interurban roads but on city roads. The cast iron wheel manufacturer says it is the old story, "the roads are again trying the steel tired wheels and will soon go back to the first love, the old cast iron wheel." This may be so, but there is much evidence in the last two or three years which shows that the steel tired wheel has many advantages not only for interurban and high speed work but also for city service. The restrictions placed upon the companies by municipalities do not allow them to get a sufficient depth of flange and sufficient width of tread for safe operation with cast iron wheels on high speed lines which must necessarily run into the city, and the remedy seems to be put on steel tired wheels. The steel tired wheel can wear down the flange as thin as one quarter to three-eighths of an inch and then possibly not be dangerous. The speaker had seen wheels running on 40 ton cars which were worn down to little more than one-quarter of an inch in thickness of flanges, and these wheels have never given any trouble. He would not say it is common practice on the road in ques-

tion, but it had some cars upon which it was necessary to run these wheels on account of not receiving wheels to replace them. The matter of the time to turn a steel tired wheel is one of importance. He noticed in one of Mr. Millar's sketches one showing the original section of tread and flange, and the other showing the section after about 35,000 miles run. It is stated, and it is proved by experience, that as the section of the wheel where the flanges join the tread, when the radius of that section assumes the same shape as the rail, the flange wear is much more rapid, and it would seem that the time for Mr. Millar to turn the flange is about at this time, as the wear will be greater from that time on. It would take very little turning to renew the flange to almost the original section and put the wheel in good shape for future service. The steel tired wheel is comparatively expensive in first cost running about four or five times the cost of cast iron wheels. The cost of turning a steel tired wheel is probably as great as that of pressing on and off a pair of cast iron wheels, so that the factor determining the economy of the wheel, outside of the question of safety, is not altogether that of the cost of turning against the cost of pressing on and off the other wheels. The life of the steel tired wheel, from what evidence the speaker had gathered in interurban service, runs from 140,000 to 180,000 miles. In many cases after turning steel tired wheels, they get a mileage of 50,000 to 60,000, so that they can compare the relative economy between the steel tired and cast iron wheels. As yet the speaker had not sufficient experience to determine how far the economy of the steel tired wheels extends, but many roads are now using steel tired wheels in city service, notably the New York City Railway Co. and the Fitchburg and Leominster, just outside of Boston. They are to be used in Manilla, and the speaker hoped to get experience there which would be valuable.

Mr. Adams inquired what would be the corresponding mileage under similar service with a chilled wheel.

Mr. Pestell replied that so far as he had been able to discover the average mileage for interurban or city service of cast iron wheels is not much over 40,000 miles.

Mr. Lake remarked that he had no experience with steel tired or cast steel wheels, but he thought that the time is eventually coming, with the rapid service on interurban work, when the roads will have to use the steel tired wheel or the rolled steel wheel. As has already been stated the cities call for a grooved rail, and in order to get a cast wheel that will apply to the grooved rail for city use, it is necessary to have too small a flange to run with safety at the speed that the interurban cars are compelled to use to keep up with the times. His experience with cast wheels had been very satisfactory for the interurban service on his lines, as these tracks have a 1½-in. grooved rail and take a flange one inch deep. It is almost an M. C. B. standard flange. On these wheels he has obtained a mileage of 80,000 miles. In regard to Mr. Millar's paper the speaker remarked that Mr. Millar in one place says that the wheels wear more on one side than they do on another. He thought that Mr. Millar would find that there were two or three things that would cause this wearing of one side; one would be that one wheel wears faster than the other in the tread; another would be that the journal brasses are not mated, or one was worn more than the other. Mr. Millar contributed it to running the car continually in one direction. The speaker uses single end cars running them continually in one direction. At the same time, about once every two or three months, if he finds a wheel wearing more on one side than on the other he turns the truck around and puts it on the other end of the car. His experience was that the wheel continued to wear on the same side. He had remedied that by using an emery shoe and grinding the larger wheel and making that wear a little faster. The suggestion might be made that the curves all go one way; but the curves on the speaker's road are very mild and are about equal as to the directions. The principal cause of this wear that he had found in the cast wheel is that the wheels do not wear equally as to the tread.

Mr. Mundy thought that the brake shoe had much to do with wheel wear and that incidentally the kind of brake shoe will make a difference in the wear of the wheel.

Mr. Baker queried whether the members had the wheel makers compare their wheels when they shipped them. His company did not get satisfactory results until they furnished gauges to check the wheels by. Another trouble was that the manufacturers sent the wheels bored out of center or eccentric. His road had less trouble from flange wear since he had insisted on a proper comparison of the wheels and a proper boring.

Mr. Pestell asked some of the members to explain the methods of turning steel tired wheels, the material used and the length of time it takes.

Mr. Doyle answered that the amount of time required in turning steel tired wheels depends largely upon the other work done on the equipment. The equipment should be brought in at least once a year. It also depends upon the condition of the line and the number of curves. The practice on his road is for one man to trim about five pairs of tires a day.

President Olds requested that the members supply data on the service of steel tired wheels and cast steel wheels and present it at the next meeting.

Owing to the lateness of the hour the discussion of the question box was deferred until the meeting on Tuesday. The meeting then adjourned.

SHOOT-THE-CHUTES FOR SALE.

An opportunity is presented to electric railway park managers in attendance at the Exposition to purchase the World's Fair steel Shoot-the-Chutes, built and patented by Capt. Paul Boyton. It is a double chute, so that boats may race down, which adds excitement to the sport. Another advantageous feature is the system which allows intending patrons to board the boats at the bottom of the chute, and avoid walking up. This new arrangement also causes people to remain in the boats and ride over and over again, thereby adding to the profits immeasurably.

The Exposition Shoot-the-Chutes is said to have been one of the greatest financial successes of the Fair amusement attractions. A. R. Rogers, president of the Pike Financing Co., will be glad to communicate with interested park managers.

PERSONAL.

MR. F. G. SYKES, until recently electrical engineer of the Schenectady Railway Co., Schenectady, N. Y., has resigned this position in order to accept the office of general superintendent of the Portland General Electric Co. at Portland, Oregon. Mr. Sykes received his first engineering experience as a civil engineer in the city engineer's office of Providence, R. I., later becoming district engineer of the district of Narragansett, Narragansett Pier. Desiring to change his profession, he entered Lehigh University and graduated as an electrical engineer. He then went to Schenectady and was in the testing room of the General Electric Co. and various other parts of the General Electric factory, including the engineering department, during a period of two years and a quarter. He resigned from the General Electric Co. to accept the position of electrical engineer and operating superintendent with the Edison Electric Illuminating Co. of Brooklyn, N. Y., which position he held for about four years and a quarter, leaving in June, 1901, to become constructing engineer for the General Electric Co. of the City & Suburban Tramway System, Sydney, Australia. This work occupied him from June, 1901, to April, 1903, when he accepted the position of electrical engineer and manager of the lighting and power department of the Schenectady Railway Co.

The Sherwin-Williams Co. is represented at the convention by Mr. F. A. Elmquist, eastern representative; Mr. H. E. Billan, western representative, and Mr. E. M. Williams, manager of the street railway sales department, of Cleveland.

Mr. Otto W. Uthoff, of Watts & Uthoff, of St. Louis, lightens the visiting railway man's pathway with cheerful greetings and miniature "Banner" lamps, which latter are given as souvenirs.

Quite a number of the delegates have been displaying good-sized "wads," which look suspiciously like the rolls of paper money which Mr. E. J. Smith, of the Peter Smith Heating Co., is giving away as souvenirs.

MAINTENANCE AND INSPECTION OF ELECTRICAL EQUIPMENT.

READ BEFORE THE AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION, OCT. 11, 1904.

BY JOHN LINDALL, GENERAL FOREMAN OF SHOPS, ELEVATED DIVISION, BOSTON ELEVATED RY., BOSTON, MASS.

The writer in preparing this paper has been impressed more than ever with the length, breadth and depth of the subject, and its importance as a factor in electric railroading. It also occurs that only two days having been allowed for the meetings of this Association, it will be necessary to make this paper very concise, to allow as much time as possible for discussing and bringing out the points which are of the greatest interest to the members.

The difference between success and failure in the "Maintenance and Inspection of Electrical Equipment" very often means dividends or no dividends. Therefore, it behooves the responsible head of this department to give much thought and careful study to this part of the work, ever bearing in mind the old maxim, "A stitch in time, etc.," which is never better applied than in the care of electrical equipment.

I have already suggested that the time would not permit me to go into details of inspection and repairs of electrical equipment, even if I were capable of so doing, and it would be presumptuous indeed for me to attempt to tell the members of this Association what is the best practice in this line, as climatic and operating conditions vary to such an extent that what is good practice in New England might be very poor policy in New Orleans or San Francisco. Therefore, I will venture to suggest only a few points which I think may be applicable in general and all important to the successful maintenance of electrical equipment, together with a brief description of inspection and repairs of electrical equipment on the Boston Elevated Ry.

JOHN LINDALL.

The education of the motorman may not be considered as within the scope of this paper. It is, nevertheless, a fact that the manner in which the car is handled has a very material bearing on the maintenance of the electrical equipment; therefore its care should begin at this point. The mechanical department should work hand in hand with the operating department for the proper education and discipline of the motorman, and the running down of ignorant and careless handling of equipment. The advancing of controller too quickly, running on resistance points, unnecessary reversing, failing to cut out defective motor, the substitution of "any old thing" for a fuse, improper closing of switches, running at high speed through water, and running with both power and brakes on, are a few of the things that bring trouble and expense to the electrical equipment. Money expended for the instruction and inspection of motormen is, in the opinion of the writer, well spent.

Defects in the equipment, however slight, should be promptly reported to the proper authority, and in such a manner that they can not be overlooked. This can best be accomplished by a system of written reports, and instead of the motorman or conductor turning in a car with the verbal report that "This car is on the bum; it was no good when I took it," they should be required to report on a form, provided for that purpose, the nature of the defect, and in case of serious trouble, the location on the line at which it occurred, with a brief statement of the conditions of operation, etc., at that time. This report not only has a morally beneficial effect upon the motorman or the conductor, but when sent to the mechanical department with the defective car, it is of material assistance in locating and determining the cause of the trouble. When evidence of improper handling or carelessness of men is found, the report, with foreman's statement to that effect, should be forwarded to the superintendent, where the question of instruction or discipline is decided.

The proper recording and tabulating of defects is very essential to the successful maintenance of equipment. Simply recording the various failures each day is not sufficient, as the value lies in being able to make quick comparisons, by week, month or year, and to see at a glance whether the various failures are on the increase or decrease, and calling attention to the points which are the most in need of improvement. Also, the history and record of defects of a piece of apparatus should always be at hand and consulted by the man whose judgment determines the course of treatment. I am very sure that the report prepared by the joint committee of Accountants and Master Mechanics will contain timely and valuable information along this line.

One of the most important factors that we have to deal with in this problem is the education of electrical inspectors and repairmen. The writer is of the opinion that sufficient attention has not been given to obtaining, instructing and retaining in the service competent men, and when we consider that about two-thirds of the cost of maintenance is chargeable to labor account, it certainly seems that too much consideration can not be given to this point. The development of good men to care for the equipment has not kept pace with the development of the equipment itself. Therefore, greater inducements should be held out to attract reliable and capable young men to the service. This is not merely a question of wages—congenial surroundings are necessary. I have recently had occasion to visit certain shops and car barns, the equipment of which was comparatively new, yet the conditions were such that no self-respecting man would stop in them. Shops should be properly laid out for the work, kept clean, well lighted, and heated in cold weather. The work necessarily being dirty, lockers for clothing, as well as ample toilet accommodations, should be provided, which would enable the men to leave the shops in a clean and respectable appearance. These are not luxuries, but actual necessities, which no well regulated company can afford to be without. They mean a better class of men, better work and more of it. Work should be laid out in such a manner that defective or careless work can be traced back, without any question as to what man is responsible. The men should understand this, also that a record is kept of the cost of work performed by the different men, and that they will be held responsible for results. They should be brought to realize that advancement does not depend merely on length of service, but on their record for obtaining good results at the least cost.

Master mechanics and foremen in figuring to accomplish the greatest amount of work today, should also consider the question of making men for the needs of the future, and should make it a point to have men fitted for any vacancy that may occur. They should realize that there is even more credit in turning out good men than there is in turning out good work, and a man who will not impart knowledge to his subordinates, for fear that they will know as much as he himself knows, is not worthy of the position which he holds. Men should be taught why—as well as how—to do work, and to work from cause and effect. They should read the effects to find causes, and not guess at them. A controller which has flashed shows, just as clearly as if photographed, the position of the cylinder at the time of the trouble (if care is taken to note the evidence before it is destroyed) and it is then easy to determine whether it is a case of hot-touch, insulation breakdown, or lack of current handling capacity.

The practice of some companies of supplying railroad literature to lobbies, for the use of motormen and conductors, can not be too highly commended, but I would suggest that if this privilege were extended to inspectors and repair men, it would be appreciated and bring good returns. Of course the periodicals would not be read during working hours, but should be made to some extent circulating—one man taking a paper to his home for a day or two, then pass it along to another man. In this manner an oppor-

tunity would be afforded for men to keep posted on the latest improvements and practices, and it would also stimulate an interest in their work.

The inspection of electrical equipment, whether it be on a time basis or mileage plan, should be systematic, and not considered as something to be done when it is convenient and let go undone when it is not. The question of how often to inspect depends entirely upon the equipment and conditions of operation and can best be determined by experiment. It is possible to do too much inspecting, and a great deal of money can be wasted in this manner, but with careful tests to determine how long the different parts of equipment will run successfully without attention, and a system which insures the necessary attention being given at the required time, the chances of failure in service, and cost of inspection, are reduced to a minimum. We must not, however, lose sight of the fact that the primary object of inspection is to prevent failure of equipment in service, and that we should weigh the cost of inspection against the direct loss in revenue, wages of trainmen while handling crippled cars, and loss of patronage due to interrupted service. I might also add the loss caused by the line becoming blockaded during snow storms on account of failures in electrical equipment of cars or plows; and we would not have to go farther back than the last winter to find a number of cases where the line would not have become tied up if that car or plow had not "laid down" at a critical moment, thereby causing a blockade which might have been prevented by proper inspection.

Under the system of inspection on the Boston Elevated Ry. surface lines, trolleys, switches, controllers and motors are inspected after three days' service, with the exception of brushes and armature grease cups of some W. P. motors, which are in severe service, and are inspected every day. In general, this inspection is as follows:

Trolleys, to see that pole is straight and securely fastened, that the harp is tight in the pole, and that there are at least three days' wear in the wheel; that contact springs, washers, bushings and spindles are not seriously worn and are properly lubricated.

Controllers, to see that they are clean and properly lubricated, that contacts make and break at proper points, that fingers and tips are sufficient for at least three days' wear and that they are not rough and cutting; that cut-out switches work properly, and that wires are firm and show no evidence of heating at terminals.

Main switches, fuse boxes and lightning arresters, to see that contacts are sufficient and in good condition, and that wires are secure in terminals.

Resistance, to see that they are not seriously burned, that they are secure, and connections firm.

Motors, to see that connections and leads are secure and not chafing, also that brushes are not broken and are good for three days' wear, that the brush holder insulation is clean, and sufficient tension in springs, that commutators are clean and smooth, that bearings are properly lubricated, that there is sufficient clearance between armatures and pole pieces, that pinion and gears are tight, that motor gear case and axle collar bolts are tight, and that the casings are not cracked.

The monthly inspection consists of opening up motors for inspection and cleaning, lubricating and cleaning trolley stands and trolley catchers. Controllers are taken apart yearly, thoroughly cleaned and painted and insulating material treated with shellac. The wires are also inspected yearly for insulation weakness.

The inspection of the electrical equipment on the elevated trains differs from the surface car inspection but slightly. Contact shoes, switches, controllers and motors are inspected twice a week—no inspection work being done on Sunday. The inspection of controllers with the multiple unit system includes the inspection of master controllers, pilot motors and relays, and testing them. The motor compressor is inspected weekly.

I have already suggested that the best system of inspection is one that is frequent enough to properly take care of the equipment with the least inconvenience to the service. This requires that when a train is due for inspection it should be complete and all parts requiring inspection should be attended to promptly, so that the train may be returned to service and other trains due for inspection taken off without interference with train schedule. It frequently occurs that an inspector finds a part of the equipment which would require considerable time to repair properly, and in order to avoid the necessity of hurried or make-shift repairs or inspection, the system in vogue on the Boston Elevated does not require the inspector to do anything but inspect and make very light repairs. Equipment requiring extra attention is reported to the foreman, who details repair men to that work, therefore no excuse is accepted from inspectors for allowing equipment to go by which is in need of attention. They are held strictly responsible, and are required to report over their signatures the numbers of the cars inspected each day—which practically amounts to a written guarantee of their work. The inspection is made by two crews, each crew being responsible for an equal number of cars; in this manner accurate comparisons can be made and quite a healthy competition aroused, each man trying to make his record just as good or a little better than the other fellow's.

The manufacturing companies have evidently given the question of inspection considerable thought, particularly in their latest types of multiple unit control, where necessary inspection has been reduced very materially.

No repairs are made to electrical equipment at the car houses of the Boston Elevated, except the changing of defective parts. Switches, rheostats, control cylinders, armatures and fields are sent to the Albany St. shops for repairs; where also are manufactured for the company's use, field and armature coils, commutators, motor bearings, brush holders, trolley wheels, contact fingers, plates, bases, etc.

It may not be out of place to mention at this time a change which we have made in the usual type of contact fingers and cylinder plates. It is not necessary for me to call your attention to the very small percentage of copper which is actually consumed from plates and fingers of the cylinder type of controllers, as compared with the amount which is scrapped, on account of the necessity of maintaining the points of contact at their proper degree for the successful operation of the controller, or to the serious proportion in which this expense grows with the increase of current to be handled. I will, however, ask you to consider this in connection with a very simple but effective means of reducing this cost, which has been found in the adoption of tips for both contact plates and fingers, making it necessary to renew only that part which is consumed or damaged by the arc in breaking current. The fingers are made of cast bronze of about the usual shape and are recessed on the inside, at the end, to receive the copper tip which is secured by two C. S. machine screws. The tip copper is drawn in bars of the required cross section, and the only work necessary is the cutting in proper lengths and drilling and tapping for the two machine screws. The application of the plate tip is still simpler. New plates are not required, as the old plates with the ends worn to the limit are put in a milling machine and the ends cut off and a groove cut for interlocking with the tip, which is drawn of proper shape and cross section, so the only work necessary on it is the cutting off in the required lengths, the same kind of tip being used on all controller plates. This device has been in successful operation for nearly a year, and has been patented.

To the men responsible for the maintenance of motors, there is probably nothing which has given more worry, or been so thoroughly non-responsive to local treatment, as motor flash-overs. In the writer's experience this trouble developed with multipolar motors and the higher speed and voltages, and has been present more or less in all motors of this type, under the above mentioned conditions. Elevated service with multiple unit system and third-rail feeders, etc., is particularly favorable for producing conditions which contribute generously to the combination effecting flash-overs, and it frequently occurs that motors on all the cars in a train flash-over at the same time. Engineers are at present giving this matter thorough study. The principal remedy appears to lie in increasing the size of the motor so as to render it less sensitive, and we trust that in the near future motors will be manufactured which will not flash-over. This will surely effect a considerable saving in their maintenance, as burnt brush holders, springs, armature and field coils, resulting from flash-overs, is not a small item.

While the display of brass car trimmings at the head of the St. Louis Car Co's. exhibit is extensive, yet, some parts may have been overlooked. This company calls attention to the fact that it makes anything and everything known in this line.

LUBRICATION.

BY WILLIAM H. STARE, SUPERINTENDENT RAILWAY JOURNAL LUBRICATING CO.

The question of lubrication of car journals is demanding more attention in recent years than in the past and it is only right that it should. In this age of progress the electric railways have attempted to keep up to the demands and have built larger cars to accommodate the public and have increased the speed to compete with the steam railroads. As the cars increased in size, the weight has increased proportionately and it has become necessary to increase the size of the journal to carry this weight.

The method of lubrication, however, has remained the same as was used in years past. When the cars were small and the speed slow, there was not a great deal of trouble from journal lubrication nor did the expense amount to very much, but as the changes have come about, both of these items have changed until they are no small part of the troubles of the railway managers.

It is only natural that we should look to our older brothers, the steam railway men for our examples, and we have done so in journal lubrication as well as in many other things, and with what results, "the same trouble that is apparent on all steam roads." We have had no small amount of experience in this line and after a great amount of trouble and expense we arrived at the point where we thought it possible to devise some means of lubricating car journals other than that of "wool waste and oil" which is so generally used.

The result of our labors in this line is a mechanical means, doing away entirely with waste, and we have also been able to reduce the amount of oil used by a large proportion. Our first efforts were rather crude, as is bound to be the case with all new devices, but after many changes, cutting out the weak points and improving it where we found opportunity to do so, the "Economy Lubricator and Dust Guard" has been developed.

JOURNAL BOX AND JOURNAL WITH LUBRICATING WHEELS IN POSITION.

It is a well-known fact that there are a great many different kinds of journal boxes used in the different styles of trucks on the market today and this has been one of the principal troubles we have had to contend with in the development of our lubricator. At first it was our intention to conform to all the different constructions, but we found that would be impossible and impracticable even if there had been no other objections which, however, there were many. We will not attempt to mention all of them, but in passing, will say, that most journal boxes are not oil-tight or dust-tight. In lubrication of journals, it is important first to keep as much of the foreign substance out of the oil as possible, and in order to reduce the expenses, it is important to keep the oil in the box. With these two important points in mind, we have constructed a box which, while we do not say it is absolutely oil-tight or dust-tight, we do say that it comes the nearest being so of any on the market.

By investigating this matter one will see that in the construction of our box we machine both the front and back of the box and in this way we get a joint that is impossible to obtain where this care is not taken. In passing, we might say, that we do not claim to be manufacturers of journal boxes, but on request of roads adopting our devices we gladly furnish prints to the different journal box manufacturers embodying our design.

It is not necessary for a road to make any radical changes in the present style of boxes. We design a box that will accommodate the journal and journal brass that may be in use and one that will fit the pedestal of the truck so there is no reason for the railway managers to object to making this change, either when replacing worn out journal boxes or ordering new equipment.

By our past experience we have found that we not only are able to save all the waste packing used and reduce the amount of oil fully 50 per cent., but also to double the life of the journal brasses. It may be asked how this is possible. In answer, we say, by delivering a larger body of oil to the journal at the bearing point we gradually build up a heavier film of oil between the journal and journal brass. By mechanical means we are able to lift a heavier bodied oil than is possible by any capillary method, and as this film of oil increases, the wear of the journal brass decreases. It is also a well-known fact that as the film of oil increases the rolling friction of the car decreases and, while it is rather hard to determine the exact amount of saving to the road from this cause, it is a fact nevertheless that this item would be greatly noticeable at the coal pile and while this point does not generally come into the question of lubrication, a certain percentage of difference in the amount of current used to operate the cars is directly traceable to this cause and must, of course, be taken into account if we are to get all the true benefits from the improved methods of lubrication.

Our lubricator is very simple in construction and because of its simplicity it becomes more serviceable and more durable. The oil is delivered by means of a ball bearing wheel which is held in contact with the journal by means of a coil spring with sufficient tension to insure a positive feed of oil at all times.

The point was raised by some engineers at first, as to the flow of oil in winter. We are now, however, able to say after going through two of the most severe winters of recent years that our lubricators have never failed to work satisfactorily in the most severe weather.

The accompanying illustration shows an end view of a journal box and journal with the lubricating wheels in position.

Those interested in perfect lubrication may see a working exhibition of this device in Block 6, Electricity Building.

THE CRANE CO. EXHIBITS.

The Crane Co., of Chicago, has two exhibits at the Exposition. The main exhibit is in block 26, aisles H and 4, Machinery Hall, and includes brass, iron and ferro-steel valves and cocks; cast iron, malleable iron and ferro-steel fittings; pipe bends and special flanged connections for all pressures and purposes; pop safety valves and water relief valves. The artistic framework of the Crane Co's. booth is composed of samples of pipe bends and gives an excellent idea of the character of the work turned out by this company. The bends include 20 and 24-in. pipe bent to a 10-ft. radius without signs of wrinkling or injury to the pipe.

In aisle H of the Transportation Building the company has an exhibit which is composed wholly of valves and fittings for steam locomotives.

The Crane Co. also has a 30-in. atmospheric relief valve and a 24-in. motor operated valve on the Allis-Chalmers unit in Machinery Hall, which supplies the power for the decorative lighting of the Fair grounds.

Mr. S. W. Mower, secretary of the American Railway Mechanical and Electrical Association, has risen to be division superintendent of the Rapid Railway System of the Detroit United Ry. in a very short time. Mr. Mower had been employed in the office of the general superintendent of the Detroit United Ry. three years.

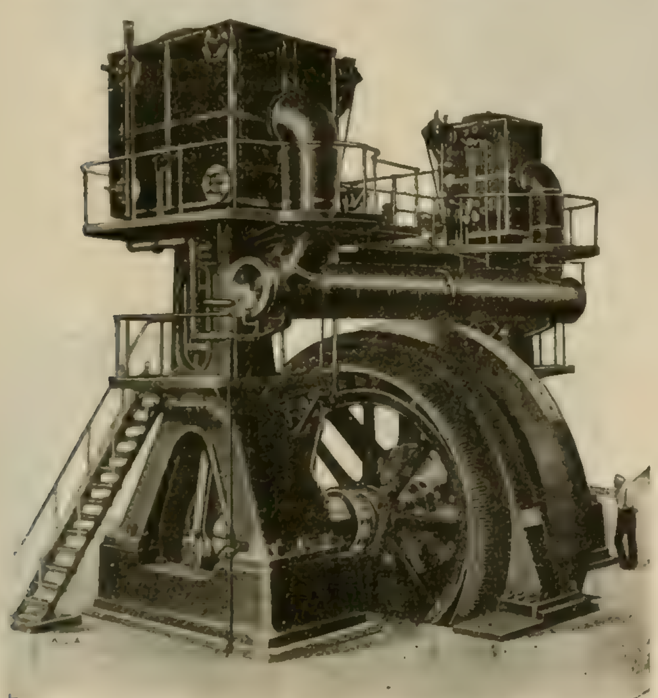
Among the interested visitors at the convention is Mr. William Scott Silver, representing W. S. Silver & Co.

NATIONAL ELECTRIC MACHINERY AT THE FAIR.

The National Electric Co., of Milwaukee, manufacturer of the Christensen air brakes and electrical machinery, although comparatively young in the electrical field, is turning out some large direct and alternating current generators for lighting, power and railway service. The unit illustrated herewith is of 1,500-kw. capacity, and is installed at block 46, Machinery Building, Louisiana Purchase Exposition, and direct connected to a 2,250-h. p. vertical, cross compound engine. The rated output is 1,500-kw., 25 cycles, 6,600 volts, running at 83 r. p. m. The power generated is used for operating the large pumps furnishing water for the Cascades.

Like all standard alternators built by the National Electric Co. this is of the revolving field type, leaving the armature stationary and easily accessible and the difficulty of properly insulating the armature coils is eliminated as the windings are not subject to any mechanical strains whatever. The revolving field is of large diameter giving additional fly-wheel effect to the engine and the construction of the field coils make them practically indestructible. All parts are accessible and the method of ventilation insures low temperatures.

The revolving field is made of cast steel in halves, which are bolted and secured together by shrunk links. The rim of the



1,500-KW. GENERATOR—NATIONAL ELECTRIC CO.

wheel is a channel in cross section to which the cast steel pole pieces are bolted. The field coils comprise 65 turns of 1½x⅛-in. copper strap, wound on edge and thoroughly insulated, the outer edge of the coil being exposed to the atmosphere for cooling. Laminated pole shoes are secured to the ends of the pole pieces and serve to hold the field coils in position. These shoes cover a large polar arc, distributing the magnetic flux evenly.

The field coils are insulated from the pole pieces by fuller board and the pole shoes and spider ring, by heavy fiber. The revolving field is 16 ft. in diameter and weighs approximately 50,000 lb.

The frame is a circular cast iron housing into which laminated punchings with inwardly projecting teeth are assembled, for the reception of the armature windings. The frame is exceedingly heavy and stiff, not requiring any external support and is divided horizontally, the halves being firmly bolted and keyed together. Bolts and keys are contained entirely within the cross section, obviating the use of side lugs.

Large open spaces are provided in the sides of the frames, allowing a free passage of air from the ventilating ducts in the core.

The armature core is built up of laminated soft steel, the punchings being annealed and japanned before assembling and ventilating space blocks are inserted at suitable intervals, providing openings extending around the circumference and allowing a free passage for the heat generated in the windings. There are six slots per pole, 2½ in. deep by 1½ in. wide, each being wound with 14 conductors of .37x.28 in. compressed copper. The internal diameter of the armature is 16 ft. ¾ in. and the width of core 16 in.

Cast iron collector rings and carbon brushes are used, enabling the machine to be operated with the minimum amount of attention at the same time providing a collector gear, which will carry a heavy temporary overload. The net weight of this alternator is 135,000 lb., and the following are the guarantees the National Electric Co. offers on this machine:

Efficiency at power factor 1—1¼ load, 95.05 per cent; full load, 95.5 per cent; ½ load, 94.75 per cent.

Regulation—5.5 per cent on power factor, 1.

Regulation—22 per cent on power factor 0.

Short circuit current with full load excitation 450 amperes.

This alternator is excited with a 45-kw. motor generator set, motor side run off 220-volt lighting mains, the exciter current on the alternator being regulated by a rheostat in the shunt of the exciter.

On Friday, July 15th, the pit was flooded with water, but the machine was dried out and in operation on the following Monday. This alternator has been several times short circuited, due to short circuits on the switchboard and mains, but has not been disabled in any way.

The temperature rise does not exceed 30 degrees on armature and magnets on a continuous run at full load and 40 degrees on the armature and magnets on a continuous run at 25 per cent overload.

The National Electric Co. also has an extensive exhibit in the Electricity Building showing the Christensen air brake equipments and electric machinery in operation.

BUDA FOUNDRY & MANUFACTURING CO.

The exhibit of the Buda Foundry & Manufacturing Co., of Chicago, will be found between posts 15 and 16, aisle C, Transportation Building, where is displayed in instructive fashion the principal standard lines of this company, together with several new devices recently added. The exhibit comprises, chiefly: Improved pressed steel wheel hand car; different styles and

BUDA FOUNDRY EXHIBIT

sizes of pressed steel wheels; Buda oscillating cattle guard; safety pneumatic crossing gates; rail benders; track drills and jacks; gages, levels and general track tools and materials.

Mr. John C. Dolph, manager of the insulating varnish department of the Standard Varnish Works, and Mr. Arthur Davis, of the same company, are "among those present."

OFFICERS AND EXECUTIVE COMMITTEE OF THE AMERICAN STREET RAILWAY ASOCIATION, 1903-4.


E. C. FOSTER,
First Vice-President


W. CARYL ELY,
President.


JOHN GRANT,
Second Vice-President


J. F. SHAW,
Third Vice-President.


J. C. HUTCHINS.


A. B. COLVIN.


T. C. PENINGTON,
Sesretary-Treasurer.


G. T. ROGERS.


W. A. SMITH.


S. L. NELSON.

WILLIAM CARYL ELY.

Mr. William Caryl Ely, president of the American Street Railway Association, is president of the International Railway Co. of Buffalo, N. Y. While his family is of New England origin, he was born in Middlefield, Otsego County, N. Y., and his family and himself are intimately identified with the history of Otsego County. When a young man Mr. Ely studied law and in 1882 was admitted to the bar at Ithaca, N. Y. In 1885 he removed to Niagara Falls and continued to practice law, at first independently and later as a member of the firm of Ely, Dudley & Cohn, which firm was dissolved in 1899, upon Mr. Ely's election to the presidency of the Buffalo Railway, and allied companies.

Mr. Ely was one of the original promoters and incorporators of the Niagara Falls Power Co., and aided in securing its charter, He was the chief promoter of the Buffalo & Niagara Falls Electric Railway, and its first president. He was also actively engaged in the construction of the Buffalo & Lockport and Lockport & Olcott Railways, and was the president of both companies.

In 1898 Mr. Ely conceived the plan of combining into one system all of the electric railways in Buffalo, Niagara, Falls, Tonawanda, Lockport and vicinity, together with the Niagara Falls & Park & River Railway, on the Canadian side of the Niagara River, and the Steel Arch Bridge at Niagara Falls, and the suspension bridge at Lewiston and Queenstown. This plan was successfully carried out. All of the operating companies, with one exception, were consolidated into the International Railway Co., all of the stock being held by the International Traction Co. Mr. Ely is president of both companies. Messrs. J. P. Morgan & Co. were the underwriters and are the bankers of the International Traction Co. This company owns and operates 352 miles of urban and interurban railways; also two great bridges across the Niagara River.

Mr. Ely was one of the original promoters, a director, chairman of transportation committee and a member of the executive committee of the Pan-American Exposition. He is a director of and has been counsel for numerous banking and manufacturing companies, including the Niagara Falls Power Co., Manufacturers' and Traders' National Bank of Buffalo; Carter Crume Co., Niagara Silver Co., and William A. Rogers, Ltd.

MANUFACTURERS ASSOCIATION.

CONSTITUTION.

I—NAME.

The name of this Association shall be "The American Street Railway Manufacturers' Association." Its office shall be that of its Secretary.

II—OBJECT.

The object of this Association shall be to advance the interests of its members, and of the American Street Railway Association, by providing for and having custody of such exhibits of material as may be made at the annual conventions, and the establishment of friendly co-operation and relations with each other and with the delegates of the railway companies.

III—MEMBERSHIP.

1. The members of this Association shall be manufacturers of street railway material, their agents or representatives, engineers or contractors engaged in railway construction, publishers and editors of the technical press, and others interested in street railways, but not engaged in the operation thereof.

2. Individuals, firms and corporations who are eligible, may become members upon signifying their desire so to do in writing and paying the annual dues.

3. Each member shall be entitled to one vote by a delegate presenting proper credentials.

IV—MANAGEMENT.

1. The management of the affairs of this Association shall be entrusted to an Executive Committee of fifteen, who shall be members or their representatives.

2. At its first meeting after the annual election of Oct. 10, 1904, the Executive Committee shall divide itself, by lot, into three classes of five each, the first class to hold office for one year, the second class for two years and the third for three years. Thereafter, at each annual meeting, five members of the Executive Committee shall be elected for terms of three years to fill the places of those whose terms have expired.

9. Vacancies occurring in any class of the Executive Committee may be filled for the unexpired term by majority vote of the remaining members of the Committee.

V—OFFICERS AND COMMITTEES.

1. The Executive Committee shall elect annually from its own body a Chairman who shall take office at the close of the meeting at which he is elected and hold office for one year. They shall also appoint a Secretary, who shall hold office during the pleasure of the Committee. The Secretary shall be paid a salary to be fixed by the Executive Committee.

2. The Executive Committee may appoint such sub-committees as may be necessary from time to time. The Chairmen of such committees shall report to the Chairman of the Executive Committee.

VI—AMENDMENTS.

This constitution may be amended by a two-thirds vote of members represented and voting, either at a meeting or by letter ballot, at least thirty days previous notice in writing having been given.

BY-LAWS.

I—MEETINGS.

1. The annual meeting shall be held on the opening day of the annual convention of the American Street Railway Association, notice of time and place having been given to the members in writing by the Secretary.

2. Meetings of the Executive Committee may be called at any time by the Chairman.

II—QUORUMS.

1. At the annual meeting fifteen members shall constitute a quorum.

2. At meetings of the Executive Committee three members shall constitute a quorum.

III—DUES.

The dues shall be fixed annually by the Executive Committee at such a figure as the finances and requirements of the Association may demand, but shall not exceed $35. In the event of the expenses of the Association falling below the amount collected a rebate shall be given to all members.

IV—ORDER OF BUSINESS.

1. At the annual meeting:
   a. Roll call.
   b. The reading of minutes of the last annual meeting.
   c. Report of Executive Committee.
   d. Report of Secretary.
   e. Reports of Special Committees.
   f. Election of officers.
2. At meeting of Executive Committee:
   a. Roll call.
   b. Reading of minutes.
   c. Reports of Committees.
   d. Unfinished business.
   e. New business.

V—AMENDMENTS.

These By-Laws may be amended or suspended at any meeting by a vote of two-thirds of the members present and voting.

OFFICERS A. S. R. A.

President—W. Caryl Ely, president International Railway Co., Buffalo, N. Y.

First Vice-President—Elwin C. Foster, president New Orleans Railways Co., New Orleans, La.

Second Vice-President—John Grant.

Third Vice-President—James F. Shaw, general manager Boston & Worcester Street Railway Co., Boston, Mass.

Secretary and Treasurer—T. C. Penington, treasurer Chicago City Railway Co., Chicago, Ill.

Executive Committee—The president, the vice-president and Jere C. Hutchins, president Detroit United Ry., Detroit, Mich.

Addison B. Colvin, president Hudson Valley Railway Co., Glens Falls, N. Y.

G. Tracy Rogers, president Binghamton Railway Co., Binghamton, N. Y.

W. A. Smith, general manager Omaha & Council Bluffs Railway Co., Omaha, Neb.

S. L. Nelson, general manager Wichita Railway & Light Co., Wichita, Kan.

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Application made for entry as second class matter.

6th Year, No. 2. WEDNESDAY, OCT. 12, 1904. Serial No. Vol. XIV. No. 9 B

SAVE THE "DAILY REVIEW."

Special attention is called to the fact that the "Daily Street Railway Review," published at St. Louis October 11th to 14th inclusive, this being the sixth successive year, is in its nature supplementary to the "Street Railway Review" published monthly. Nothwithstanding the "Daily" is a separate publication it should be bound with the monthly for convenient reference and in order to facilitate this, the pages of the "Daily" are given numbers consecutive with those of the next preceding monthly issue. Reference is again made to this fact for the reason that very frequently the "Daily" is entirely overlooked by subscribers when sending the "Review" to be bound, and as soon as the binder discovers that 150 pages or so are missing, we receive a request to furnish the missing numbers, which unfortunately we are not always able to do.

THE NAME OF THE ASSOCIATION.

The Executive Committee of the A. S. R. A. had referred to it at the last convention a resolution to change the name of the association. The "Review" expresses the hope that this is the last convention of the American Street Railway Association and that next year it will be the American Electric Railway Association, or the American Traction Association.

STREET RAILWAY CLAIM AGENTS.

The meeting of the Street Railway Claim Agents, which was held Tuesday morning at the Transportation Building adjourned until 2:30 p. m., Wednesday, October 12th. This meeting was postponed in order that claim departments of all the different roads may be represented. Many from this department will not reach the city until today. This is a very important branch of street railway work and the organization of the Claim Agents Association should be of material interest to all. All claim agents and those interested in this department are requested to meet in Room 11, Transportation Building, at 2:30 p. m., Wednesday, October 12th.

Among those prominent in the movement to organize the claim agents are: W. A. Dibbs, New York City Ry.; William Wright, Chicago City Ry.; W. H. Renaud, jr., New Orleans Rys.; Benjamin B. Davis, Columbus Railway & Light Co.

THEATER ANNOUNCEMENT.

In order that none who desire to attend the theater Thursday night may be overlooked, the Entertainment Committee will arrange to have representatives at the theater door the evening of the entertainment to provide tickets for all convention visitors wearing badges.

TODAY'S PROGRAM.

This is "Street Railway Day" at the Fair.

9:30—10:00 a. m.—Band Concert.

10:00 a. m.—Twenty-third annual meeting of the American Street Railway Association, second floor Transportation Building.

Address—Hon. D. R. Francis, President Louisiana Purchase Exposition.

Address—Hon. Rolla Wells, Mayor of St. Louis.

Address—Prof. W. E. Goldsborough, Chief of Department of Electricity.

Roll Call.

President's Address—Hon. W. Caryl Ely.

Report of Executive Committee.

Report of Secretary and Treasurer.

Presentation of Papers.

Convention adjourns for the day at 1:00 p. m.

11:00 a. m.—Meeting of Claim Agents, Room 10, second floor Transportation Building.

2:30 p. m.—4:00 p. m.—Band concert at New York Building, complimentary to President Ely.

7:15—9:30 p. m.—Entertainment at "Boer War." Enter at main entrance. Badges recognized for admission to reserve section. Proceed from entertainment to Lagoon, where launches and gondolas will be taken for a ride over the entire Lagoon, from Machinery Garden Landing.

BADGES FOR OHIO INTERURBAN MEN.

President H. P. Clegg and Secretary Merrill, of the Ohio Interurban Railway Association have issued a circular announcing the design chosen for the badge of the association. This is to be in the form of a rim of a trolley wheel, with the front end of an interurban car dashing through the center. The badges are about the size of a silver dime, and may be had in either button or pin form. The rim is blue enamel, the front of the car and the track are in gold, the car bears the initials of the name of the Association.

THE MANUFACTURERS' ASSOCIATION.

It is now eight years since the "Review" first urged the advantages that might be expected to result from an organization among the supply men who attend the conventions of the electric railway association. Four years ago, it will be remembered, in the Kansas City issue of the "Daily Review" the subject was exhaustively discussed.

While the advantages of organization were apparent to the great majority of all interested parties, there was an unexpected conservatism when it came to action; a conservatism that was increased by two successive meetings in cities where there was but little to complain of as regards extortionate rates for teaming, booth making and other contract work. Largely because of this the effort to organize the supplymen in 1902 failed.

But when the burden of entertaining the convention became so great that no company cared to extend an invitation and the association, having to pay its own way, went to Saratoga Springs in 1903, the ice of conservatism vanished in the heat of the friction resulting from the conditions there. The first steps looking to the organization of the Manufacturers' Association were taken at a meeting of exhibitors held at Saratoga, Sept. 4, 1903.

The committee on organization found it necessary to reconcile many conflicting interests, and the successful outcome is cer-

tainly due in greatest measure to the energy of the chairman, Mr. Daniel W. Brady, and his extraordinary ability as an organizer.

After the meeting to effect a permanent organization was held Monday night, the executive committee for the ensuing year paid Mr. Brady the hearty compliment of a unanimous re-election as chairman.

RULES FOR THE GOVERNMENT OF EMPLOYES.

There will be presented at the A. S. R. A. convention an addition to the Standard Rules for the Government of Employes, intended especially for companies operating interurban railways. We are advised that these Interurban Rules are identical with those adopted by the New York State Association at its meeting last month, and therefore, there is no impropriety in discussing the report prior to its presentation. Rather, we wish to call attention to the comments made in the "Review" for September 20th, from which we quote as follows:

"A standard code of rules has also been adopted by the Street Railway Association of the State of New York; as rearranged and renumbered by the rules committee, September, 1904, this code has been published in book form by that association. The interurban rules to be used in connection with the standard code are a great improvement over the old rules and show some very efficient work on the part of the rule committee. However, there are three points which do not seem to have been fully covered: There is no provision for the handling of trains by train orders; in protecting a train, the instruction to a conductor to go back a "sufficient distance" is not definite enough; and in the spacing of trains, one mile apart when running at speed is not sufficient. Also, there is no provision for the use of fusees and torpedoes, appliances which are in use on all steam roads and which have been used by a number of the interurban lines.

"Standard forms of train orders have been found a necessity by the steam railroads of the country, and a great many of the larger interurban lines have adopted the standard forms of train orders as used on the steam lines. A "sufficient distance" for a conductor to go back to flag a following train or car should not be left to the judgment of the employe. It is dangerous to run cars only one mile apart at the high speeds at which interurban cars are run. For instance, train No. 11 meets with a slight accident while running at a speed of 30 miles an hour and the train is stopped; the second section of train No. 11 is only one mile behind it; it would be impossible for the conductor to get back a sufficient distance to flag the second section; the result is too well known, and the experience of steam roads has taught them that, unless block signals are used, five minutes apart is as close as safety will permit, and in a great many instances roads have found that ten minutes is as close as trains can be run with safety. This is a point that cannot be given too much consideration in the operation of interurban cars at high speed.

"The Ohio Interurban Railway Association, which now has a membership of 132 companies, for the most part roads in Ohio, Pennsylvania and Indiana, has a committee at work formulating rules to govern the operation of interurban railways and general instruction to all employes, and copies of the draft of the proposed rules are now in the hands of the members of the association. The rules as submitted by this committee as a whole are very good. The grouping of the rules under the different heads, such as definitions, use of signals, train signals, whistle signals, movement of trains, etc., is exceptionally good and is quite an improvement over the others mentioned.

"About the only unfavorable criticisms to be made on these rules are, as in the case of the other association's rules, the distance which a flagman must go back to protect his train, the method or manner of protecting his train as regards the use of fusees and torpedoes, and the distance or time between trains running in the same direction. Trains moving in the same direction at high speed should keep at least 5 and possibly 10 minutes apart, and the "sufficient" distance for a flagman to go back to protect his train is ¼ mile on straight track and ½ mile on curves."

It is believed that the American Association, in adopting a book of Interurban Rules, ought to act with rather than independent of the Ohio Interurban Association.

MANUFACTURERS' RECEPTION.

The informal reception in honor of the convention delegates held at the Palace of Electricity last evening by the Manufacturers' Committee, was very enjoyable and well attended by the ladies as well as the delegates. Reeve's celebrated brass band furnished the music, giving a concert in the court of the building during the early part of the evening and later played at the various booths, where the receptions were held. Dainty sandwiches and assorted cakes together with frappe, coffee and other enticing beverages were served, and cigars were provided for the men.

Those who received at the Allis-Chalmers-Bullock reception were Mr. W. J. Dimfield, in charge of the exhibit; Mr. H. P. Hill, manager of the Bullock St. Louis office asisted by Messrs. G. S. Phillips, C. J. Larson, Ward Arnold, A. V. Moyer, N. W. Frapnell, A. Locker and E. W. Stull, of the various companies' departments.

Those who enjoyed the hospitality of the Westinghouse companies are indebted to Mr. W. K. Dunlap, manager of the exhibit, and Messrs. F. S. Smith, C. H. Smith, Graham Smith, A. B. Bond, Thurston and Clark of the several departments. The Nernst Lamp Co. and the Cooper-Hewitt Lamp Co., which were represented by Mr. H. M. Reed and Messrs. Hubbard and Evans, respectively, enterained with the Westinghouse companies.

The spacious booth of the General Electric Co. was thrown open to the delegates, the guests being received in the reception room and luncheon served on the roof garden, which was very prettily decorated for the occasion. Mr. F. H. Gale, manager of the exhibit, was in charge and was assisted in entertaining by the following representatives of the company: Mr. R. J. Cash; Mr. G. D. Rosenthal, manager of the St. Louis office; Mr. T. P. Bailey, of the Chicago office; Mr. S. W. Trewick, of the New York office; Mr. Ralph Moore, of the Philadelphia office; and Messrs. Wm. Hand, J. G. Barry, F. E. Case, and M. M. Woods, of the electrical and engineering departments.

The delegates are indebted to a very great extent to Mr. F. H. Gale, president of the Electricity Club, and Mr. W. E. Goldsborough, Chief of Department of Electricity, for the very pleasant entertainment, these gentlemen being prominent in the organization and promotion of the receptions. That the receptions were a great success and the Manufacturers' Committee are royal entertainers, those who attended will attest, and the evening's enertainment will mark another memorable and enjoyable epoch in the social history of the street railway associations.

Mr. F. C. Robbins, manager of the Niles Car & Manufacturing Co., Niles, Ohio, is among the Tuesday arrivals.

Mr. H. M. Littell, general manager of the Chattanooga Rapid Transit Co., registered on Tuesday morning.

Mr. A. H. Sisson, general manager, Mr. E. B. Suden, auditor, and Mr. W. C. Gardner, assistant secretary of the Jewett Car Co., Newark, Ohio, arrived at the "seat of war" Tuesday morning.

Mr. T. C. White, of the Central Union Brass Co., was actively circulating among his friends yesterday.

H. W. Byllesby & Co., of Chicago, have been appointed engineers and consulting managers of the Oshkosh Gas Light Co., of Oshkosh, Wis. This company has purchased the plant of the Oshkosh Electric Light & Power Co., formerly owned by the United Electric Securities Co., of Boston.

Mr. L. E. Fisher, manager of the McKinley properties in Danville and Decatur, Ill., has been appointed general manager of the Illinois Traction System.

Mr. Charles E. Lied, formerly consulting engineer of the General Electric Co., has been named as mechanical director of the Manhattan Transit Co.

The Benjamin Electric Manufacturing Co., of Chicago, has increased its capital stock to $50,000.

TUESDAY REGISTRATION OF THE MECHANICAL & ELECTRICAL ASSOCIATION.

MEMBERS.

William E. Rolston, superintendent Dayton & Troy Electric Railway Co.

Thomas Hawken, general manager Rockland, Thomaston & Camden Street Railway Co.

L. M. Sheldon, master mechanic Cincinnati, Dayton & Troy Traction Co.

R. B. Sheldon.

J. Murray Africa, chief engineer Lewiston & Reedsville Electric Railway Co.

J. J. Ahearn, master mechanic Ottawa Electric Ry.

John A. Kreis, jr., superintendent of power and master mechanic St. Louis & Suburban Railway Co.

F. P. Maize, master mechanic Rochester Railway Co.

J. Z. Murphy, chief engineer Chicago Union Traction Co.

W. S. Jackson, line superintendent Public Service Corporation of New Jersey.

Clement C. Smith, president Oskosh & Western Electric Railway Co.

NON-MEMBERS.

George W. Knox, general manager Green Bay Traction Co.

E. R. Gilbert, assistant general manager Chicago City Railway Co.

Albert Taylor, Electric Storage Battery Co.

W. H. Brown, International Register Co.

George Stanton, sales agent Cleveland Frog & Crossing Co.

J. J. Morse, secretary and treasurer St. Louis Car Wheel Co.

E. H. Martin, general manager Toronto Railway Co.

Knox Taylor, Taylor Iron & Steel Co.

H. S. Cooper, general manager Galveston City Railway Co.

W. Worth Beau, jr., manager and secretary Benton Harbor & St. Joseph Electric Railway & Light Co.

Warren Bicknell, president Lake Shore Electric Railway Co.

C. P. Wright, superintendent and treasurer Standard Brake Shoe Co.

H. Peck, general salesman Standard Brake Shoe Co.

Irwin Fullerton, general auditor Detroit United Ry.

W. H. Chapman, erecting engineer General Electric Co.

Henry W. French, Consolidated Engine Stop Co.

Harrie P. Clegg, assistant secretary Dayton & Western Traction Co.

A. D. Campbell, master mechanic Seattle Electric Co.

J. C. Vincent, of engineering staff Twin City Rapid Transit Co.

Frank Clark Cosby, manager Boston office Standard Underground Cable Co.

Clarence Renshaw, electrical engineer Westinghouse Electric & Manufacturing Co.

N. W. Storer, engineer railway division Westinghouse Electric & Manufacturing Co.

J. C. Webster, engineer railway division Westinghouse Electric & Manufacturing Co.

T. E. Crossman, New York City.

H. A. Lockport, electrical engineer, Toronto, Can.

R. L. McEwen, salesman Murphy Varnish Co.

James Paton, inspector Ford, Bacon & Davis.

A. J. Bemis, manager Brockton & Plymouth Street Ry.

William Wolmsley, superintendent South Chicago City Railway Co.

George B. Dusinberry, manager Westinghouse Electric & Manufacturing Co., Cleveland.

W. J. Lynch, accountant and treasurer Quebec Railway, Light & Power Co.

R. R. Dorland, electrician Ogden Rapid Transit Co.

A. M. Smith, electrician Toronto Railway Co.

James G. Smith, track foreman Toronto Railway Co.

William F. McKenzie, overhead foreman Toronto Railway Co.

Charles L. Henry, general manager Indianapolis & Cincinnati Traction Co.

F. Marchant, superintendent of power and roadway Chicago & Joliet Electric Ry.

George E. Macomber, president Rockland, Thomaston & Camden Railway Co.

Guy P. Gannett, vice-president Rockland, Thomaston & Camden Railway Co.

C. M. Taylor, mechanical superintendent Atchison, Topeka & Santa Fe R. R.

Barry Dibble, electrical engineer.

PRESS.

George A. Barnes, "Street Railway Review," Chicago.

Harold Buttenheim, secretary Street Railway Journal, New York.

E. E. R. Tratman, editor Engineering News, Chicago.

H. W. Young, Western Electrician, Chicago.

J. H. Smith, manager The Electric Club Journal, Pittsburg.

LADIES.

Mrs. Irwin Fullerton, Detroit, Mich.

Mrs. A. D. Campbell, Seattle, Wash.

Mrs. S. A. Clemons, Chicago.

Miss Alice H. Macomber, Rockland, Me.

Miss Annie Macomber, Rockland, Me.

A SUGGESTION.

Put on your visiting list a memorandum to call at post 52, aisle D, Transportation Building, and investigate the advantages of the Western water-jacket car heater manufactured by the Franklin Railway Supply Co., Franklin, Pa.

CENTRAL UNION BRASS CO.

The Central Union Brass Co., of St. Louis, makes a specialty of electric and steam railway specialties, such as car trimmings and other brass and iron castings of every description, motor and journal bearings, mica and mica bond, commutator bars, line and insulating material, ratchet brake handle, etc. The company has been supplying car trimmings to the builders for nearly a quarter of a century and it has on hand a large, varied stock of patterns which enables it to make trimmings of any desired style. Its stock of overhead material for city and interurban electric railways is also very complete and includes several specialties of new design.

The Central Union Brass Co. supplied a large part of the line material for the Intramural Ry. It has also filled several large orders for brass and iron castings of special design for the Exposition company, including the complicated brass parts for the coin-in-the slot turnstiles at the entrances to the Fair grounds.

The ratchet brake handle which the Central Union Brass Co. exploits is especially recommended on account of its few parts and general simplicity. This brake handle is made of highly polished bronze metal and has but six parts, all parts being fitted to standard gages and, consequently, interchangeable. It can be adjusted to or removed from the brake shaft with facility. The handle is furnished complete with steel stub end ready to be welded to the brake shaft.

The company's new 1,000-page catalog is believed to be the most complete catalog of car trimmings and railway supplies ever published. It will be sent upon application to the company's office 11th and Mullanphy Sts., St. Louis.

The Central Union Brass Co. was founded in 1881 by Mr. George Kingsland, its president. The other officers of the company are: Vice-president, Abe Cook; secretary, F. L. Bouquet. Mr. Cook was formerly secretary of the Laclede Car Co.

Mr. James A. Brett, formerly general manager of the Electrical Installation Co., with Mrs. Brett, are domiciled at the Inside Inn.

Mr. J. C. McQuiston, superintendent of the Westinghouse Companies' publishing department, is here renewing old friendships and making new ones.

SECOND REGULAR ANNUAL MEETING

American Railway Mechanical and Electrical Association

St. Louis, Mo.—Oct. 10-14, 1904.

TUESDAY MORNING SESSION.

President Olds called the meeting to order at 10:45 o'clock, and announced that he had appointed as the committee to confer with the Executive Committee of the American Street Railway Association, on the subject of a reorganization of the associations the following named gentlemen: C. F. Baker, H. H. Adams and F. G. Simmons.

The convention then proceeded to the consideration of the paper on "Maintenance and Inspection of Electrical Eqipment," by John Lindall, general foreman of shoes, Elevated Division, Boston Elevated Ry., Boston, Mass. As Mr. Lindall was not present at the meeting, the paper was read by Mr. Alfred Green.

Mr. William Pestell stated that he hardly agreed with Mr. Lindall on a great many points in connection with the paper, especially in connection with the education of motormen and others who are not directly connected with the mechanical department. He also agreed as to the keeping of men in line for promotion. There should be men who can take the place of the master mechanic or engineer at any time should the latter be away for some length of time. The only difficulty he experienced in connection with that matter was that about as soon as they got a man educated, so that he was really valuable he would usually leave the company's employ to take a better position with another company—they could not pay him money enough to keep him; but there was some advantage in it, as some road got the benefit of his education.

In his opinion reporting and tabulating of defects is very essential to the successful maintenance of equipment—he did not think he could dwell any too strongly on that point. The proper looking after the details of motor equipment can be very greatly helped by the reports that come from previous failures, and in this way a great many things are found which otherwise would escape detection. These reports should be in such shape as to be easily comparable, week by week, month by month, and year by year, as Mr. Lindall stated. He had found, for instance, in a case of road where the cars are at a number of shops, that one man who takes care of one kind of trouble has practically none of it, and another man has a great deal of it. By tabulating the defect one can find out the weaknesses of the foreman and the weaknesses of the equipment. Perhaps this weakness may be due to conditions under which the equipment is operated, and this tabulation of defect gives the master mechanic a chance to find the conditions and what to do to get at the cause of the trouble and remedy it.

Mr. Pestell said that Mr. Beggs stated in his address yesterday that the work of the Accountants' Association was practically ended. In his opinion the Accountants have a great deal to do—it is quite probable that in the general arrangement of accounts for the operation of the road, the caring for statistical reports and general reports of operation, that much work will be required and the master mechanics have only just started on this sort of connection with the accountants. This work is destined to be very important, and it is one in which the accountants can help the electrical and mechanical engineers to a very great extent. They know what they want in a sense, but the accountants are better able to give advice as to how to keep the accounts in proper shape so as to be easily compared and kept with the least possible labor. The speaker believed that if the shop accounts and the power station accounts were taken up in connection with the Accountants Association better results would be secured than are secured today. The matter of shop arrangements, especially facilities given the men for cleanliness and that sort of thing are very important. It is not conductive to good work to have a shop where a man does not have a chance to clean up when he goes out to lunch and before he goes home at night. A man who is always slovenly in his appearance is apt to be that way in his work, and the speaker thought that the members should try to get all the conveniences practical in shops for the comfort of the men.

The speaker thought that the suggestion in that paper about supplying technical literature for the shop men a very good one, and a practice that ought to be followed more than it is. The technical papers are very generally found in the motormen and conductors' rooms, but the shop man, unless he buys such publications, rarely sees them. Mr. Pestell thought there should be a place provided where the men can get these things—perhaps they could be kept on file and a catalog made of them, giving the men cards, making it a sort of a library system, so that every man connected with the shop could be put in possession of the latest literature in connection with the work upon which he is engaged. A man cannot know too much about his work. He thought the most important thing that the Mechanical and Electrical Association was organized for was to put knowledge within the reach of the men, to bring about an interchange of ideas, but if the association does not furnish the information which is developed in the meetings to the men generally, it does good to but a very few. He believed the members should work to get publications on file for the men to read. These things should be accessible to the mechanics in the pits, even the car washers; they do not want to wash cars all their lives, and they should be given an opportunity to advance themselves, if they will do so.

The matter of the inspection of electrical equipment, whether on the mileage or time basis, the speaker thought is one that in many cases must be governed by local conditions. There are comparatively few roads in different parts of the country that are entirely parallel in their operating conditions, and what might be good on a mileage basis on one road would not be on another. Some roads are able to put a man on a car for the purposes of inspection only once in two or three days, even for the purpose of inspecting the brushes and for greasing. Other roads find it necessary to do this every other day. The track conditions and conditions of service vary so that no two roads can follow the same general plan in regard to these things, and in consequence of this these matters must be taken up individually by the engineer in charge and worked out for the particular road on which he is working. Mr. Pestell remarked that the members had heard something yesterday about trolley trouble and controller troubles which are mentioned in the paper under consideration. The roads are getting on their cars today four motors, mostly on double truck cars, the motors of 40 h. p. capacity and larger, and the platform type of controller, if of a size sufficient to properly handle the motors, is becoming cumbersome and clumsy, takes up a lot of room, and makes a great deal of work up on the end of the platform, which is destructive to the car construction in service. The multiple type of control or a type of control remote from the platform, using only a master controller of small size on the platform, seemed to him to be the proper solution for the controller troubles. He believed that the companies should demand from the electrical manufacturing companies a controller of this type for motors even as small as 40 h. p., four to a car, and get all mechanism underneath the car, out of the way. The troubles that are experienced with this type of control for heavy service are so small, comparatively, that they should be practically nothing with the currents that are handled with 40-h. p. motors, with a proper design of the controller. A thing which should be

worked to is to get the current carrying part of the controlling apparatus off the platform. This is especially desirable on open cars. The method pursued by the Boston Elevated that Mr. Lindall referred to, of renewing only the points of contact fingers, the speaker had examined on this system and he believed it a good one to follow. He believed a good deal of money could be saved, even with K types and other types of control used on the platform. The controller finger item is quite a large one on a big system, and but very little of the controller finger is actually gone when it has to be renewed.

Mr. Pestell further said that another point that Mr. Lindall mentioned, especially in relation to elevated railway service, is the flashing over of motors, and Mr. Lindall suggested the using of a larger motor to prevent this flashing over. The speaker's experience had been that the flashing-over of motors occurs more as the motors increase in size, and that splitting up of the motors, putting in four motors rather than two of the larger size, would reduce the flashing-over. He might be mistaken in this theory, and he would like to hear some expression of experience from some of the other members in regard to it.

Mr. W. D. Wright, of Providence, said that he wanted to express himself in regard to the value of reports from motormen when they turn the car into the car house. This is a great help to the men taking care of the apparatus but sometimes it is hard to get a written report from a motorman which can be made much out of. Sometimes slips are used, on which are printed different numbers which apply to the apparatus liable to give trouble and if the motorman notices some trouble in these parts he checks off the number. The speaker thought it better to go further than this, and to require the motorman at all times in bringing the car into the house to make some kind of report; in other words, he must O. K. the car or note the defects which exist. They had found the O. K. report in practice to be of great value.

Mr. Pestell stated that he knew of a form of report for this purpose with the principal items which occur in service printed on a sheet, leaving a place for a check mark for any trouble which occurs in service, and a place for the numbers or name of the car crew. That saved any writing except filling in the number of the car on the blank, checking off the item in connection with which the defect was supposed to exist, giving the time and speed run, and the motorman and the conductors' name and number.

Mr. G. J. Smith, of Kansas City, inquired if the members had ever heard of a motor flashing-over when comparatively new. In the flashing-over of motors, on a road he was formerly connected with, 90 per cent. of the trouble was from that cause, and they found that a motor that was comparatively new never flasher over, or if it did flash-over within three or six months of the time that it was installed, when they tested out the field coils and insulation they found leaks, break-downs, etc., and when these troubles were removed, the flashing-over stopped. They never had a motor flash-over when it was comparatively new.

Mr. J. S. Doyle, of New York, said they found on the Interborough that new motors will flash over as well as old motors, and the remedy is the splitting of the field coils;—the cause of motor flash-over is due to partially or wholly interrupted circuits. The field saturation does not correspond with the magnetic effect of the armature. The result is there is an increase of potential across the armature, causing the motor to flash-over. The remedy is to split the field coil shells and stop all flashing-over.

Mr. Alfred Green said he wished to ask as to the experience of the different master mechanics as to how far a motorman should be educated concerning the handling and the maintaining of the electrical equipment. In the speaker's opinion that is one of the most important points in the practical operation of electric street railroads today. A motorman is taken from the ranks. He is given a piece of apparatus, which costs a great deal of money, and also takes a great deal of money for its maintenance. That apparatus is put in charge of a motorman, and it frequently happens that two and perhaps three men handle the same car during the eighteen or twenty-four hours of its operation. The point which the speaker desired to raise was how much of an education the motorman should have.

Mr. D. F. Carver, of Jersey City, replied that he believed theoretically, that the motorman should have all the education he could get. On the Public Service Corporation of New Jersey apparatus was installed about a year ago to give the motorman a pretty thorough education in the handling of the machinery on the car, but the practical difficulty was that the employment department could not keep the road supplied with men fast enough, so that the time could be taken to give the men this instruction education and they had not been able to do it as thoroughly as they would liked to have done. They adopted the usual practice of sending a new man out with an old employe for several days, until the new man was broken in pretty well. They had not the trouble now which they experienced some years ago, because they are now putting on many four-motor equipments. They are using four 40-h. p. motors under comparatively light cars, which have plenty of resistance, so that the motormen are not able to do the equipment so much harm as formerly, and he did not think trat they would harm the equipment to any great extent under the new condition of affairs. If a motorman feeds too fast it makes a jolt on the car which is not only uncomfortable for the passengers, but uncomfortable for the man, and he gets plenty of notice if he is doing what he should not do. Their troubles from that cause are decreasing right along. The speaker said that the mechanical and operating departments are very much pleased at the way the men take hold of new things; they find their men, as a general thing, are with the company in every movement which the company desires to make for the improvement of the service and equipment, and instead of the heads of departments having to go around and drum into the men the new matter, the men talk to some of the shop men or the men around the depots and in this way secure full information about any new plan. His experience was that on all of the roads the average motorman tries to get the information required. The speaker said that on one of the South Orange lines the feeling among the men is that a man would rather be kicked than turn a car in off the road; the consequence is that very few cars are turned in.

Printed blanks are given to the motormen containing a list of some fifteen different types of trouble that might occur in the car, and when the car is turned in at night, if there is any defect, the conductor punches out the one indicating the particular trouble. The motorman does not always hit the cause of the trouble right, but if there is some trouble the conductor punches the number indicating what he thinks the trouble is. The fact that he punches the slip indicates that there is something the matter with the car and the mechanics overhaul the car to see what the trouble is.

The speaker said that brought up another question which had been mentioned at the meeting in regard to damage suits. In two cases he remembered that by that nightly record the company was able to prove that the equipment was not defective and was able to save itself from serious loss. There was one case which happened about six weeks ago; they had quite an unfortunate accident with one of their cars. In the morning the motorman who had the accident, had a car on which they had put a new kind of locomotive black on the stovepipe. In the morning the motorman went into a drug store and telephoned that this car was out with wet paint on the smokestack, and asked for another car. He received another car. In the afternoon he had a serious accident with that car, and the company discovered the next morning that the druggist in the store where the motorman had gone for another car had stated that the accident was caused by negligence of the company in putting out a car which was in bad order, and that the motorman had come into his store in the morning to telephone them for a new car. By showing the records of the actual transaction, the company completely absolved itself from negligence. Mr. Carver did not know for what the claim was settled, but it was probably ten per cent of what it would have cost if the company had not been able to show records, which proved that it had complied with the motorman's request for another car. They had the conductor's slip of the night before, which showed that the car on which the accident had occurred had been turned in "O. K." After the accident, the company took the car and was able to demonstrate that it was in good order at that time. If a conductor turns in a car as being crippled, and the mechanics go over it and cannot

find anything wrong with the car, there is nothing said about it: there is no penalty for making an erronious report. The company desires the criticism of its employes in regard to the condition of its equipment, and gives them every facility for making the criticism; if they make a mistake, nothing is said about it.

Mr. A. M. Patten, of Topeka, stated that they had tried a scheme on the Topeka Railway, which had proved quite satisfactory. They require their motormen to make a daily report, with the different troubles liable to occur to the car listed on the report, and there are columns for the different motormen to sign "on" and sign "off"; in other words, in passing the car from one motorman to another motorman they O. K. the car in all essential particulars. These reports and other means are used in the education of the men. Of course, there are many times when the motorman does not locate the trouble correctly. When this occurs, the company takes up the matter and explains why the motorman did not locate the trouble correctly, and the company is securing more accurate reports from the motormen in regard to these troubles since they have adopted that practice.

Mr. J. S. Doyle, of New York, stated that the Interborough company provides two school cars for the education of the motorman, and issues a book of instructions, containing a description of the various apparatus on the car, with a list of questions and answers. Upon the school cars, all the apparatus employed, including the air brake and multiple control, are so designed that a motorman can readily see all the workings of the apparatus—one piece in each part is sectionalized so that he can see all the action. The questions and answers pertaining to failures of apparatus are got up with a view of reducing the detention to service. In other words, when anything occurs, he goes through the list of questions and answers pertaining to failures, and going through this list he finds the trouble and reduces the detention. It is the intention of the company to require motormen to pass a yearly examination to determine their knowledge of the appartus. The book of instructions is very complete, and Mr. Doyle offered to send a copy of it to any master mechanic who might desire it as it might help some of the members of the association in solving the troubles which they have.

Mr. W. K. Evans, of Minneapolis, said that he was glad to know about the experience being had with instruction cars. The Twin City Rapid Transit Co. had contemplated some thing of that kind, in fact it had a system of instruction under which the men met in groups each week and went over questions such as have been considered in the discussion; but from the discussion which had been had on the subject it occurred to him that the companies were working at the wrong end of the proposition. In all of the discussion that had preceded the idea was to depend entirely on the motorman to eliminate the trouble. His experience had been that the company cannot get motormen fast enough to educate them, and the consequence was that the superintendents of transportation had to put the men out on the car some considerable time before they have any extensive knowledge of the apparatus; and it was the opinion of Mr. Evans that a great deal of time can be wasted in instructing the motorman, because about the time the motorman should be instructed, in many cases he would have left the employ of the company. While it is a very good thing to have a well posted man there is no line in the country that can afford to tie up the system long enough to allow a motorman to repair the car. If there is a little trouble in the controller or something of that kind the motorman can fix it and get his car in. He would like to hear more discussion from the other end of the question as in his experience, motormen's reports have been very misleading as to what the trouble really was.

Mr. Evans said that it will have to be admitted that the motormen are not thoroughly instructed concerning the apparatus in his charge, but he ought to be able to detect or repair trouble. There is one peculiarity about instructing men in a knowledge of the apparatus which they handle. For example some of the best air brake men on the steam roads know practically nothing of the construction of the apparatus; they simply know how to shut off the engine to make an even stop at the station. They have that down to nicety, but can tell very little about the intricate construction of the air brake apparatus. It was the opinion of Mr. Evans that if the companies are going to depend altogether on the motormen for information relating to car troubles on the road, they are working at the wrong end. The motorman can give a great deal of assistance, but it would not be advisable to depend upon him.

Mr. Evans thought the paper a very good one and he would like to hear it discussed very thoroughly. Mr. Lindall mentioned the tabulation of defects and recording them. The Twin City Rapid Transit Co. had found that practice to be a very great advantage; but there is one point which had not been touched upon, which, in the opinion of Mr. Evans, was very important and that is that the defects should be tabulated in such a way that not only the master mechanic but everybody interested in the equipment could see just how it was running. He had been surprised to find out the interest such a practice had generated even in the ordinary repair man at the station, when they find that the company was keeping a check of this kind, and he had been surprised to find that some of the repair men whom he thought were not interested at all had come to him and told him that their reports would be better than they were last month.

Mr. Green said that what he had in mind, in asking the question, was not the matter of repairing a car on the road, but the question of sending out a man who would keep the road open. He had known where a motorman did not know, when he was cut out, where the fuse box was, and he stood there until another motorman came along. He knew of another case where a motorman went to start and got stuck in a curve, because he forgot to release his brake. The question is how far you have to instruct a man to keep the car going until it comes back and not block the system—that is what is desired. It is a good point to study out, as it is for the master mechanic to get the blame for everything that goes wrong with the apparatus; and it is a good point to start on, to find out why the master mechanic has to assume all the responsibility on account of incompetent handling of the car. The speaker had seen a motorman run a car for three miles, and never let the brake off, and when he wanted to stop the car he turned the controller handle around and the car stopped. In his opinion much of the trouble was due to the motorman.

Mr. J. S. Doyle, of New York, said that in regard to the inspection of electrical equipment the Interborough company had a system which might prove interesting. The company published each month a schedule showing the cost of daily inspection, and also the cause of all delays; there was a competitive merit system among three different inspection shops and one shop will take care of seven hundred cars and inspect each car every three or five days. They started out a year ago to see which was the best foreman with the understanding that the man who saved the most money would receive a certain percentage of it. In the first year the company saved a considerable sum of money. A schedule was issued showing every delay that occurred and the cause of it. The company found that at the end of the first year the reliability of the service was improved thirty per cent and the expenses cut down to a very great extent.

Mr. H. A. Johnson, of Jersey City, remarked that the same system had been tried in the Public Service Corporation and had produced very satisfactory results. Giving each shop force a certain class of equipment and a certain number of equipment to take care of, resulted in considerable competition among the men, and very excellent results.

Mr. William E. Rolston, of Tippecanoe, Ohio, inquired what was the experience of the members and what they gained by the use of the ammeter in instructing motormen to handle large cars on interurban roads. It has been the practice of the Dayton and Troy Railroad Co. to take a volt meter and an ammeter on the front end of the car, and at the same time use a wattmeter on the car, to make a record of the consumption of current on the line, and compare that with the power used by the older men in the service. This was done to demonstrate to the new men how to properly handle the consumption of current, and a great saving can be effected and considerable time saved by instructing the new men at the start how to properly handle the car, especially with heavy equipment, as four 75 h. p. motors under thirty ton cars, in which case the power consumption is a big item. By giving the motorman to understand how to feed his car, and what advantage he can gain by feeding slowly or by feeding fast, he found there was a great economy, and he would like an expression of the members as to their experience in that line.

Mr. William Pestell said that he knew of an ararngement which had been put into effect for checking up the records of cars taken in for various troubles. The system was to rule a sheet, showing the car numbers in numerical order on one side and the days of the month across the top, and entering on the sheet each time a car was brought in the motorman's number in the square for that date, and giving the number of the car that was pulled in. Such a schedule shows at a glance which motormen were having the most trouble on the street as well as what particular cars were giving trouble, and initials were provided which showed what trouble the car had been pulled in for. This is particularly valuable on small roads having anywhere from 25 to 200 cars.

Mr. W. H. McAloney, of Denver, thought the matter Mr. Pestell had just mentioned was important, and also the matter he mentioned previously, as to their being further work for the accounting department. He thought it was important on small roads to show how many cars were taken out of service per day, week or month, and a comparison made for certain periods. He thought that was something which every company needed. Before he left Denver he had looked the matter up, and from the data he had he found that only 2 per cent. of the cars operated had been taken permanently off the line in any given week, that is for more than incidental repairs or adjustment.

Mr. Evans said that as to the statement about tabulating the number of failures, that the Twin City Rapid Transit Co. had been trying something of that kind and had tabulated the failures, that is, cases where the cars were pulled out of service, and reduced it to a mileage basis, to show that each station had so many pull-ins for the month and so much mileage per pull-in, and in that way you get it down to something like actual conditions. They also keep a record of the motormen who have the pull-ins, and if they find any particular men have too great a number, the man is called to account, and it has the effect of reducing the trouble. The speaker was still a little bit inclined to think, in opposition to Mr. Green, that the meeting was working at the wrong end of the proposition. He did not wish to appear to contend that there is any disadvantage in educating the motormen, but that it appeared to him to be a practical impossibility to get the motormen educated to that point where they can be thoroughly relied upon to take care of the equipment.

Mr. J. S. Doyle answered Mr. Evans that his company did not find this to be the case. The Interborough handles six and seven-car trains with about 140 persons in each car, under two minutes headway. Very frequently they have train line troubles. A burst hose, a burst pipe, or governable trouble a motorman can frequently clean up in two minutes. It is surprising to discover how much the men know about the apparatus. They are well posted on the air brake and also on the control apparatus. With their system of control the imporant thing is to maintain the train line. The motormen can quickly find if the train line is in good condition or not. As a whole they discover that their motormen are very capable in making necessary repairs and adjustment of the apparatus in emergencies.

Mr. Evans said that his company did not have any trouble under the conditions Mr. Doyle cited, as the men handling seven car trains are undoubtedly the preferred men on the system. Mr. Evans had no trouble where they run steam service, because in that service their best men were employed, but it is the extra man, the everybody, who takes a car out upon whom the station man must depend to fill out the service. Under the conditions Mr. Doyle spoke of they had no trouble, because in the case of such men the company knows that when it gets a report the trouble is what it is stated to be.

Mr. Doyle replied that his men are not preferred men. On one of the lines they run six-car trains all the day and during the rush hours they run seven cars, and every man must be capable of handling a seven-car train.

Mr. McAloney inquired if the school car is run over the lines.

Mr. Doyle replied that they had two school cars, one for the subway road and one for the elevated road. There is a schoolmaster on each car, and each motorman is required to take a certain course, so many lessons. The car on the Manhattan Elevated division is kept three months on the East Side system and three months on the West Side system, and rotates from one system to the other. The same practice is observed in regard to the school car assigned to the subway division. The cars are run to the various terminals, and kept there a sufficient length of time to enable the men to receive the proper course of instruction. The school car is stationary; it is a regular motor car with some special equipment.

Mr. D. F. Carver, of Jersey City, said that he believed that he could answer Mr. Ralston's question in a way which might be interesting. He said that they had put two 40 h. p. motors with a 22 tooth pinion, on each nine bench car, and it ran the car pretty lively, and the new motormen in handling that car could not keep the car on the line or keep the fuses in. They hit upon the experient of taking a few of the brightest men on the division and let them take the car out, and went with them and let them run the car for one trip in the way in which they usually handle it. Then they put an ammeter in the car, and let the men handle it in the same way, and showed the current consumed at various points on the controller in their way of running the car. They went up to 350 amperes when swinging from series into parallel. We then showed the motorman how it should be done. The men went around the club rooms and told the other motormen what they had seen. In a few days the trouble vanished, the cars were kept on the line in proper shape, and in a week or so the men would not have anything else than these fast cars. They had not had any trouble in the last two months, no cars being turned in, where formerly they had eight or nine cars a day turned in, the men saying they could not operate the cars and keep the fuses from blowing.

Mr. J. S. Doyle remarked that was quite an important engineering question, and he thought the solution was to resort to the multiple unit system, automatic control, especially in four motor equipments. As Mr. Pestell had said, the roads were coming to it and the automatic feature is one of the best features of the control; and as to training the men how to run cars, you may do that for a day, or for a week, but unless you watch them continually they will go back on you, and he thought, after all, it was a question of the use of the automatic control to get the best results.

Mr. Pestell remarked that one thing had been suggested to him, and that was that perhaps he was too much of a believer in reports and records, and possibly he would get too many reports. He admitted it was possible to have too many reports; that a master mechanic can have too many records and not have time enough in which to get around to see his work. He believed these records could be summarized by his assistants, so as leave the master mechanic time to go out on the job and see what is going on. He was a firm believer in personal supervision of all work in progress.

President Olds remarked that he felt that the question was one of very great importance, as the motors and the equipment are becoming heavier and the speeds higher, it requires better work. Many of the companies are holding the voltage up to 600 volts, and a motor that would operate successfully on five hundred volts, when operated at a higher voltage will flash-over and cause trouble at the brush-holders or controllers, where they would be all right at the lower voltage. He felt that it was a question of the utmost importance, not only to educate the motormen to handle the car properly, which he thought was very essential, but that the repair men must be more efficient and abler than they were a few years ago when they were handling the old equipments. As Mr. Doyle mentioned, regarding the seven-car trains on his road, a great many of the roads have interurban lines running out through the country, not on a two-minute headway, but possibly on a headway of an hour. If there is anything wrong with the car, with two or three cars, or possibly a half dozen cars in a train he considered it important that the motorman should be able in a very few minutes to locate the trouble and not stay there to be pushed in or wait for some older man, who better understood the business, to help him out. In his experience he had found it necessary to send a repair man twenty miles to attend to a slight matter, that the motorman should have been able to detect at once. He was a thorough believer in giving the motormen, especially on the interurban lines, a comprehensive knowledge of the apparatus in their charge, and they should be required to pass an examination.

Mr. H. J. Lake, of Muncie, Ind., considered that the matter of

instructing motormen is something of vital importance to every electric railway system. If reference is made to the steam railway systems, it will be found that they do not put a new man upon an engine until he is a qualified engineer. Why, he asked, is it not just as essential that the electric railroads should have good engineers to handle the electric trains? The electric roads are certainly carrying more people in the course of 24 hours than are the steam roads; and as to the motorman's ability to handle his train in case of emergency, he should have sufficient knowledge of the apparatus to prevent a tieing up of the system, and with the sidings on electric roads two or three miles apart, or less, he ought to be able to get his train to a siding; but the car house man has got to go after it to pull it in or else delay the road. The point has been raised that a motorman understanding his duties should be able to repair his car in a few minutes' time. Motormen do not always receive the instructions which they should receive; a motorman is put on the line for instruction, and the motorman he has on with him becomes well acquainted with him in a few days and he is turned in to the superintendent of transportation as being all right and is given a car, and about the only thing he knows about the car is to start and stop it. He does not know how to fix a crippled motor. If a controller finger gets caught so that the controller will not work, he does not know what to do with it; if a controller hangs fire he does not know what to do in a case of that kind. These are small points that come up every day, and if a motorman is put through a course of schooling and thoroughly understands his business these are points that he should know about, and he should know how to get his car in working order and maintain the regular schedule. A crippled controller finger does not necessarily put a car out of business. In the majority of our platform controllers, by simply raising the finger, the car will proceed in the usual manner without any trouble whatever.

President Olds then appointed the following named gentlemen as a committee on nominations: Mr. W. O. Mundy, Mr. Alfred Green, Mr. J. Millar, Mr. W. D. Wright, and Mr. W. K. Evans.

The meeting then adjourned until 2:30 o'clock.

TUESDAY AFTERNOON SESSION.

President Olds called the meeting to order at 2:30 o'clock and stated that the first business of the session would be the consideration of the Question Box. The secretary read the printed questions and answers, and there was a very spirited and valuable supplementary discussion by the members generally of the questions contained in the Question Box.

In the general business which was considered, Mr. Baker, chairman of the committee to attend the meeting of the executive committee of the American Street Railway Association, in conjunction with a committee of the Accountants' Association, reported that the meeting of the joint committees had been held on Tuesday morning and as a result of the meeting the executive committee of the American Street Railway Association would make certain recommendations to that Association looking to a reorganization of the parent Association and the auxiliary Associations, the recommendations to be made by the committee being in line with the ideas of the special committee of the Mechanical Association.

On motion of Mr. William Pestell it was resolved that it was the sense of the meeting that the executive committee be recommended to consider the matter of the appointment of special committees to report upon matters relating to cars and car equipment, shops, car house and equipment, power stations and power station equipment, track and track equipment, and such other subjects relating to electric railroad work as met the approval of the executive committee.

Mr. Mundy, as chairman of the committee on nominations, reported the following gentlemen for officers of the Association for the ensuing year.

President, C. F. Baker, Boston; first vice-president, H. H. Adams, Baltimore; second vice-president, John Millar, Buffalo; third vice-president, F. G. Simmons, Milwaukee; secretary and treasurer, S. W. Mower, Detroit.

Executive Committee: D. F. Carver, Jersey City; J. S. Doyle, New York; C. C. Lewis, Schenectady; W. H. McAloney, Denver.

On motion the secretary was authorized to cast the ballot of the Association for the officers nominated.

Mr. Mundy remarked that the committee considered Mr. Simmons a suitable candidate for the vice-presidency for two reasons, one for his apparent interest in the organization and his ability, and the other because he was the leading representative of the movement to organize a maintenance of way association, and the committee desires to show that the mechanical association appreciates the fact that the maintenance of way men are to become members of the Association.

Mr. Mundy further said that while he had the floor, he would as chairman of the committee on nominations take upon himself the privilege of extending the thanks of the Association to the past president, Mr. Olds, for the great interest he had taken in the work; and the only reason why the committee had not insisted upon the re-election of Mr. Olds to the executive committee was the fact that Mr. Olds took the ground that it was proper than the president of the organization should hold office for but one year. The work of Mr. Olds had been very efficient and beneficial to the Association in every way and it was the pleasure of Mr. Mundy to move that a vote of thanks be extended to Mr. Olds.

Mr. Green, in seconding the motion, said that it was the desire of the Association to show the retiring president that the members appreciated his labors during the past year, and to show how kindly they felt toward him he would like every member to stand while the motion was passed.

Mr. Green put the motion, which was adopted, and in announcing the result he said that the members would never forget Mr. Olds as the president of the Association.

Mr. Olds, in responding, said that he thanked the members for their kind expression, and it was impossible for him to fully voice his feelings regarding the tribute of appreciation paid to him; as stated in his address, he considered the brightest spot is his career as a railroad man was to have been able, with the assistance of the members, to hold four meetings of the Association in the World's Fair Grounds at St. Louis, at which meetings there had been an average of 125 men sitting through the complete sessions and taking an active interest in them. He considered it a thing which, as master mechanics and electrical men, the members should be proud of; he was proud of it, and he was proud of the Association.

Mr. Olds said that the supply men, as the members know, are royal fellows; they had done a great deal in entertaining the members of the Association and proposed to do more. The entertainments provided by the supply men were open to the members of the Association, and he expressed the hope that the members would give their hearty co-operation and support to all of the plans arranged by the supply men.

Mr. C. F. Baker, the newly elected president, was then introduced by President Olds. He said that he wished to thank the members for the honor they had conferred on him. He would try to work for the advancement of the Association with the assistance of the other officers and members at large; that one man can do but very little in an organization of the character and proportions of the American Railway Mechanical and Electrical Association.

The vice-presidents, Messrs. Adams, Millar and Simmons, were introduced in order, and each made appropriate remarks expressing their appreciation of their election to office, and promising that they would exert their best efforts in behalf of the Association.

President Baker called attention to the joint meeting of the Accountants' Association and the Mechanical Association to be held on Friday morning and requested a full attendance of the members at that joint meeting.

The meeting adjourned.

Mr. Max A. Berg, of Porter & Berg, Chicago, arrived Tuesday morning and is at the Southern.

Mr. George E. Pratt, of the Star Brass Works, Kalamazoo, Mich., reports a flourishing business and monthly sales of 30,000 trolley wheels.

A. S. R. A. DELEGATES REGISTERED TUESDAY.

Alton, Ill.—Alton, Granite & St. Louis Traction Co. Joseph F. Porter.

Austin, Texas.—Austin Electric Ry. Co. Frank E. Scovill.

Akron, Ohio.—Northern Ohio Traction & Light Co. Charles Currie, Charles Lohr (Inside Inn).

Atlanta, Ga.—Georgia Railway & Electric Co. W. H. Green, Thomas K. Glenn (Planters).

Birmingham, Ala.—Birmingham Railway, Light & Power Co. C. O. Simpson, J. A. Emery, Geo. H. Harris.

Boston, Mass.—Boston Elevated Railway Co. C. F. Baker (Jefferson).

Boston, Mass.—Boston & Worcester Street Railway Co., Charles C. Pearce.

Bridgeport, Conn.—Connecticut Railway & Light Co. William Darber (Usona).

Baltimore, Md.—United Railways & Electric Co. H. H. Adams.

Bridgeton, N. J.—Bridgeton & Millville Traction Co. C. L. S. Tingley (Hamilton).

Chicago, Ill.—Chicago Union Traction Co. F. E. Smith (Inside Inn), J. Z. Murphy.

Chicago, Ill.—Chicago Consolidated Traction Co. F. E. Smith, J. J. Linden.

Columbus, Ohio.—Columbus Railway Co. M. S. Hopkins, J. A. Jens.

Cincinnati, Ohio.—Cincinnati Traction Co. Dana Stevens, Robert Dunning (Southern).

Cleveland, Ohio.—Cleveland Electric Railway Co. John Ehrhardt, W. G. McDole, Henry N. Staats (Inside Inn).

Cleveland, Ohio.—Eastern Ohio Traction Co. R. L. Andrews (4549 Westminster Pl.), J. J. Doyle (Southern).

Dayton, Ohio.—Peoples Railway Co. J. L. Breen, W. J. Breen (Hamilton).

Duluth, Minn.—Duluth Superior Traction Co. Herbert Warren (Inside Inn).

Des Moines, Iowa.—Des Moines City Railway Co. Charles L. Wight.

Detroit, Mich.—Detroit United Ry. George H. Russell.

El Paso, Texas.—El Paso Electric Railway Co. W. V. Neal (4535 Clayton Ave.).

Ft. Wayne, Ind.—Ft. Wayne & Wabash Valley Traction Co. M. J. Kehoe (Inside Inn).

Grand Rapids, Mich.—Grand Rapids Railway Co. J. C. Madiger (2822 Russell Ave.).

Harrisburg, Pa.—Central Pennsylvania Traction Co. F. B. Musser, W. J. Calder.

Joliet, Ill.—Chicago & Joliet Eastern Railway Co. A. S. Kibbe (4472 Forest Park Bl.).

Kansas City, Mo.—Metropolitan Street Railway Co. George E. Lawson.

Kenosha, Wis.—Kenosha Electric Railway Co. G. A. Damon, W. H. Rosecrans.

Lebanon, Pa.—Lebanon Valley Street Railway Co. Charles H. Smith.

Lexington, Ky.—Lexington Railway Co. Thomas D. Murray (Southern).

Mobile, Ala.—Mobile Light & Railway Co. H. M. Barnet.

Nashville, Tenn.—Nashville Railway & Light Co. W. B. Brockway (Inside Inn), G. W. Swint, G. D. Mills.

New York, N. Y.—New York City Railway Co. Oren Root, Jr., J. J. Higgins (Buckingham Club).

Port Chester, N. Y.—New York & Stamford Railway Co. N. F. Heft, R. J. Allyn, H. C. Wybro, C. O. Mailloux.

Rockford, Ill.—Rockford & Interurban Railway Co. F. A. Poor, J. C. Barr (Hamilton).

Rockland, Me.—Rockland, Thomaston & Camden Street Ry. G. E. Macomber, Thomas Hawken.

Saginaw, Mich.—Saginaw Valley Traction Co. J. Charles Young.

San Antonio, Texas.—San Antonio Traction Co. Samuel Kahn.

Springfield, Ohio.—Springfield Railway Co. O. Jackson.

St. Joseph, Mo.—St. Joseph Railway, Light, Heat & Power Co. F. A. Dillman.

South Bend, Ind.—Indiana Railway Co. James Kent (New St. James).

Washington, D. C.—Capitol Traction Co. H. D. Compts, D. S. Carll.

Webb City, Mo.—Southwest Missouri Electric Railway Co. A. G. Kniseley.

Wichita, Kas.—Wichita R. R. & Light Co. W. R. Morrison.

LADIES.

Mrs. J. F. Porter, Alton, Ill.
Mrs. F. E. Scovill, Austin Tex.
Mrs. J. D. Leeper, Austin, Tex.
Mrs. Thos. K. Glenn, Atlanta, Ga.
Mrs. C. O. Simpson, Birmingham, Ala.
Mrs. Sarah Bishop, Birmingham, Ala.
Mrs. Geo. H. Harris, Birmingham, Ala.
Mrs. C. C. Pearce, Boston, Mass.
Mrs. O. L. S. Teagley, Bridgeton, N. J.
Mrs. M. S. Hopkins, Columbus, Ohio.
Mrs. Robt. Dunning, Cincinnati, O.
Mrs. John Ehrhard, Cleveland, O.
Mrs. W. G. McDole, Cleveland, O.
Mrs. R. L. Andrews, Cleveland, Ohio.
Mrs. Herbert Warren, Duluth, Minn.
Mrs. G. H. Russell, Detroit, Mich.
Miss Russell, Detroit, Mich.
Miss Long, Detroit, Mich.
Mrs. W. V. Neal, El Paso, Texas.
Mrs. M. J. Kehoe, Ft. Wayne, Ind.
Mrs. F. B. Musser, Harrisburg, Pa.
Mrs. A. S. Kibbe, Joliet, Ill.
Miss Ova Lawson, Kansas City, Mo.
Mrs. G. A. Damon, Kenosha, Wis.
Miss Ellie Murray, Lexington, Ky.
Mrs. H. M. Barnet, Mobile, Ala.
Mrs. W. B. Brockway, New York.
Mrs. W. R. Morrison, Wichita, Kas.
Mrs. A. G. Kniseley, Webb City, Mo.
Mrs. F. A. Dillman, St. Joseph, Mo.
Miss Helen Kahn, San Antonio, Texas.
Mrs. Thos. Hawkin, Rockland, Me.
Misses Macomber, Rockland, Me.

Y-DO-I.

Among the very novel souvenirs that are being distributed by the manufacturers is Y-Do-I, for which we are indebted to Messrs. Watts & Uthoff, St. Louis agents for the Star Brass Works. Y-Do-I is a Japanese doll and it is said she can do most anything but talk.

THE PHILIPPINE EXPOSITION.

About the time the World's Fair City is waking at early morning, 100 barelimbed Igorote often sacrifice and eat a dog on the Philippine reservation. Those attending the conventions who do not count themselves among the "early birds," however, will find just as interesting things going on at the Philippine Exposition at all times. This is the first comprehensive display of the Filipinos, their work and habits, made in the United States and is well worth seeing.

A lead pencil with rubber top is handy thing to have, and when it is painted blue and white, like those the McGuire-Cummings Manufacturing Co. gives away, it is "worth while."

Mr. Peter Kling, representing the John Stephenson Co., is very much in evidence these days.

Among the early arrivals at the convention were Mr. Cornell S. Hawley, general sales agent of the Consolidated Car Heating Co., and Mr. S. B. Keys, district manager, New York office. Other representatives of this company, who arrived Tuesday morning, are Mr. W. S. Hammond, district manager, of Chicago, and Mr. C. C. Nuckols, also of the Chicago office. The company's exhibit in the Transportation Building is in charge of Mr. C. A. Eggert, of Chicago.

NEW CARS FOR THE NORTHWESTERN ELEVATED RAILROAD CO.

The accompanying illustration shows the construction of a new car, 35 of which are just being put in service by the Northwestern Elevated Railroad Co., of Chicago, and which is known as the

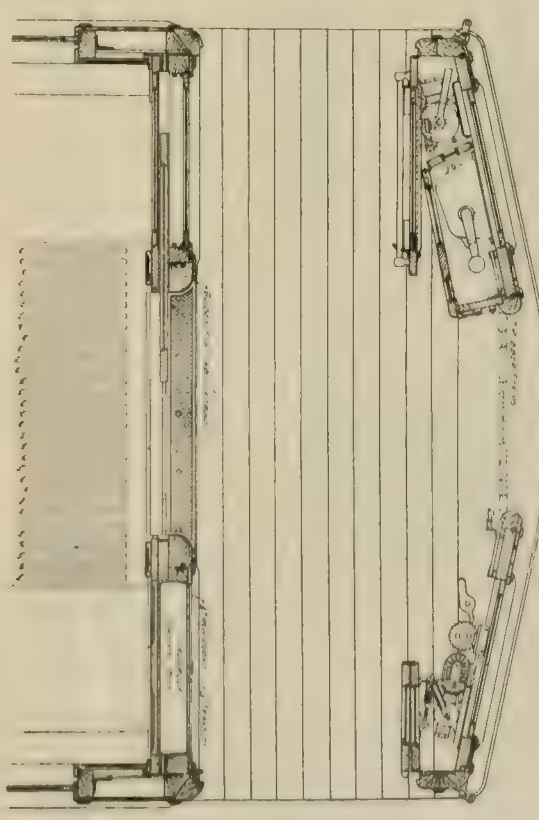
COMBINATION MOTOR AND TRAILER CAR OF NORTHWESTERN ELEVATED R. R.

combined motor and trailer car. This company has adopted the type M multiple unit system of motor control and to give greater flexibility in arranging the train service, it was desired to have a car that could be used in any position in a train.

The design of the car involves a number of new and interesting features. The underframes are of steel and were built by the Pressed Steel Car Co., of Pittsburg, and after assembling were shipped to the St. Louis Car Co., of St. Louis, which built the car

INTERIOR OF COMBINATION MOTOR AND TRAIL CAR, NORTHWESTERN ELEVATED R. R.

bodies and trucks. The side sills are 7-16 in. plates pressed into girders of fish belly section, 17 in. deep at the center and 10 in. deep at the ends, the top and bottom flanges being 4 in. These girders instead of having the convex side placed down as is the usual practice, have been inverted and the covex side placed up. Between the side sills are three longitudinal sills of 5-in. 6½-lb. channels. The intermediate sills and the bottom of the side sills are filled with spruce packing blocks bolted down at frequent intervals for the purpose of providing suitable nailing strips for the main floor of the car, which is made up of two thicknesses of 1x4 in. matched and dressed yellow pine laid diagonally and in opposite directions. Between the two floors ½ in. of hair felt is



VESTIBULE FOR COMBINATION CAR.

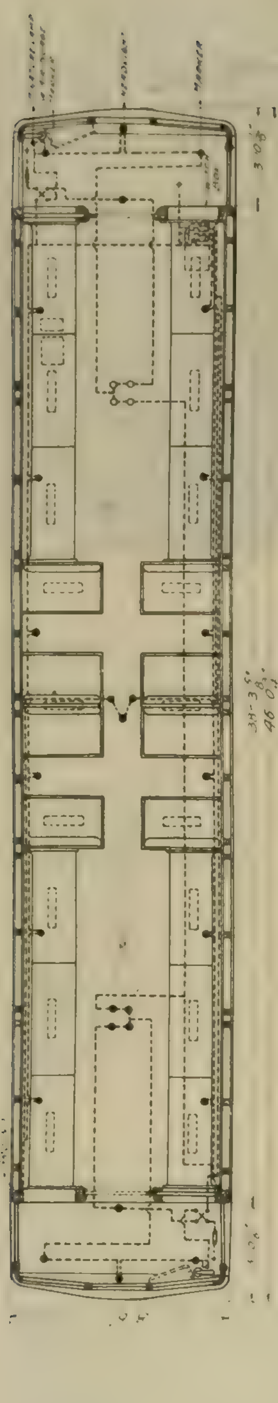
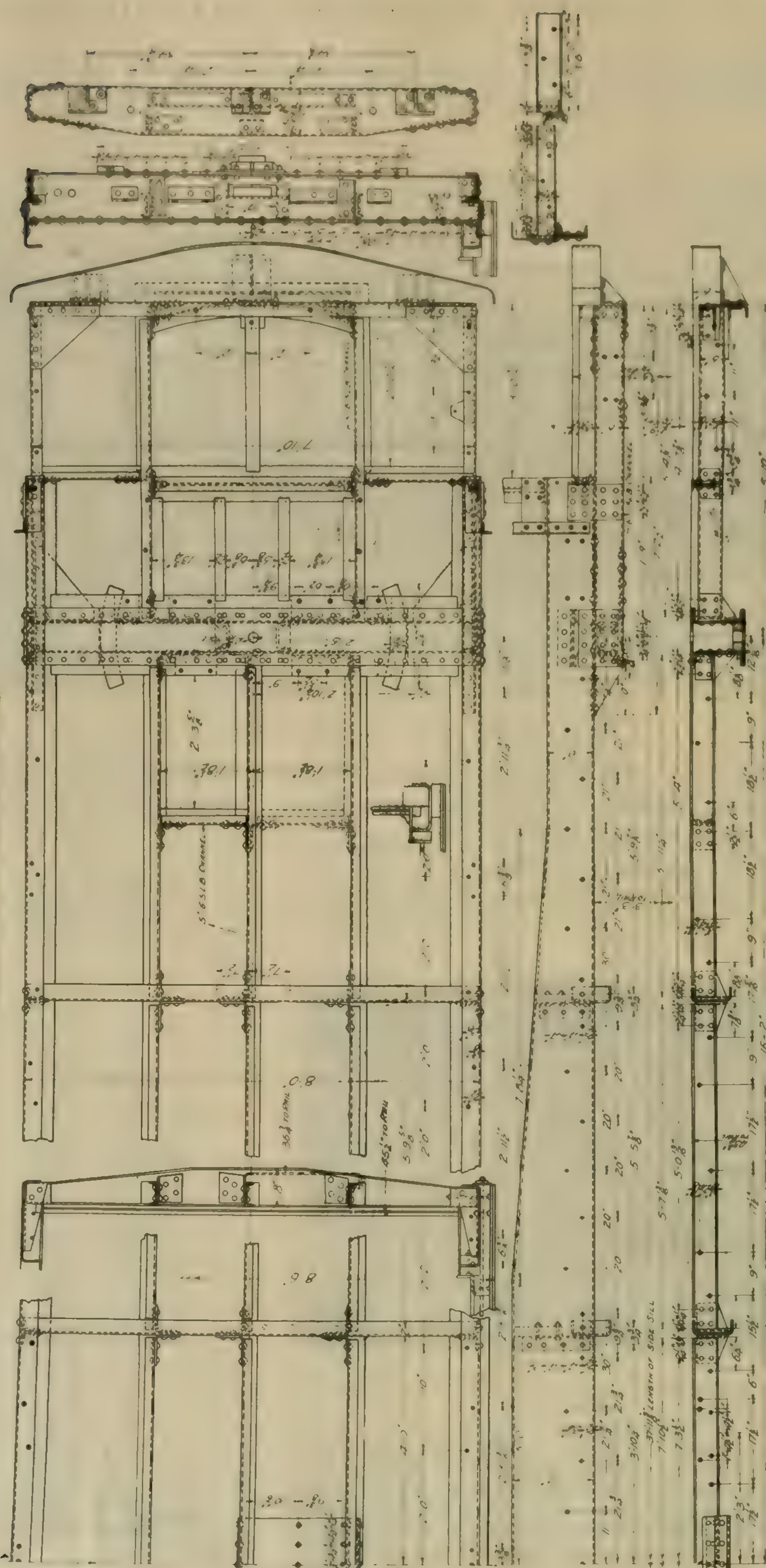
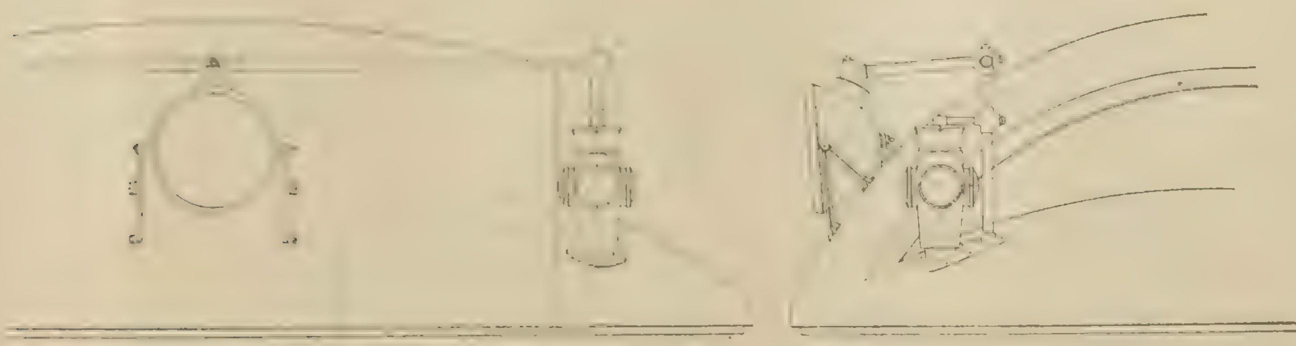


DIAGRAM OF CAR LIGHTING CIRCUITS.



STEEL UNDERFRAME OF NORTHWESTERN ELEVATED CAR.

placed for the purpose of keeping the car warm and it also serves as deadening, as no sealing is provided, all the space between the sills being open to give convenient and ample room for installing electrical and air brake equipment. The bolsters are pressed steel channels 10 in. deep made up of two ⅜-in. plates riveted to the flanges of the channels which form the sides of the bolsters. The metal end sills are pressed steel shapes 8 in. deep at the center and reduced to 6 in. at the ends to fit the 6-in. channels carrying the vestibule overhang. Between the bolsters are four cross members similar to the end sills which are 8 in. deep at the center and reduced at the ends. No side sill truss rods nor needle beam truss rods are required. The overhang of the vestibule platform is carried on 6-in. channels riveted to the bottom sides of the fish belly girders constituting the side sills. These cars also have a steel anti-telescoping structure at the end similar to the motor cars of the Northwestern Elevated; this consists of steel angles and plates framed into the end sills and extending up to the deck, where they are tied across by the deck and sills. The general dimensions of the car are: Length over vestibule, 46 ft.; length over corner posts, 38 ft. 4 in.; width, 8 ft. 8½ in.; height of floor above top of rail, 3 ft. 7½ in.; distance from floor to eaves, 6 ft. 7 in., distance from eaves to crown of roof, 2 ft. 5⅜ in..



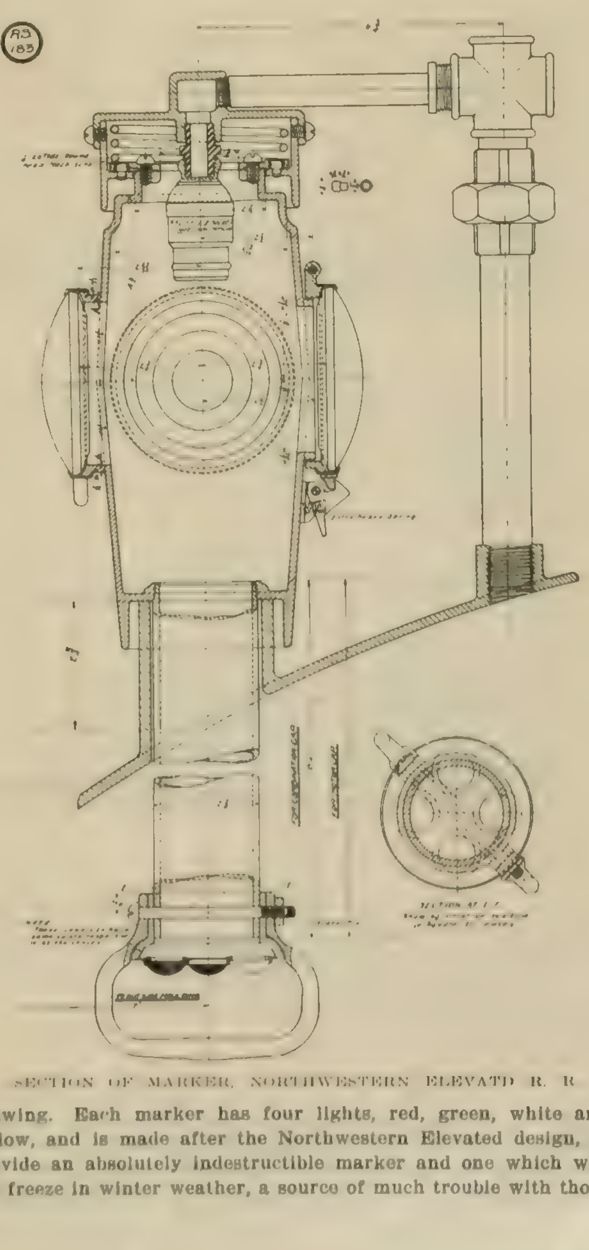
FRONT AND SIDE ELEVATION OF CAR HOOD, SHOWING HEADLIGHT AND MARKERS

COUPLERS FOR NORTHWESTERN ELEVATED CAR

The siding on the exterior is two thickness of ½-in. material, the first put on horizontally and the outside vertically and extends down below the bottom of the side sills so that the underframing is entirely concealed. The seating is designed to accommodate 60 persons, there being eight double cross seats at the center of the car and the rest longitudinal. The bodies are mounted on Northwestern Elevated standard M. C. B. trucks which have 5-ft. wheel base and are placed 32 ft. 4 in. between truck centers. The wheels in these truck were furnished by the Standard Steel Works and are 34-in. steel tired and mounted on [illegible] in. axles.

It is the intention when these cars are put into service to exchange one M. C. B. trailer truck for one Northwestern Elevated class A motor truck, which is equipped with two G. E. 55 motors and also to mount a two-motor equipment of the G. E. type M control on the bottom of the car together with the new style magnetic circuit breaker, which is opened and closed by the operator manipulating a set and tripping switch from any point in the car or in the train. There are two controllers on each car in the vestibules, one on each end at the left hand side in the platform vestibule. Folding doors are provided to completely enclose the controllers when they are not in use and to fold around to the right and close the opening in the vestibule wall, making a convenient cab the entire size of the platform vestibule for the motorman's use. This cab will be heated by an independent electric heater, and all the switches, fuses and electrical apparatus of similar nature are placed in a compartment enclosed in the main wall of the car at the end on the right hand side and completely lined with ¼-in. transite and provided with sheet iron doors, the doors opening into the vestibule.

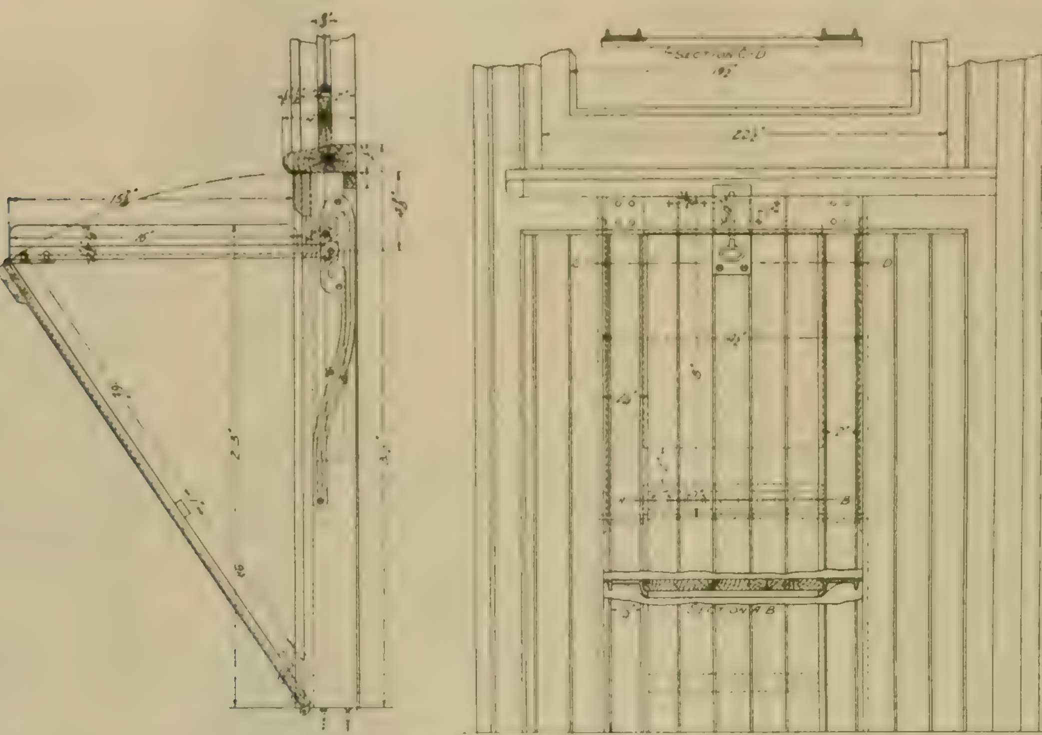
Each end of the car is equipped with a set of markers and headlight of the Northwestern Elevated standard shown in the



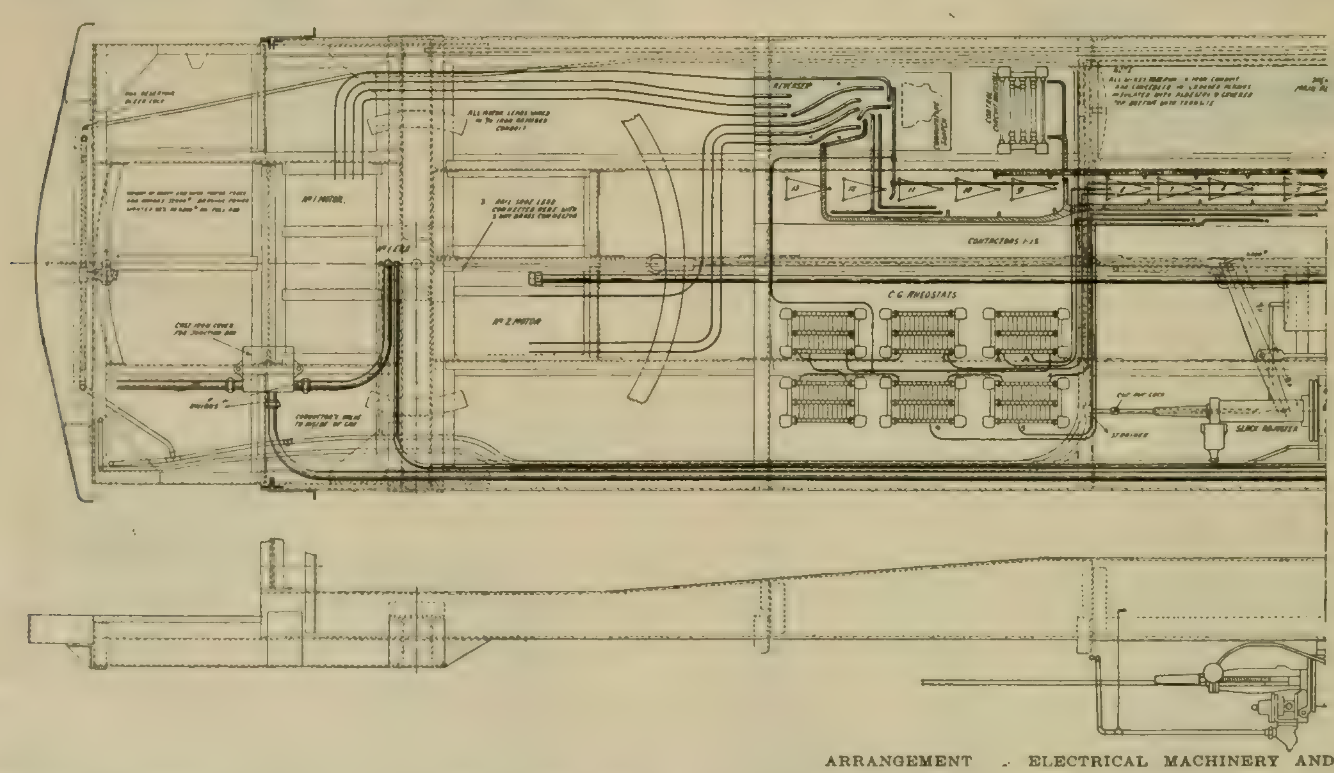
SECTION OF MARKER, NORTHWESTERN ELEVATD R. R.

drawing. Each marker has four lights, red, green, white and yellow, and is made after the Northwestern Elevated design, to provide an absolutely indestructible marker and one which will not freeze in winter weather, a source of much trouble with those

formerly used. One 16-candle power lamp is in each marker and headlight. The headlight and marker circuit is controlled by a special way switch, circuits being wired in such a manner that the operator can at will throw on the headlight and marker circuit, at the same time cutting out the vestibule light. As cutting out the vestibule light kills one of the five lamp circuits ordinarily used for lighting the car, two of the other four lamps on this circuit are cut into the marker and headlight circuit, leaving two dead lamps on the interior of the car. For lighting the interior of the car there are 23 lamps, which together with one in each vestibule, give five 5-lamp circuits. These are in two 4-lamp and one 3-lamp fixtures in the ceiling of the car and six lamps on each side, the sockets being placed in the upper molding of the advertising space. The interior finish of the car is natural oak. The seats were furnished by the Hale & Kilburn Manufacturing Co., of Philadelphia. The equipment includes Westinghouse automatic quick action air brakes with motorman's brake valve and American Brake Co. slack adjusters, and Cristensen motor driven air compressors, made by the National Electric Co. The electric heaters were furnished by the Consolidated Car Heating Co.

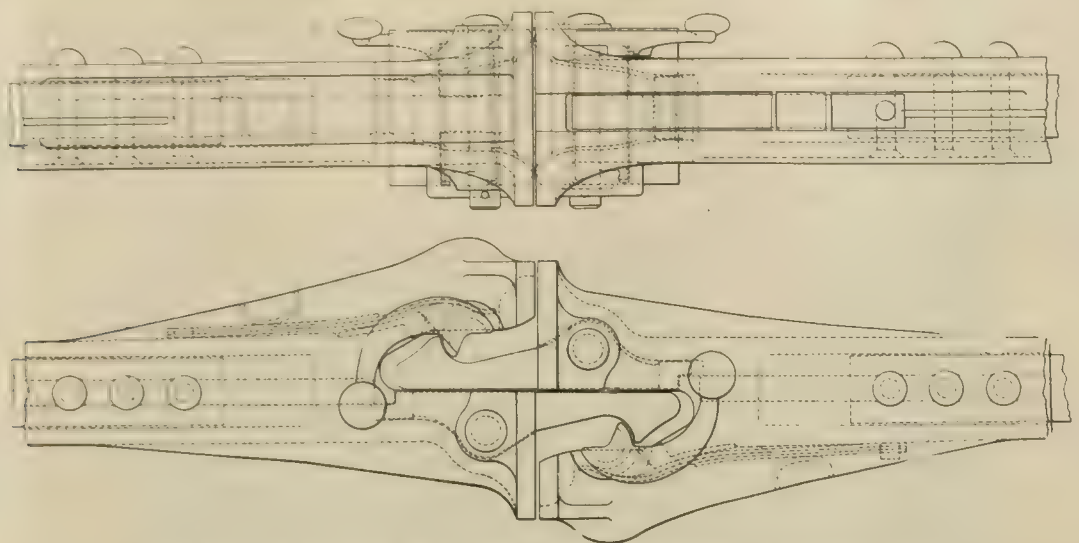


MOTORMEN'S SEAT, NORTHWESTERN ELEVATED CAR.



ARRANGEMENT . ELECTRICAL MACHINERY AND

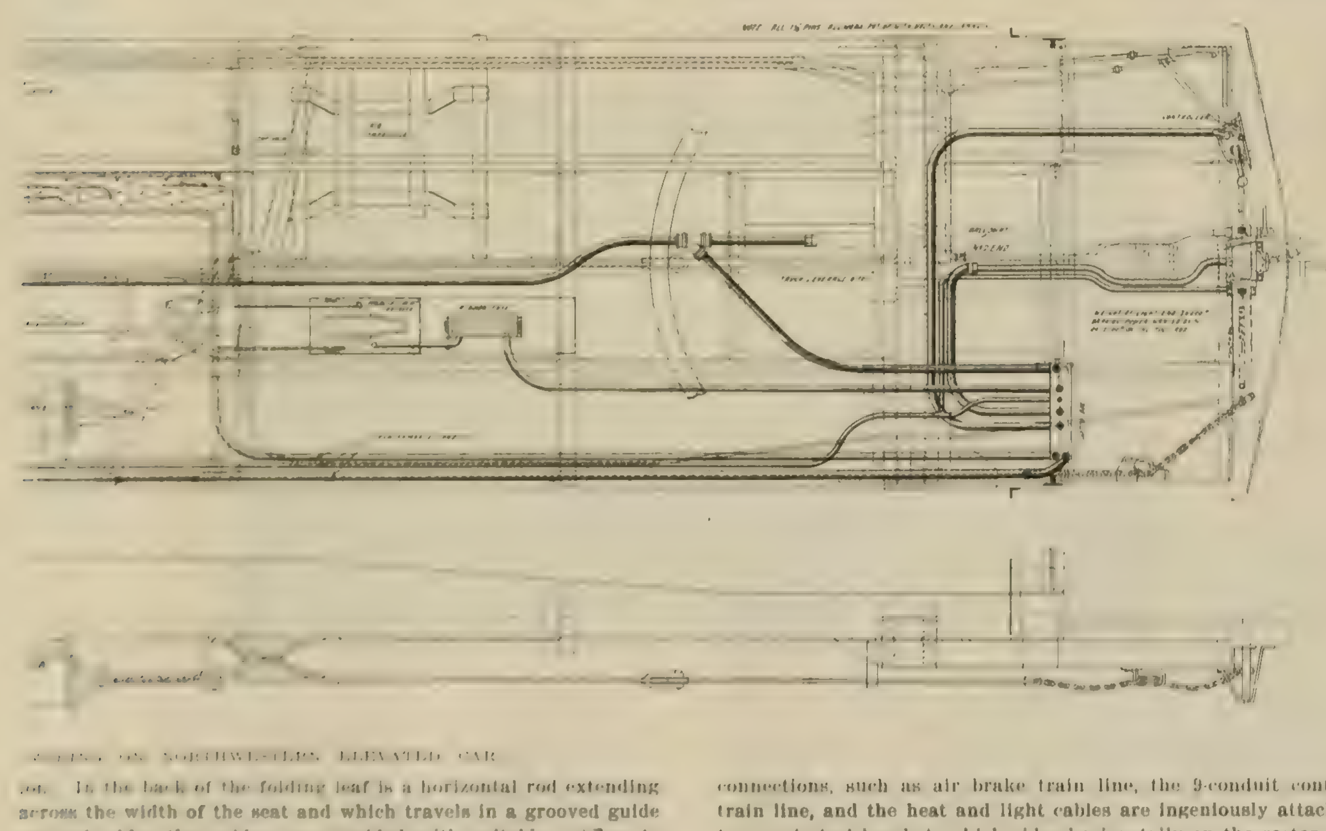
One of the interesting features of this car is the folding cab on the platform. This is shown in one of the accompanying drawings from which it is seen that by making the end door of the vestibule in two leaves and using a hinge of suitable design this door can be swung around so as to completely enclose the controller when the car is in use as a trailer. As the Northwestern is operated left-handed, the controller is placed at the left at the side of the cab. The side vestibule door is operated by a lever device in connection with a Yale & Towne door check. The left vestibule door, just inside the cab, has a single leaf only with sliding sash. Another detail of the vestibule is the motorman's seat, which is designed to fold into the end of the car body when not in use. This seat is constructed of maleable iron frame, the face of which is molded to conform with the appearance of the end of the car and has a leaf, folding when not in use into the space between the inner and outer walls, to which is attached a cushion. In the back of the folding leaf is a horizontal rod extending across the width of the seat and which travels in a grooved guide on each side; the guides are provided with suitable notches to give proper elevation. The whole mechanism folds up by the seat leaf dropping down following the guide, and the outer frame work latches to the window sill with a flush catch so as not to present any obstruction in the passage way when not in use.



PLAN AND ELEVATION OF COUPLER FOR NORTHWESTERN ELEVETAD CAR.

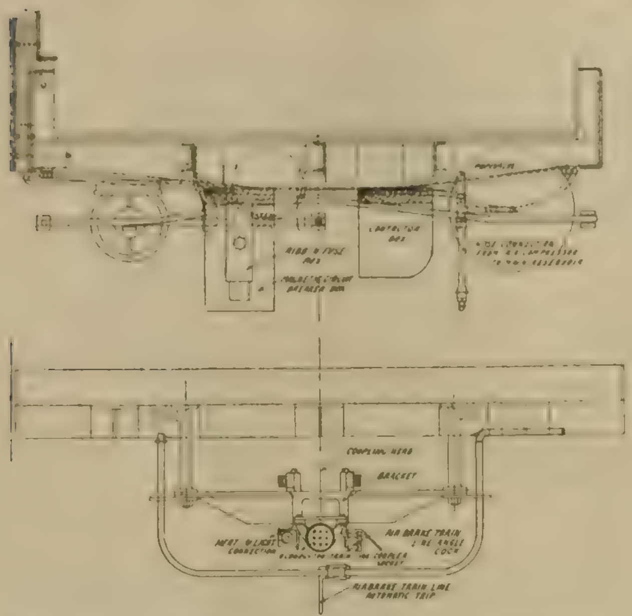
The car is equipped with Stearns & Ward automatic car couplers of the same design as that recently adopted as standard on the Underground Electric Railways of London, and now being applied to 430 of its cars. The coupler is one especially designed for this class of work to meet the requirements of hard service and sharp curves and is of the vertical plane type with double lock and will allow a car to freely oscillate within a limit of 6 in. vertically and any amount horizontally desired. The couplers are made of Tropenas steel, annealled and were furnished by the Chicago Heights plant of the American Brake Shoe & Foundry Co.

The draft rigging was designed by the Northwestern Elevated to provide ample space for the motors and with free horizontal range for the swing of the cars on sharp curves. The train line connections, such as air brake train line, the 9-conduit control train line, and the heat and light cables are ingeniously attached to a cast steel bracket, which rides horizontally on the sector bar with the movement of the draw bar. Arresting springs on either



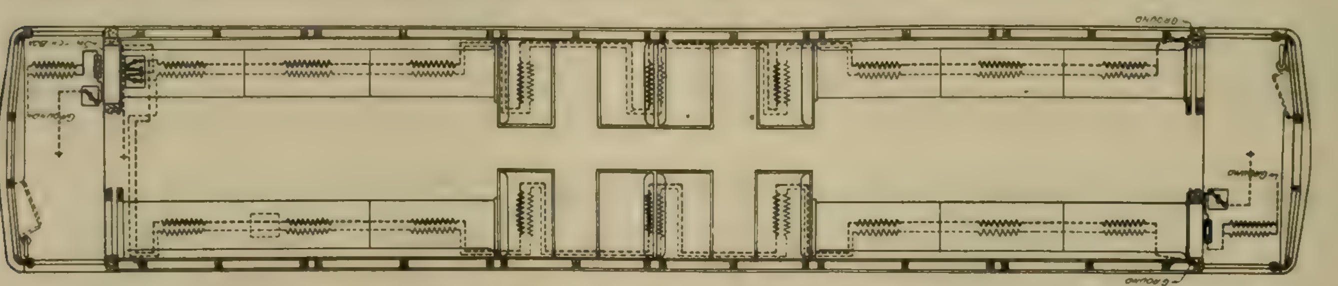
[illegible] OF NORTHWESTERN ELEVATED CAR

side of the bracket are provided for preventing shocks on the free end of the car. All electric wires are as much as possible run on the bottom of the car in iron armored conduits, except the



END ELEVATION OF ELECTRICAL MACHINERY AND BRAKE RIGGING ON CAR.

heat and light circuits inside of the car and the short lengths of cable necessary to run into the fire proof switch box and out again, all of the wiring is under the car floor. The motor leads



WIRING FOR CAB AND CAR HEATERS, NORTHWESTERN ELEVATOR CAR.

and through train line circuits attached to the draw bar are protected against abrasion by brass armor. The air compressor is suspended on the bottom of the car and the air brake apparatus has been especially designed to take up the least amount of room on the bottom of the car as shown in the drawing.

For the description and illustration of this car, we are indebted to Mr. R. B. Stearns, superintendent of the Northwestern Elevated Railroad Co.

ELECTRIC HEATERS FOR NEW YORK CITY RY. CARS.

The Consolidated Car Heating Co. has received an order for electric heating equipments for the 150 new cars for the New York City Railway Co., which cars are to be wired in accordance with the new rules of the National Board of Fire Underwriters. Each car is to have 16 panel heaters, the connecting wires being carried in a metal conduit which will extend into the heater cases. There will, therefore, be no joints or exposed wires outside the heater cases. The Consolidated company's new double quick break knife switches will be used. Both the heaters and switches have been approved by the New York Board of Fire Underwriters.

The Consolidated company has also just received the following orders for electric heater equipments: Boston Elevated Railway Co., 24 18-heater equipments for elevated cars; Cincinnati Traction Co., 50 12-heater equipments of the truss plank type; Montreal Street Railway Co., 50 8-heater equipments of the cross seat type.

ANENT AMBER MICANITE.

The Mica Insulator Co., of New York, advises us that it has learned that a report has been circulated that the company had been making what is known as amber plate by using India mica in the center with a coating of amber mica on the outside, and the company desires to state that these reports are absolutely false. It declares that during the 12 years the company has been in existence every piece of insulation it has turned out has been exactly as represented, and that it never sold any amber micanite that did not consist entirely of the best amber mica it could purchase. The company guarantees all its amber plate to be made from pure, soft Canadian amber splittings prepared in its own factory at Ottawa.

The Dearborn Drug & Chemical Works, which furnished its vegetable feed-water treatment for boilers in the Steam, Gas and Fuels Building, is ably represented at the convention by Mr. Robert F. Carr, the vice-president and general manager, of Chicago; Mr. G. W. Spear, also of the Chicago office, and Mr. Frank Eardley, manager of the St. Louis office.

Mr. Edward J. Meisenheimer, representing the publicity department of the Allis-Chalmers Co., is here for the double purpose of attending the convention and seeing the Fair.

Mr. George A. Damon, manager of the Arnold Electric Power Station Co., of Chicago, registered at the Association headquarters at the Southern Tuesday morning.

WESTINGHOUSE MEN AT THE CONVENTION.

The Westinghouse companies are represented at the convention by a large number of its managers and engineers, among whom are the following of the Westinghouse Electric & Manufacturing Co.: L. A. Osborn, fourth vice-president; Calvert Townley, special representative; H. P. Davis, assistant chief engineer; W. K. Dunlap, and F. S. Smith, directors of Westinghouse exhibits; G. Pantaleon, special western representative; C. S. Cook, and C. B. Humphrey, department sales managers; D. E. Webster, T. P. Gaylord, W. F. Fowler, Maurice W. Thomas, J. R. Gordon, L. M. Corgo, district office managers; also, R. L. Wilson, Graham Smith, C. H. Smith, O. B. Bond, Leon Goldsmith, R. S. Brown, George C. Ewing, J. C. McQuiston, C. S. Schenck, J. E. Webster, S. H. Anderson, J. McA. Duncan, W. S. Rugg, W. O. Mundy, Clarence Renshaw, R. P. Jackson, Mr. N. W. Storer.

The Westinghouse Traction Brake Co. is represented by J. R. Ellicott and C. W. Townsend. H. M. Reed, of the Nernst Lamp Co., and W. A. Evans, of the Cooper-Hewitt Electric Co., are also in attendance.

Mr. J. M. Griffin, president and general manager of the Wheel Truing Brake Shoe Co., of Detroit, is in charge of the company's exhibit, as usual, and also as usual is distributing useful souvenirs, the gift this year being a pocket cigar cutter.

WEST BADEN AN IDEAL MEETING PLACE.

Apropos with the announcement that the American Street Railway Association has received an invitation from the West Baden Springs Hotel, of West Baden, Ind., to hold the 1905 meeting at West Baden, we quote the following pertinent remarks which appeared in the American Legal News' report of the 10th annual convention of the Commercial League Club of America, which was held at this hotel July 25-29 last:

"The opportunity should not be lost of saying that the West Baden Springs Hotel entertained the convention in a way superior to that of any other League convention hotel up to date. The entire hotel was put at the disposal of the League, and nothing that was asked for, in reason or out of reason, was refused. The hotel itself, in the multiplicity of its conveniences and the magnitude of its various appointments, was a great surprise even to those who had, by reading of it, formed some conception of it. The hotel is an ideal place for a convention, and the proprietor and manager, and all who have the conduct of the hotel in charge, are courteous and generous. There was not a complaint registered by the League itself, or by any individual member, to our knowledge. The consensus of opinion among the members in attendance at the convention was that the success of the convention was due very largely to the intelligent and hearty co-operation of the hotel management."

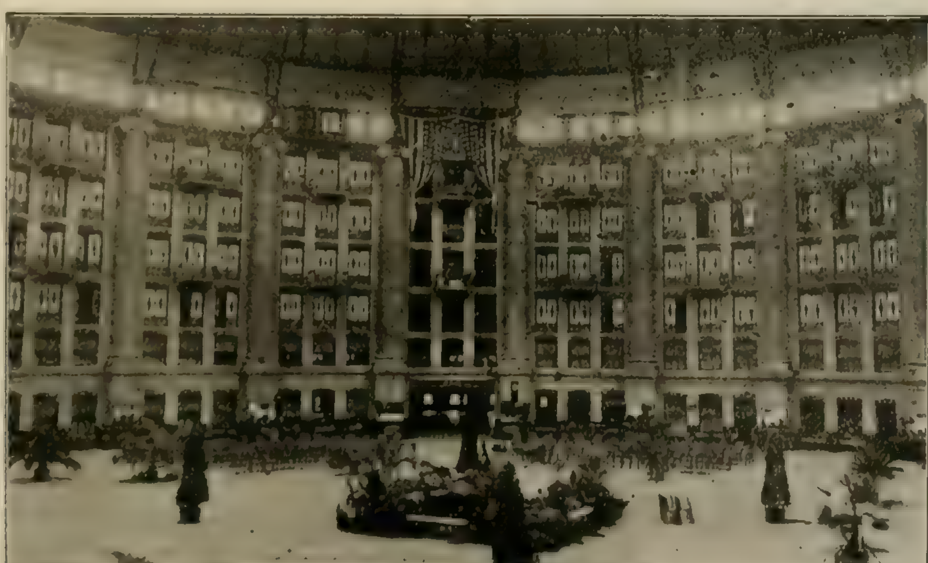
The West Baden Springs Hotel was described and illustrated in the "Review" for August and some of the salient reasons why it is an ideal meeting place were pointed out. A recapitulation of the chief features is in order at this time, especially as the hotel's invitation to the A. S. R. A. is receiving serious consideration.

The new West Baden Springs Hotel was built in 1901-02, replacing a frame building which was destroyed by fire. The new structure is absolutely fireproof, having been built of brick and concrete on a foundation of solid rock; no wood, excepting the doors and window casings, entered into the construction.

WEST BADEN SPRINGS HOTEL.

The hotel building proper is octagonal in shape, surrounding a circular central court, called the "Grand Atrium," and covers nearly five acres. The total floor space covered by the hotel and Atrium is 15 acres. The building is six stories high and contains 708 guest rooms, each room provided with bath, toilet, clothes closet, stationary wash basin, with hot and cold water, and long-distance telephones. The hotel is heated by steam and lighted by electricity.

The central court is 200 ft. in diameter and is covered by a dome of steel construction which is 135 ft. high at the center. The only other building in the world having a large dome constructed of steel is the Capitol at Washington. That is only 120 ft. in diameter, however.



GRAND ATRIUM, WEST BADEN SPRINGS HOTEL.

In addition to the guest rooms, which will accommodate 1,400 people, there are 31 parlor suites, a ball room 80x94 ft., main

dining hall 80x94 ft., and six private dining rooms. The office rotunda is 100 ft. in diameter.

Connected with the hotel by arcades are several annexes, in which are located one of the largest bath houses in the world, a gymnasium, an opera house, and a Casino with bowling alleys, billiard and pool tables and unexcelled opportunities for indulging in games of chance. Near the Casino is a covered oval, two-story bicycle track, the inner field being available for base ball, foot ball or tennis.

Located on the ground floor and opening into the Grand Atrium are the West Baden National Bank, a drug store, a furnishing goods store, a barber shop and a depot for oriental goods.

Excluding the fountain the floor space available for exhibition purposes in the Grand Atrium is 32,938 sq. ft. The floor of the Atrium is cement concrete laid on solid rock. Two entrances from the exterior may be used. These entrances are

ORIENTAL PARLOR.—JAPANESE.

GLIMPSE OF CAFE

rectangular and 17 ft. 4 in. wide by 10 ft. 5 in. high in the clear. The hotel management has offered to place the Grand Atrium at the disposal of the A. S. R. A. for exhibit purposes and to furnish 125-volt electric current for operating exhibits.

West Baden is reached by the Monon Route which has, by means of the Baltimore & Ohio Southwestern, Cincinnati, Hamilton & Dayton, Big Four, and Pennsylvania lines, direct connections with Chicago, Louisville, Cincinnati, St. Louis and Indianapolis. A spur from the Monon runs direct to the entrance of the hotel on one side, and on the other is the track of the French Lick & West Baden R. R., the electric railway which connects West Baden with French Lick.

West Baden Springs have become almost as widely known as Saratoga Springs, and there are other excellent spas in the vicinity which are reached by beautiful drives. There are likewise a number of other hotels at West Baden which can easily accommodate 1,000 or more guests between them.

Of the numerous important conventions which have been held at the West Baden Springs Hotel this season was that of the $200,000 Club, composed of agents of the New York Life Insurance Co., each of whom has written insurance for the company, in one club year, to the amount of $200,000. This convention was held September 20-22 last. One of the entertainment features provided by the hotel which elicited unstinted commendation was the menu for the banquet, while the club members spoke highly of the "superb conditions they found at the resort generally."

The West Baden Springs Hotel was designed in all its details by its owner, Hon. Lee W. Sinclair, and from all accounts it would be an ideal meeting place for the A. S. R. A.

CARE OF EQUIPMENT.

Editor "Review:"

The old adage: "A stitch in time saves nine," applies to the care of the equipment of a street railway, as well as to other things. My knowledge of the street railway business is probably very limited, when compared with that of some of my readers, but it has fallen to my lot in the past two years to visit all the large cities and towns of the country calling on railway officials in connection with my business, and being somewhat of an observer of men and things, it was very noticeable how the equipment of the various roads was kept up. The thing which attracted my attention particularly was the fact that the roads whose tracks, cars and other equipment were in the best condition seemed, from all that I could learn to be the roads that were paying the best dividends to their stockholders, while contrarywise, the road whose tracks were rough and whose cars were rattly and wheels flat, were invariably in the same shaky financial condition. I appreciate that this rule will not apply to every road that has allowed its equipment to run down. I have personal knowledge of some roads whose equipment is sadly in need of repairs, but whose dividends are always prompt. But it is the exception that proves the rule, and as I have had occasion to ride on the street railways in the many cities throughout the country, I have found myself making note of these facts.

As a result, when I get to a city and find the tracks good, the cars well kept and the wheels round the fenders in repair, and the motormen and conductors neat and gentlemanly, I find myself at once becoming covetous with a desire to be a part owner in such a road. I may be wrong in my deductions, but I do not think I am.

The street railways serve the public, and are dependent upon it. I believe the public appreciates the efforts of the company that strives to look after its welfare, and it is therefore a short sighted business policy to allow equipment of any kind to run down so that it must be replaced by new, instead of applying the stitch in time and thereby keeping it in a good condition continually.

The foregoing is particularly applicable to the care of fenders or life guards. It seems strange to me that railway men will go to the expense of putting fenders on their cars and then apparently give them no further consideration, unless they have been knocked completely off by an ice wagon, or the car ahead, or some equally serious mishap. They seem to forget or neglect the fact that a fender is put on a car for a specific purpose—that of saving the life or limb of the unfortunate person who happens to get in front of their moving cars.

In nine cases out of ten, a car fender is of no actual value, and in fact worse than nothing if it is not kept in working order. It should be the duty of every motorman to be perfectly familiar with the character and operation of the fender on his car. Before he takes the car from the barn he should be compelled to examine the fender and see that it is in working order. If he has familiarized himself with the mechanism of the style of fender used by the road on which he is employed, it would be but the work of a moment for him to determine whether it was in working condition, and ready for efficient service in case of accident. If it is not in perfect condition he should report it at once, that the fender may be repaired, or a new one substituted before the car is taken out again. If the fender on a car has been smashed in a collision they would not think of allowing it to remain on the car in that condition; yet it may be just as use-

less as far as its efficiency as a fender is concerned, through some trifling part being out of order. Still, the car with such a fender will be allowed to run day in and day out, and no one seems to care a rap. The next thing we hear, or read in the headlines of the newspaper: "Man Run Down By Car. Fender Failed To Work." If the railway companies would take more care to see that their fenders were kept in good condition there would be fewer fatalities, fewer injuries, and in consequence a greatly diminished number of claims for damages to be paid.

"The stitch in time," surely saves nine in more ways than one when applied to car fenders. It costs less to keep them in repair when they are looked after promptly, and not let go until they are completely battered out of shape. If the fender is of the right pattern, and is kept in working order, it will save your company many times its cost in case of accident. Besides, what is the use of spending your good money for a fender if you do not propose to keep it in shape to do the work for which it is placed on the car. To be sure, I am interested in the fender business, but I have seen the various makes of fenders of our different competitors, as well as our own, in condition of absolute worthlessness, because of their battered condition. I speak for the good of the cause, and not altogether from a selfish standpoint, for if I did I would say: "Let them run down, do not keep in repair, because that means the quicker they will wear out, and the quicker you will have to buy a new supply of fenders." Is it selfishness then on the part of the fender makers? No—a fender kept in repair means money in your pocket and the possible saving of a life that might otherwise be jeapordized.

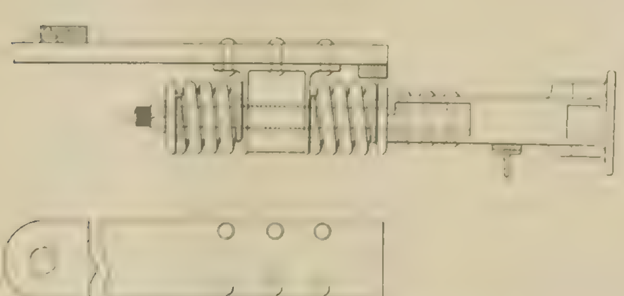
C. B. FORWARD.

HEYWOOD BROTHERS & WAKEFIELD CO.

The Heywood Brothers & Wakefield Co., of Wakefield, Mass., has an exhibit at the Consolidated Car Heating Co's. booth, aisle E, post 57, Transportation Building, where are shown the company's Wheeler slideover seats, with pedestal bases and automatic adjustable foot rests, these samples being among the finest reversible car seats that can be manufactured. They are upholstered in leather and have bronzed back bands and mahogany arm rests. The seats were lent to the Consolidated Car Heating Co., to be shown equipped with its heaters, this being a mutually profitable arrangement.

VAN DORN COUPLERS AT THE FAIR.

No street railway man in attendance at the Exposition should go home before he has inspected the automatic couplings and drawbar attachments with which the cars of the Intramural Ry. are equipped. The couplers were made by the W. T. Van Dorn



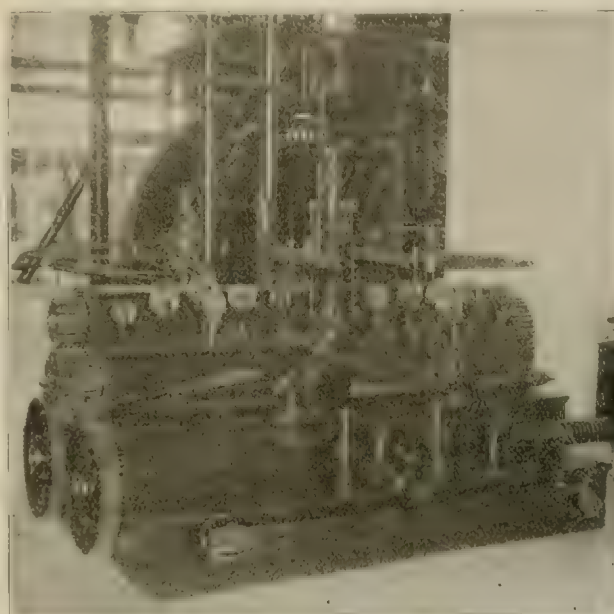
VAN DORN COUPLER FOR INTERURBAN CARS

Co., of Chicago, and are of the style known as No. 11. The accompanying illustration shows the No. 11 drawbar in detail, together with the manner of attaching it to the bottom of the car. The life of the coupling is equal to the life of the car and with practically no expense for repairs.

As is well known, the Van Dorn couplings are used on all the elevated railroads of this country and among the most recent types of drawbars made by the Van Dorn company are the new heavy style used on the Metropolitan West Side Railroad Co's cars, in Chicago, and the heavy motor drawbar adopted by the Interborough Rapid Transit Co., of New York.

EXHIBIT OF THE R. D. NUTTALL CO.

The exhibit of the products of the R. D. Nuttall Co. at the Exposition is in the Westinghouse space in the Palace of Machinery, and consists of a display of cut and planed gears, trolleys, trolley gears and pinions, for electric railway, mine, and industrial haulage motors. The parts shown are in almost all instances heavy, as designed to meet the requirements for modern service. There are double and single pole, single throw trolley bases of heavy design and single pole, double throw bases of moderately light weight, also a special stand for single vertical trolley in which



TROLLEY BASES AND WHEELS, GEARS AND PINIONS—R. D. NUTTALL CO. MACHINERY BLDG.

the spring is wound about the main holder. The harps shown are of both iron and brass, with brass wheels of both solid and spoke type. The trolley poles are for surface cars and mine locomotives. Extra heavy and moderately light cast steel axle gears of the solid and split types, and forged steel pinions complete the exhibit.

The car of the Indiana Union Traction Co., which is shown in operation on tracks just north of the Palace of Transportation, equipped with the Westinghouse unit switch system of multiple control, is equipped with Nuttall apparatus, including both double throw and single throw trolley bases.

BENJAMIN ELECTRIC MANUFACTURING CO.

The Benjamin Electric Manufacturing Co., of Chicago and New York, has one of the most attractive exhibits at the Fair. It is located in block 25, aisle G, Electricity Building. At the rear of the booth is a display board showing the elements of the company's wireless lamp clusters and other electrical specialties as they appear in different stages of assembling; also the completed articles with a variety of finishes. A smaller display board is also provided showing clusters used in street car work.

At different points in and around the booth are shown to advantage the company's No. 4 twin sockets, No. 6 porcelain receptacles, shades of different makes for indoor and outdoor lighting, a 20-light cluster with a large mirror reflector, a style K cluster with pagoda shades, No. 19 two-light brackets with individual shades and 11-light spherical clusters with individual shades.

Benjamin clusters are used in the cars of the St. Louis Transit Co., Interborough Rapid Transit Co., Brooklyn Rapid Transit Co., Boston Elevated Ry., the electric roads at Los Angeles, and other important systems. The lamp clusters made by this company for electric railway use have no sockets to break down and no soldered connections, there being nothing to get out of order. They cost less than the old-style clusters.

The exhibit is in charge of Mr. L. G. Kalloch, who is assisted by Mr. G. P. Buckner.

WESTERN WHEELED SCRAPER CO.

The Western Wheeled Scraper Co., of Aurora, Ill., has two exhibits, one in aisle I, posts 98-101, Transportation Building, and the other in the Liberal Arts Building. The exhibit in the Transportation Building includes various kinds of dump cars and wagons which this company makes for track and roadbed work, one of its specialties being a 10-yd. center dump car specially adapted for ballasting purposes or for filling in trestles, hauling cinders, coal, gravel, crushed stone, etc.

In the Liberal Arts Building are shown working models of road graders, wheel scrapers, wagon loaders, dump wagons and a full line of machinery, vehicles and apparatus for hauling earth and dirt under all conditions of road building, excavation work, trenching, electric and steam railroad roadbed work, etc.

STOW FLEXIBLE SHAFT CO.

The Stow Flexible Shaft Co. has a working exhibit in block 28, aisle F, Electricity Building, showing the application of electric control to flexible shaft driving.

ST. LOUIS CAR CO. EXHIBIT.

The St. Louis Car Co's. exhibit at post 26, aisle G, Transportation Building, is one of the most interesting exhibits at the Exposition. It shows the evolution of travel from the early days to the present, beginning with an omnibus of the early 60's

THE BEGGS PRIVATE CAR AND COMBINATION CAR FOR PACIFIC RY

and concluding with a handsome private coach which the company built for Mr. John I. Beggs, president of the Milwaukee Electric Railway Light Co.

CAR SHOWING STAGES OF CONSTRUCTION.

There are shown an old and new horse car; the first cable car, which was used in San Francisco; the first electric car built by the company in 1887; the St. Louis Car Co's. export car, built for Argentine; two double-deck cars, representing the London and Dublin types, and modern cars built for the St. Louis Transit Co., Northwestern Elevated Railroad Co., Interborough Rapid Transit Co. (subway cars), Oakland Transit Co., Pacific Electric Railway Co.

OFFICE AT ST LOUIS CAR CO EXHIBIT

The exhibit also includes the following St. Louis Car Co. trucks: No. 23-B heavy interurban, Hedley motor, interurban and elevated No. 50, elevated, and No. 47 short-wheel base city truck. There are also displayed bronze trimmings, seats, arc headlights and arc lamps for interior lighting.

THE POPULAR MINIATURE RAILWAY.

The miniature railway installations along the Pike and in other parts of the Exposition grounds have proved exceedingly popular and profitable attractions and the Cagney brothers, who make these little outfits, under the style of "The Miniature Railroad Co," have reason to be proud of their efforts to entertain the vast number of Fair visitors who have patronized them.

This is the largest display of miniature railways ever made. The Miniature Railway Co. has 24 complete three-car trains on the Fair grounds and has built 8 miles of miniature track. The locomotives are less than 5 ft. long and 2 ft. from rail to top of smokestack. Steam is used at 100 lb. pressure, real coal being burned, and each locomotive is capable of exerting 12½-h. p. continuously. With a train of three cars, one of these midget locomotives will haul 24 adults, or 36 children, at a speed of from six to eight miles an hour.

These miniature railways are great drawing cards for parks, as a number of electric railway managers well know. The office of the Miniature Railroad Co. is at 407 Broadway, New York City.

WHEEL TRUING BRAKE SHOE CO.

The Wheel Truing Brake Shoe Co., of Detroit, Mich., exhibits in conjunction with the Wesco Supply Co., at block 8, aisles A, B, U and V, Electricity Building, where it shows its wheel grinding brake shoes of various sizes and designs. Included in the exhibit are shoes designed for removing flats from chilled iron wheels of electric cars, for dressing down flattened wheels of locomotive driver wheels and for dressing down tread worn or grooved tires of locomotive drivers.

H. B. CAMP CO.

The H. B. Camp Co., of New York and Chicago, exhibits in the court of the Electricity Building a section of a complete installation of underground conduit built under the H. B. Camp patents. Engineers and others interested in conduit work will find a visit to the Camp space profitable.

WESTINGHOUSE COMPANIES AT THE FAIR.

In addition to the splendidly equipped main service power station at the Exposition, the entire contract for which was awarded to the Westinghouse Electric & Manufacturing Co. by the Exposition management, and the operating exhibit installed in Machinery Hall, a large section of the Electricity Building is occupied by Westinghouse apparatus. In fact, so extensive an exhibit of electrical machinery and detail apparatus has never before been made by a single company outside its factory walls.

The contract for the main service plant was awarded shortly after the plans for the Exposition assumed final form. It called for the designing, installation and equipment of a complete central station to supply electric power for general use—for the night illumination of the 1,240 acres and countless buildings, for pumping water for lagoons and court basins, cascades and fountains, for operating exhibits and concessions in various parts of the grounds. The entire steam and electric station was designed and installed by Westinghouse, Church, Kerr & Co., and constitutes a model plant of 14,000 h. p. capacity.

The four 3,500-h. p. Westinghouse-Corliss vertical cross-compound reciprocating engines within the Westinghouse enclosure at the west end of Machinery Hall, as well as the smaller motive power apparatus, including that in the service plant section of the Steam, Gas and Fuels Building, were manufactured by the Westinghouse Machine Co. The auxiliary electric apparatus and switchboard equipment were supplied by the Westinghouse Electric & Manufacturing Co. The plant has been in continuous operation since April 15th, maintaining its own load, and from time to time carrying extra loads which exhibit plants have been unable to sustain.

The plant occupies, with the exciter units, condensers, cooling towers and 35-panel switchboard, 26,260 sq. ft. The four large generating units are direct driven, each of 2,000 kw. capacity, operating at 83½ r. p. m., and deliver a 25-cycle current at 6,600 volts. The space, over all, occcupied by each unit, including the 36 and 75x54-in. Westinghouse-Corliss vertical compound engines, is about 55x15 ft., and 32½ ft. in height, the fly wheel being 23 ft. in diameter. The space occupied by the smallest of the belt-driven generating units at the Chicago Exposition was about 65x27 ft.

Steam for the Westinghouse service plant is furnished by Babcock & Wilcox boilers installed in the Steam, Gas and Fuels Building. Included in the equipment of the boiler plant are Roney stokers which are operated by Westinghouse "Standard" steam engines. Each of the four generating units receives steam from a separate pipe line supplied by a separate boiler battery and the units may be operated independently or together.

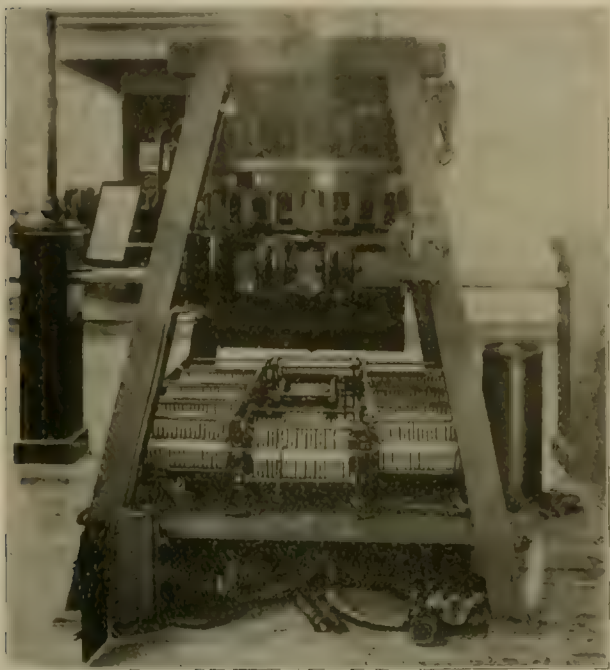
West of and adjoining the Westinghouse service plant in Machinery Hall is a Westinghouse-Parsons steam turbine generating set of 400 kw. capacity, operating at 3,600 r. p. m., and delivering a three-phase, 60-cycle current at 440 volts. This is the smallest turbine unit built by the Westinghouse Machine Co., and is suitable for power stations of moderate size. The company is building a number of these units which will have a capacity of 7,500 h. p.

The Westinghouse Electric & Manufacturing Co's. exhibit in Electricity Building covers an area of more than 10,000 sq. ft., including 1,600 sq. ft. devoted to electric trucks and locomotives built in conjunction with the Baldwin Locomotive Works. Two mining locomotives are exhibited, one weighing 20,000 lb. and the other 30,000 lb., each equipped with No. 79 500-volt motors. A 20,000-lb. locomotive for switching is equipped with two No. 75 220-volt motors. The company's regular electrical equipment display includes the following: A 400-kw. turbine type generator; typical generators for direct and alternating currents, belted or direct connection; rotary converters; motor-generator sets; oil insulated and air blast transformers; direct current and alternating current railway motors and controllers; single and polyphase induction motors of constant and variable speeds; direct current motors of many types; switchboard apparatus, ammeters, voltmeters, wattmeters, synchroscopes, power factor meters, circuit-breakers and switches; portable instruments, instruments of precision; potential regulators, and many other forms of auxiliary apparatus and instruments, as well as the alternating current, series wound, single phase crane motors, and the new Westinghouse unit switch system of multiple control.

STREET RAILWAY MOTORS, WESTINGHOUSE EXHIBIT—ELECTRICITY BUILDING.

EXPOSITION SERVICE SWITCHBOARD — MACHINERY HALL.

There is installed as part of the exhibit in the Electricity Building an operating sub-station which is supplied with current from the large generators of the service plant, or from the operating unit of the Westinghouse Company in the Palace of Electricity, the current being transmitted over three-phase lines and reduced to the desired voltage and character. The sub-station machinery includes two 300-kw. a. c.-d. c. rotary converters and two motor



PARTS OF WESTINGHOUSE UNIT SWITCH SYSTEM MULTIPLE CONTROL. ELECTRICITY BUILDING

generators. For the control of the operating apparatus a very complete and well-equipped switchboard has been erected.

In Machinery Hall, in addition to the electric service plant and the main exhibit of Westinghouse gas engines, turbo-generators, rotaries, exciters and motors in operation, is the Westinghouse Auditorium which seats 350 persons. Here are displayed biograph and mutoscope pictures of scenes in the various Westinghouse works. The Cooper-Hewitt lamps, which were employed in photographing the shops for mutoscope purposes, are exhibited in the Westinghouse booths in Machinery Hall, and in the Electricity Building. These lamps are designed for general illumination, photography and photo engraving.

There are about 10,000 Nernst lamps used in the Exposition buildings, of which 6,000 are in the Fine Arts Museum. The Illinois Building is lighted by them, as well as several exhibits of the National Cash Register Co., and the Westinghouse companies use 300 Nernst street glowers in their exhibits.

The Westinghouse brake companies' exhibits will be found in the Transportation Building, aisle I, posts 111-17, where the Westinghouse Air Brake Co. and the Westinghouse Traction Brake Co., and others, have a combined operating exhibit, which includes a display of the Westinghouse alternating current single phase railway motors. The air brake exhibit shows a rack composed of apparatus constituting the equipment for a six-coach passenger train, with engine and tender, all fitted throughout with high-speed brake and signal equipment. The engine and tender are also equipped with combination automatic and straight air brake. All valves are placed in duplicate, one being sectioned to show the internal makeup, and the Westinghouse friction draft gear is also shown in section with a specially designed machine for testing it in operation. The straight air brake exhibit shows the equipment used on electric cars and operated by the company's standard compressors. Both axle and motor driven compressors are exhibited.

The Union Switch & Signal Co., another of the Westinghouse companies, also exhibits at aisle I, posts 111-17, Transportation Building, and shows a group of full size working signals. The company's chief exhibit, however, comprises installations in actual service, including the Westinghouse electro pneumatic interlocking system at the Union Station. This system controls all of the passenger yard movements and is the largest interlocking apparatus ever built.

At the Westinghouse companies' headquarters in Machinery Hall can be obtained a pamphlet guide to all the Westinghouse exhibits. Visitors are invited to make themselves at home at the Westinghouse headquarters, also.

NEW CARS FOR CALUMET ELECTRIC STREET RY.

The G. C. Kuhlman Car Co., of Cleveland, recently delivered 15 semi-convertible cars of the Brill patented type to the Calumet Electric Street Railway Co., of Chicago. The railway company has had 15 cars of this type in operation for the last two years and has evidently found them well suited for the service. The system of this company extends over the southern portion of Chicago and well out into the suburbs in different directions, connecting with the elevated and surface systems at the center of the city.

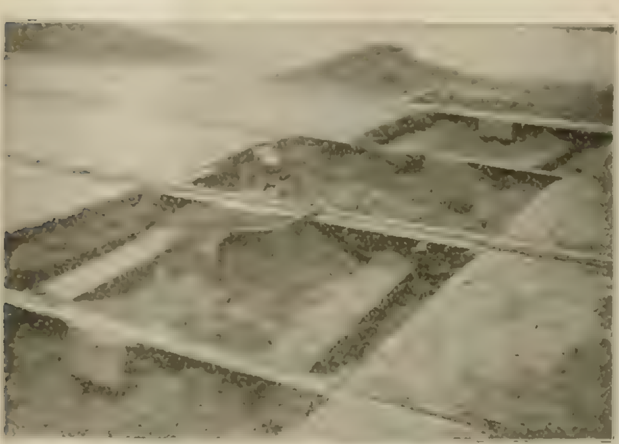
The new cars are 31 ft. 8 in. over the end panels and 44 ft. 8 in. over the crown pieces; width over sills, 8 ft. 3½ in., and over posts at belt, 8 ft. 6 in. The seats are 37 in. long and the aisle is 24 in. wide. Centers of posts, 2 ft. 8 in.; sweep of posts, 1¾ in.; thickness of corner posts, 3¾ in. with 12x⅜ in. sill plates, and the end sills, 5¼x6⅞ in. The cars are seated for 44 passengers, the smoking compartment having accommodation for 12. The cars have a large amount of standing space, because of the wide aisle and long platforms. The interiors are finished in cherry, stained to a mahogany tint and the ceilings are of birdseye maple. Between the compartments is a hardwood partition with a single sliding door.

The character of the single runways in each post is simple and five window lock stops in the runways are provided. These runways are entirely of metal from the window sills to the upper ends in the roof pockets. The top of the window sills is but 24⅝ in. from the floor and has arm rests bracketed thereto, which are arranged not to interfere with the window locks. The sashes in the vestibules drop into pockets in the wainscoting. The vestibule doors fold against the vestibule posts. The cars are mounted on Brill No. 27-G trucks having 4-ft. wheel base, 33-in. wheels and 4-in. axles.

SEMI-CONVERTIBLE CAR FOR CALUMET ELECTRIC STREET RY.

MERITS OF HEIL RAIL JOINTS.

The Heil [illegible] rail joint made by the Heil Rail Joint Welding Co., of Milwaukee, has been thoroughly tested during the past two years and the results, especially during the severe winter of 1903-04, have been most gratifying. Testimonials from prominent railway officials indicate that the Heil joint is more perfect in fusion, higher in conductivity and more durable than the rail



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itself, and affords a strong endorsement of the following claims:

The Heil process insures a continuous rail without buckling and kinking; the welding temperature does not injure the tread of the rail, as the joint amalgamates thoroughly with base and web of rail only, and the improved method employed reduces breaking of rails to less than $\frac{1}{2}$ of 1 per cent.

Records of conductivity vary from 90 to 140 per cent on Heil joints and the reduced power required averages from 4 to 15 per cent. The rail surface is left perfectly level when the joint is installed with the aid of the company's grinder. The Heil welding

[illegible]

method does not deteriorate the physical quality of the rail and [illegible] but it is easily applied at a greatly reduced cost. The Heil cast-welded joint does away with expen[illegible] and constant annoyance of low joints, and prevents electrolysis. The various changes of temperature do not affect [illegible] strength of the joint being ample to overcome all resistance. The improved rail surface renders the operation of [illegible] more perfect and reduces wear and tear to [illegible]

[illegible] practical use on the tracks of the Pittsburg Railways Co., demonstrating highly satisfactory results on large rails where traffic exists at the rate of one car per minute. The company has also furnished joints to the Cincinnati Traction Co., and the United Power Co., East Liverpool, O. Both of these companies speak most favorably of the results. Future contracts have been closed with companies in Illinois and Ohio, reference to which the company will advise upon if desired.

The Heil company has enjoyed a large measure of popularity and success since its foundation, over three years ago, and its officers are always alert to the needs of patrons and apply active

THE CUPOLA.

energy to every improvement which will enhance the high standard of the company's products.

In addition to the cast-welded joint the company makes and erects all sizes of self-supporting stacks for power houses, and is also prepared to turn out sheet steel work of every description, including storage tanks, steel boxes for coal wagons, line patrol wagons, etc.

The president of the company is Mr. Charles Abresch, one of the most progressive business men of Milwaukee. The active members, Mr. J. P. Heil, manager, and Mr. L. Wieland, secretary and treasurer, are well known to the railway fraternity and deserve special credit for their untiring efforts in promoting the company's welfare. The financial backing of the company comprises men of excellent reputation and ample resources.

WESTON ELECTRICAL INSTRUMENT CO.

The Weston Electrical Instrument Co., of Waverly Park, Newark, N. J., has an exhibit in block 25, aisles G and Z, Electricity Building, where are shown cases containing samples of the great variety of electrical measuring instruments which the company makes.

The standard portable instruments include direct reading voltmeters, millivoltmeters, voltammeters, ammeters, milammeters, ohmmeters, ground detectors and circuit testers for all kinds and conditions of work.

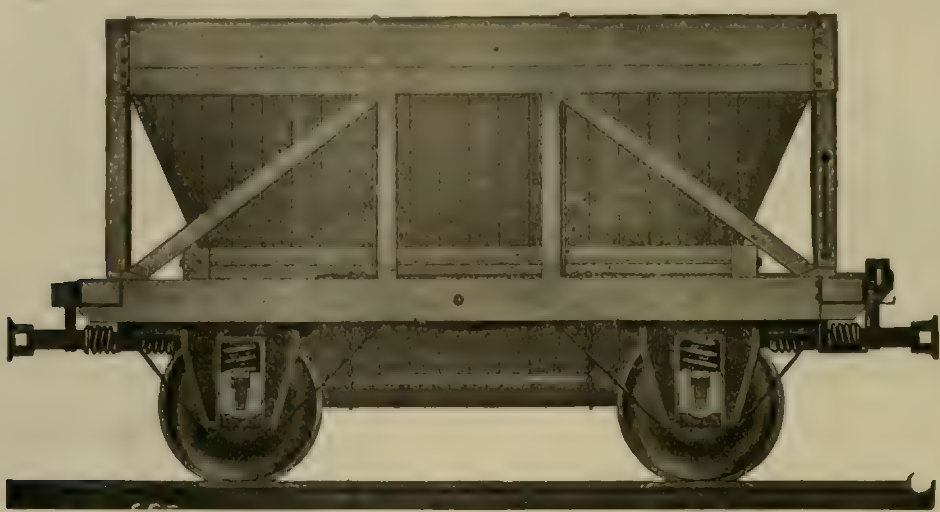
On the walls of the booth are displayed a full line of station instruments, including Weston station instruments, and Van Vleck edgewise system, made by the Weston Electrical Instrument Co.

WESTERN ELECTRIC GENERATORS.

The Western Electric Co., of Chicago and New York, has issued bulletins describing and illustrating generators and motors adapted to special phases of power and lighting work and built on lines calculated to insure the most satisfactory performance under the most trying conditions. Bulletin No. 2,005 treats of "Belt Driven Generators for Power and Lighting, 125 and 250 Volts, Type L." Bulletin No. 2,015 treats of "Type L Direct Driven Generators for Power and Lighting." Bulletin No. 3,040-A treats of "Types D, C and E, Encased and Partially Encased Motors and Generators." Bulletin No. 3,040-B treats of "Type G, Open Type Motors and Generators."

RODGER BALLAST CAR FOR ELECTRIC RAILWAYS.

The great economy in time, labor and money, resulting from the use of the Rodger cars, has been fully established and recognized by the leading railways of the United States during the past ten years. While many interurban lines have used Rodger cars with equally satisfactory results, the users being quite as enthusiastic as the steam railway managers as regards the results obtained, yet owing to the difficulty in handling standard size cars on short curves in cities, as well as the small mileage under construction, and consequent desire to economize in the cost of rolling stock, there has been hesitation to purchase large cars.



RODGER BALLAST CAR FOR ELECTRIC RAILWAYS.

To provide a car, which deposits ballast in the center of the track and embodies all the valuable features of the standard Rodger car available for even the smallest roads, either city, suburban or country, the Rodger Ballast Car Co. has designed the new type shown herein, and which is substantially the same as the company's standard car, except that it is not convertible.

The illustrations show a side elevation, also a cross sectional view throughout the center of the car, the dimensions of the car being as follows: Length over end sills, 12 ft.; width over side sills, 8 ft. 6 in.; height above rail, 7 ft. 1 in.; capacity level full, 9 cu. yd.; capacity with 9 ft. heap, 11.4 cu. yd.; capacity of wheels, axles and bearings, 15 tons.

SECTIONAL VIEW.

The old principle of the Rodger center dumping system is maintained in this car accurately, and the car will do the same work exactly of the larger ballast cars of eight wheels design, 20,000 of which are now in use on all the leading steam railways and many of the large electric interurban lines throughout the United States.

The saving of this system of ballasting amounts to one-half the cost of handling ballast with flat cars, and is so great that when the ordinary amount of ballast is put under the track, the entire cost of one of these cars is saved for every mile of track ballasted. After the ballasting is finished, the cars can be used for maintenance work, or can be used as coal cars or cinder cars.

Full information, specifications, blue prints and details will be cheerfully sent to all interested in dump cars of any type, by addressing the Rodger Ballast Car Co., Railway Exchange, Chicago, as the company builds cars with a cubic capacity of from 200 to 2,200 cu. ft. and all intermediate sizes.

WESCO SUPPLY CO.

The Wesco Supply Co., of St. Louis, has a fine exhibit in block 8, aisles A, B, U and V, Electricity Building, where, in addition to a regular line of electrical apparatus and electric railway supplies, the company has a railway department which contains exhibits of special railway products made by companies for which the Wesco Supply Co. is agent. Among the companies and devices represented in this part of the exhibit are the following:

Electric Railway Equipment Co., iron lighting and trolley poles from which are suspended Adams-Bagnall arc lamps.

Locke Insulator Manufacturing Co., samples of porcelain and glass insulators.

The H. W. Johns-Manville Co., "Noark" fuses, blocks and fuse boxes.

Globe Electric Manufacturing Co., arc headlights.

Marshall-Sanders Co., incandescent sockets, switches, cut-outs, etc.

Diamond Meter Co., recording wattmeters.

Wheel Truing Brake Shoe Co., grinding brake shoes for truing car wheels.

Triumph Electric Co., motors and apparatus for electrically driven direct connected machine tools.

W. N. Matthews & Bro., Stombaugh guy anchors and Peerless lamps.

Mr. L. Milton Zapp is in charge of the Wesco Supply Co's. exhibit.

GOLD CAR HEATING & LIGHTING CO.

The Gold Car Heating & Lighting Co., of New York City, exhibits at aisle E, post 61, Transportation Building. Besides showing various types of panel and cross-seat electric heaters in practical application in connection with the company's regulating switches, there is a display of the Gold systems of heating for steam railroad trains, and of the Edison battery for train lighting, the latter being controlled by the Gold company.

EXHIBIT OF ELECTRIC STORAGE BATTERY CO.

In section 20 of the Palace of Electricity is the exhibit of the Electric Storage Battery Co., of Philadelphia, which is perhaps the largest, most comprehensive and instructive exhibit ever made of storage batteries and apparatus used in connection with battery installations.

One of the prominent features is a large map of the United States, about 30 ft. by 45 ft., on which are indicated, by means of colored jewels, the location and character of the various installations of the "Chloride Accumulator." The exhibit includes a model battery house, in which is installed a model regulating railway battery operating on a variable load. Five standard marble switchboard panels are shown, including the panels for controlling the model railway battery. The other panels are an Edison central station three-wire panel, the panels for regulating combined lighting and power loads, the railway feeder panels and panels for regulating railway power house loads. Two motor-driven boosters are also shown, the smaller being used in connection with the model battery, and the larger a standard 100-kw. railway regulating booster.

Among the types of "Chloride Accumulators" are three H-61 cells, with a discharge capacity of 4,800 amperes for one hour, six cells type G-77, capacity 3,000 amperes for one hour, and types G-17 and F-17, all being in standard lead-lined wooden tanks.

The smaller cells shown are types "F," "E" and "D" in glass jars, and types "E" and "D" in rubber jars for train lighting and yacht lighting. There is also shown a very complete set of "Exide" cells for automobiles, and "Exide" sparking sets for gas and gasoline engine ignition. The "Exide" exhibit includes a large easel, showing in detail the various component parts of the Exide battery.

At one end of the space is a group of three large end cell switches, operating from the Edison three-wire panel. Each of these switches is of 2,000 amperes capacity, and is motor driven, with electrical indicators. These end cell switches are in actual operation and are so arranged that each switch may be driven by its own motor, or by means of clutches any two or all may be driven by any one motor. Clutches and hand wheels are also provided whereby the motors may be thrown out of gear and the switches operated by hand.

The model battery, with its booster and switchboard, forms a very interesting working exhibit. The battery is of type E-15, in lead-lined wooden tanks, and is mounted on white enamel brick tiers. The battery is in every particular an exact model in miniature of the larger railway installations. The battery is insulated from the brick tiers by means of standard double insulation, consisting of vitrified bricks, then glass insulators, then prepared wood stringers and another set of glass insulators. On the switchboard controlling the model battery are the necessary battery and booster switches and automatic circuit breakers with their interlocking devices, a Bristol recording voltmeter and the Weston instruments, consisting of voltmeter, the zero center battery ammeter, the generator ammeter and the total load ammeter. The conditions under which the model battery operates are exactly similar to street railway conditions. The generator delivers the average current required, and as a heavy external load is thrown on the system, the battery assumes the load, the needle of the generator ammeter remaining almost stationary. As the load is thrown off the battery automatically charges. The external load is caused by starting up the 100 kw. booster and by throwing on a bank of eighty 100-c. p. lamps. As an example of how well the battery regulates the load, it may be stated that the direct-current circuit supplying power to the exhibit is limited to 100 amperes. With the battery regulating, a load of 300 amperes is thrown on the system, causing a drop in the lighting or generator circuit of less than 1 volt in 110, and a rise in current in the line, or generator circuit, of less than 7½ per cent of the total load. The action of the battery is automatically controlled by the small booster and its carbon regulator.

Referring again to the type G-77 "Chloride Accumulator," it may be stated that 584 cells of this type have recently been installed on the system of the St. Louis Transit Co. This is stated to be the largest individual installation of storage batteries in the world.

EXHIBIT OF ELECTRIC STORAGE BATTERY CO.

Have you been through the private coach "Milwaukee?" Mr. Beggs is certainly to be congratulated upon the possession of this handsome palace on wheels. Nothing just like it has ever been built. The beautiful interior finish was all done at the works of the St. Louis Car Co.

JOHNS-MANVILLE CO'S. FUSE EXHIBIT.

An inspection of the exhibition of Sachs "Noark" enclosed fuses and fuse devices made by the H. W. Johns-Manville Co. in the Electrical Building, will repay the observer and convince him that the enclosed fuse has obtained a permanent position in the electrical field.

While the exhibit is not large, it is thoroughly representative, and shows to excellent advantage the various enclosed fuse devices of various types and styles manufactured by this company. It is mounted on a large display board, rising from the center of a handsome oak table. Over all is suspended an enormous enclosed fuse, duplicating the actual device in every particular. One side of the display board is covered with 220-volt devices, while on the other side is shown the higher potential appliances.

Placed upon the table on each side of the display board, and also on the floor underneath the table, is a complete line of fuse and service boxes, with the well-known lobster-claw fuse-clamping arrangement, and also a full line of car equipment fuse boxes, subway boxes, etc.

From time to time is given demonstration of the operation of open and enclosed fuses by means of a testing box.

The exhibit is in charge of Mr. G. D. Pogue, of the electrical department of the St. Louis branch of the H. W. Johns-Manville Co.

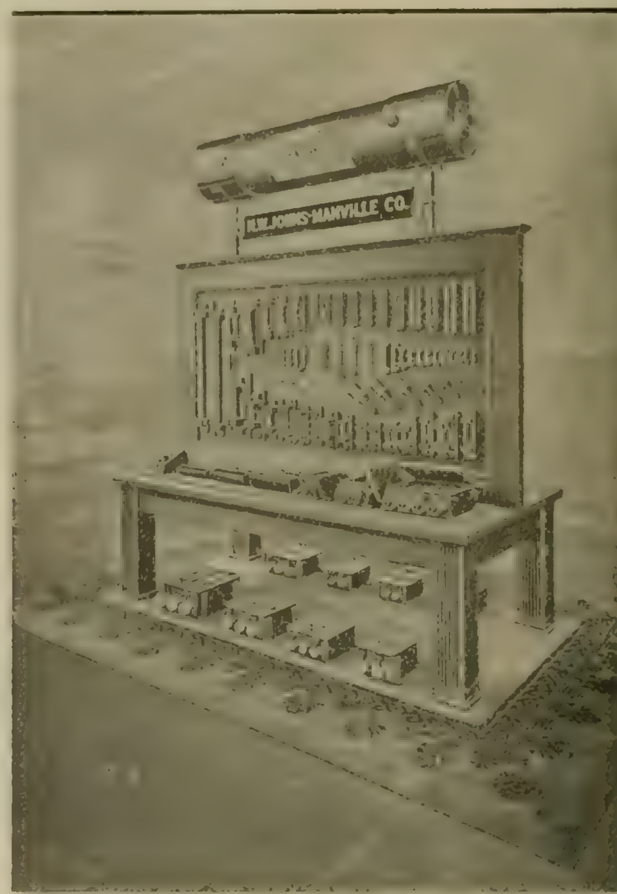


EXHIBIT OF H. W. JOHNS-MANVILLE CO.

STANDARD STEEL WORKS.

The Standard Steel Works of Philadelphia, has its exhibit at post 21, aisle C, Transportation Building, where are shown several sizes and types of steel tired wheels and solid rolled steel wheels which this company makes and which have acquired a reputation for excellence. The company invites inspection and inquiry and will be pleased to furnish full information concerning the life and cost of the steel wheels it makes for heavy electric railway service.

DEARBORN DRUG & CHEMICAL WORKS.

The Dearborn Drug & Chemical Works, of Chicago, as an exhibit, supplied its feed-water treatment for about 4,000-h. p. of the Aultman & Taylor "Cahill" boilers in the Steam, Gas and Fuels Building, and the treatment is said to be accomplishing all that is claimed for it. After analyzing the water the company compounded the vegetable treatment to suit the conditions shown by the analysis.

The Dearborn vegetable treatment will keep boilers free from scale, prevent pitting, corrosion, priming, or foaming. It is fed from the dissolving tank through a sight-feed lubricator to the suction pipe of the feed pump and feeding in this manner also insures the feed pipes and connections from scaling or pitting.

AJAX METAL CO. SPECIALTIES.

The exhibit of the Ajax Metal Co., of Philadelphia, comprises trolley wheels, all kinds of motor, armature and axle bearings, journal bearings and anti-friction metal of all kinds. The trolley wheels shown are of improved pattern and made of a durable composition. Of the materials used in the manufacture of bearings the company's specialty is plastic bronze, guaranteed to show a rate of wear equal to 50 per cent slower than any other composition on the market, at the same time possessing the advantage of a high melting point, thus precluding the possibility of armatures dropping down on account of the metal being melted out by heat induced by friction.

Although the Ajax plastic bronze has been on the market only a little over four years it has met with decided success and there are in service nearly 20,000,000 lb. of journal bearings made of this metal. Plastic bronze was specified to be used on the Pennsylvania R. R. testing apparatus now in operation at the Fair. The company also makes babbitted bearings and has a full line of patterns for Westinghouse and General Electric motors.

The Ajax Metal Co.'s products are well and favorably known throughout the world.

WM. WHARTON, JR., & CO'S. EXHIBIT.

Wm. Wharton, Jr., & Co., Inc., of Philadelphia, is exhibiting on aisle C, posts 8-10, Transportation Building, where it has a comprehensive display of switches and frogs, including the following samples: Cast welded "Combination Rails" for uniting track laid with different sections of rails by casting steel around the joint; frog and mate of solid manganese steel casting for T-rail track on electric railways; improved tongue switch, manganese steel center construction, with Dunham spring throw attachment, for electric railways; worn out frog, demonstrating that manganese steel will outlast adjoining rails, the specimen exhibited having had 1,600,000 electric cars pass over it, the rails being completely worn out, while the manganese steel center is in good condition.

At the back of the Wharton space are shown specimens of special work for street railways, including street railway crossing with manganese steel center construction; crossing of street railway over steam railroad; curved T-rail cast solidly of manganese steel; crossing of three-rail type, street railway over steam railroad. The exhibit also includes samples of manganese steel bent into various forms to show its great toughness combined with its extreme hardness. Photographs of Wharton special work are also shown. The exhibit is in charge of Mr. Arthur S. Partridge, whose office is at 421 Olive St., St. Louis.

THE PHOTOSCOPE CO.

The Photoscope Co., of New York City, has headquarters in the Liberal Arts Building, where the company's automatic nickel-in-the slot photographing machines are demonstrated. The Photoscope takes photographs as rapidly as persons can get into position in front of it, and delivers a photo, framed and finished, in less than one minute. Park managers will be interested in the Photoscope.

THE DAYTON MANUFACTURING CO.

The steady growth and development of the Dayton Manufacturing Co., of Dayton, Ohio, since its beginning in 1883, has been pleasing to the promoters. Its facilities for the manufacture of interior and exterior brass trimmings for steam, street or interurban cars are unsurpassed. It has an unusually large selection of patterns, which includes, in addition to those made by the company, all of Post & Co's. patterns, that business having been purchased in 1892; also all of the Henry C. Hart Manufacturing Co's. patterns, which business was absorbed in 1894, and to these have been added many new and original designs. Trimmings from the same adorn many of the fine vestibule trains running on the principal railroads.

Having had so many years' experience in supplying the needs of railroads and car builders, the company is prepared to supply first-class work, and is always ready to meet the wants of the trade in new designs and elegantly finished material. In addition to car trimmings the Dayton Manufacturing Co. manufactures switch locks, water and dry closets for all kind of cars, and the Avery acetylene lighting system for steam road coaches, street railway or interurban cars.

The company's new and attractive 1,100-page catalog is full of interest. It contains thousands of illustrations and is full of details appreciated by railroad car builders, purchasing agents, and other railroad officials.

For the past 12 years the Dayton Manufacturing Co. has been manufacturing Silvey storage batteries for railway car lighting. The unusual success in this line of work induced the company to prepare and place on the market a line of central station cells. A handsome new catalog, just issued, fully illustrates the method of construction, lists cells of every description and in addition contains a vast amount of storage battery information which will be of value to central station managers.

A short time ago the company absorbed the Columbus Storage Battery Co., of Columbus, O., and with added facilities it is equipped to handle and furnish central station cells and equipment for street railway work.

AULTMAN & TAYLOR MACHINERY CO.

The Aultman & Taylor Machinery Co. has a working exhibit in the Steam, Gas and Fuels Building and a large still exhibit in block 53, aisle G, Machinery Building. The former comprises 20 "Cahall" horizontal water-tube boilers and 3 "Cahall" vertical boilers, all of which are equipped with the company's chain grate stokers. Of the 20 horizontal boilers, 8 are 508 h. p. capacity, built to carry 250 lb. steam pressure; 4 are 508 h. p. capacity, built for 175 lb. pressure, and 8 of 400 h. p. capacity carry 175 lb. of steam. Each of these groups of boilers is equipped with an independent induced draft apparatus.

The three vertical boilers are of 250 h. p. capacity each and each has an independent stack and is operated with natural draft. The entire boiler exhibit comprises a total capacity of 10,038 h. p., and all of the boilers are in operation and are developing 12,000 b. h. p. This is said to be the largest boiler exhibit ever made and it constitutes about 60 per cent of the entire exhibitors' plant at the Exposition. The high-pressure boilers operate the steam turbines in the Machinery Building.

The "still" exhibit comprises one 125-h. p. horizontal water-tube boiler equipped with the company's superheater and chain grate stoker; one cross drum type horizontal water-tube boiler of 100 h. p. capacity and one 100-h. p. "Cahall" water-tube boiler.

ATLAS RAILWAY SUPPLY CO.

The Atlas Railway Supply Co., of Chicago, exhibits in aisle C, post 28, Transportation Building, a line of supplies for electric and steam railway use, including "compromise," or "step" joints, insulated joints, straight joints for T and girder rails, chairs, braces and tie plates; also Atlas primer and Atlas surfacer for use on cars and engines of both steam and street railways.

G. M. GEST'S FINE EXHIBIT.

G. M. Gest, the widely known electrical subway contractor, of Cincinnati and New York, has a very fine and attractive exhibit in the court of the Electricity Building. The exhibit consists of a manhole divided by a concrete wall, virtually making two holes out of one.

The front section is open, showing the company's patent enamel terminal brick used around the ducts entering manholes for the protection of cables; patent frame and adjustable cable brackets (single, double and triple); patent sewer trap, burlap machine, mandrels and other devices used in the construction of underground conduit work.

A conspicuous feature of the Gest exhibit consists of two life-size wax lay figures of workmen, one demonstrating how tile should be laid in the trench, and the other showing how cables are spliced.

GREEN ENGINEERING CO.

The exhibit of the Green Engineering Co., Western Union Building, Chicago, at the Exposition, consists of eight Green traveling link grates, each containing 72 sq. ft. of active grate surface, which have been installed under eight 400 h. p. Heine boilers. This is a part of what is known as the "Service Exhibit," which furnishes power for lighting the Exposition buildings, as well as a large amount of the power which the Louisiana Purchase Exposition Co. is under contract to furnish to the St. Louis Transit Co. from the service plant.

The Central and the Northern power plants of the St. Louis Transit Co. are also equipped with the Green traveling link grates, making three plants furnishing power to the Transit company equipped with these grates. In addition to this, the Green Engineering Co. has installed 5,000 h. p. of its stokers in the East St. Louis & Suburban Railway Co's. power plant, having equipped all its boilers.

W. N. MATTHEWS & BRO.

W. N. Matthews & Bro., of St. Louis, have an interesting exhibit in block 8, Electricity Building, where are shown different styles and sizes of the well-known Stombaugh guy anchor, a device which is now standard with many of the largest railway companies. A feature of the Stombaugh anchor which appeals to railway companies in large cities is the fact that they can be bored into the ground under sidewalks, fences, barns, and in lawns and places where property owners will not allow digging and where it would necessitate expensive work in digging up and replacing streets and sidewalks. An instance of this nature is illustrated by a photograph shown in the exhibit, showing one of the 8-in. anchors bored under a sidewalk on the Union Ave. line of the St. Louis Transit Co. In this case there was a saving of about $25 in the cost of the anchorage.

Summing up a severe test which was made by Prof. R. C. Carpenter, of Cornell University, that gentleman stated:

"Taking all in all, the test gave some valuable data as to the holding of ground anchors, and indicated that great resistance can be secured by the use of simple helix form of anchors."

Professor Carpenter made 70 odd tests of the Stombaugh anchor and compiled a formula determining their great holding power, which formula has been proved correct during the last four years by actual practice.

PAWLING & HARNISCHFEGER CO.

The Pawling & Harnischfeger Co., of Milwaukee, has installed cranes in the bays of the Electricity Building and the Machinery Building. In the Electricity Building is one of the company's four-motor, 30 ton electric cranes. The craneway has a span of 57 ft. 5½ in. A 20-h. p., 220-volt motor gives a horizontal speed of 250 ft. per minute, and an 8-h. p. motor gives a trolley transverse speed of 150 ft. The main hoist is equipped with a 30-h. p motor, having a speed of 25 ft., and the auxiliary hoist with a 15-h. p. motor, and has a travel of from 30 to 90 ft. per minute.

DAILY STREET RAILWAY REVIEW

6TH YEAR, No. 3 | OCTOBER 13, 1904. | SERIAL NO. VOL. XIV, No. 9 C

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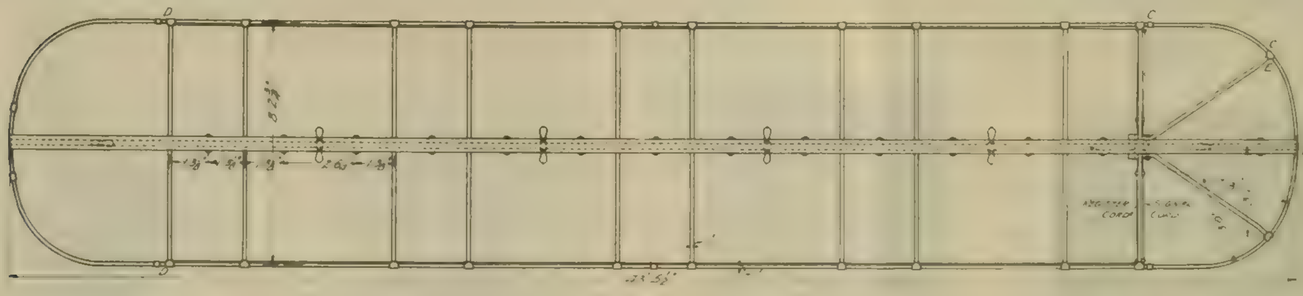
DOUBLE-DECK CAR FOR TWIN CITIES.

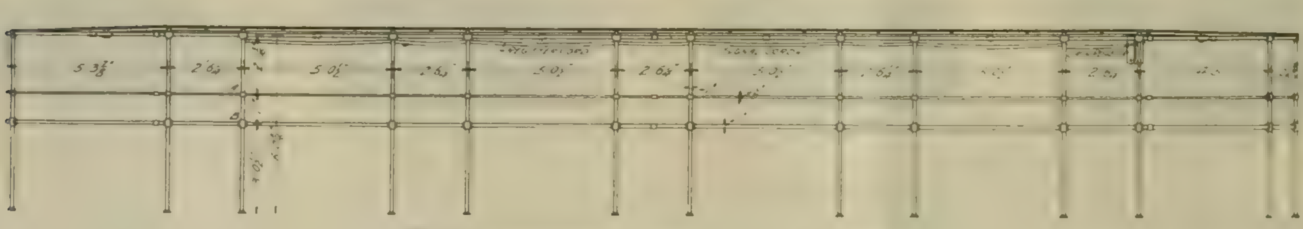
The Twin City Rapid Transit Co. has designed and built a double-deck trolley car, which we illustrate herewith. In designing this car one of the principal features stipulated was that the lower car, both in appearance and utility, should correspond with the standard car in use. Another requirement was that the upper structure might be removed, leaving the lower car complete for operating as a single-deck car; the reason for this being that these cars would be used for excursion business during the summer months, and on account of the severe weather in winter months the upper seats could not be utilized.

The height is limited by the overhead construction, entrance to carhouse and viaducts, and on account of the height required by a double-deck car it was desirable to make the appearance of the upper work as light as possible.

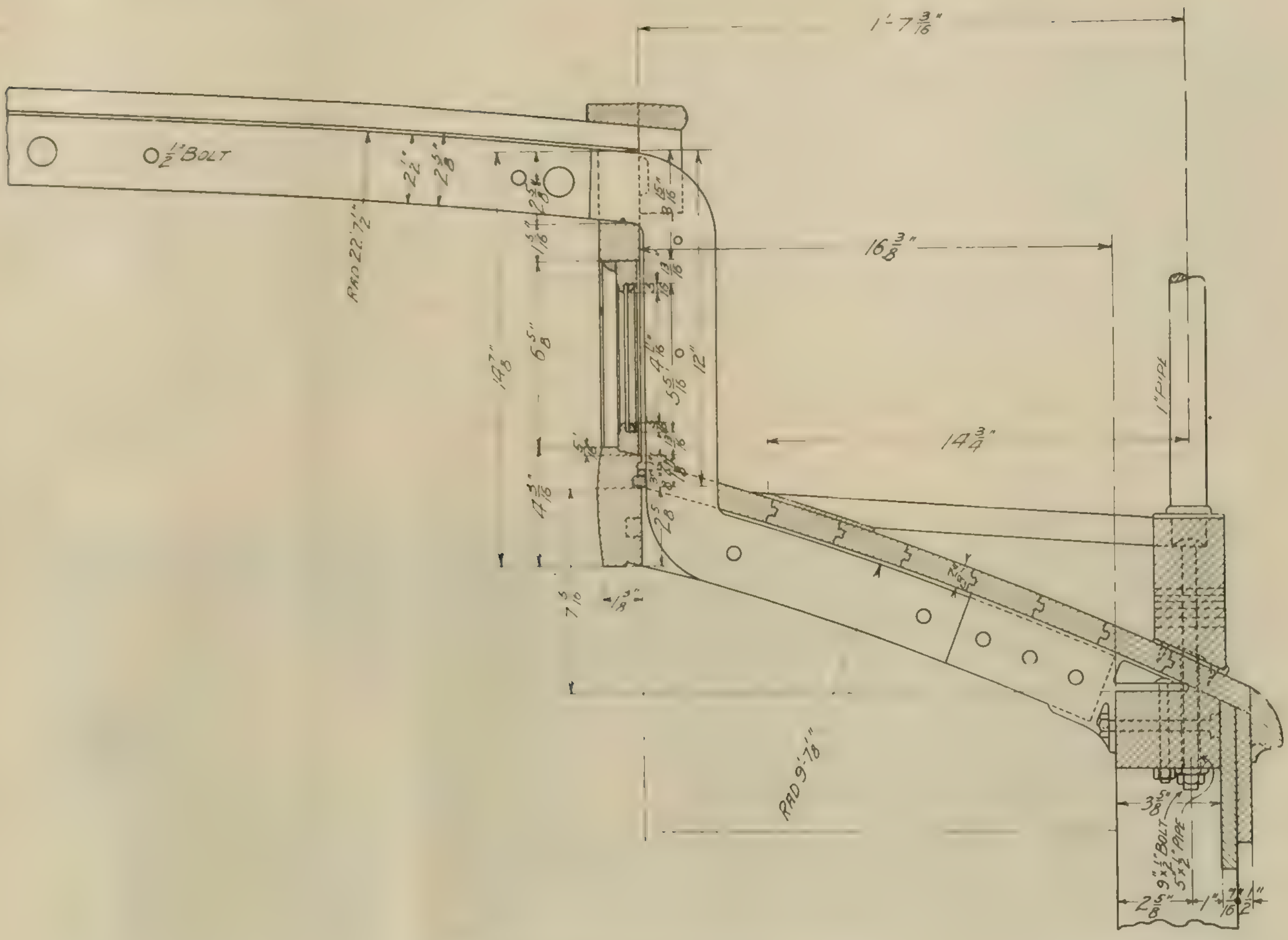
NEW DOUBLE DECK CAR, TWIN CITY RAPID TRANSIT CO.

The lower car construction is identical with that of the standard car, with the exception that the trusses and cross-sills are heavier. The roof is reinforced with iron carlines, ½x2½ in., placed over each side post, and provided at the ends with a cast shoe bolted to the side plate. The roof boarding is heavier, and the runways at the sides are provided with open racks to protect

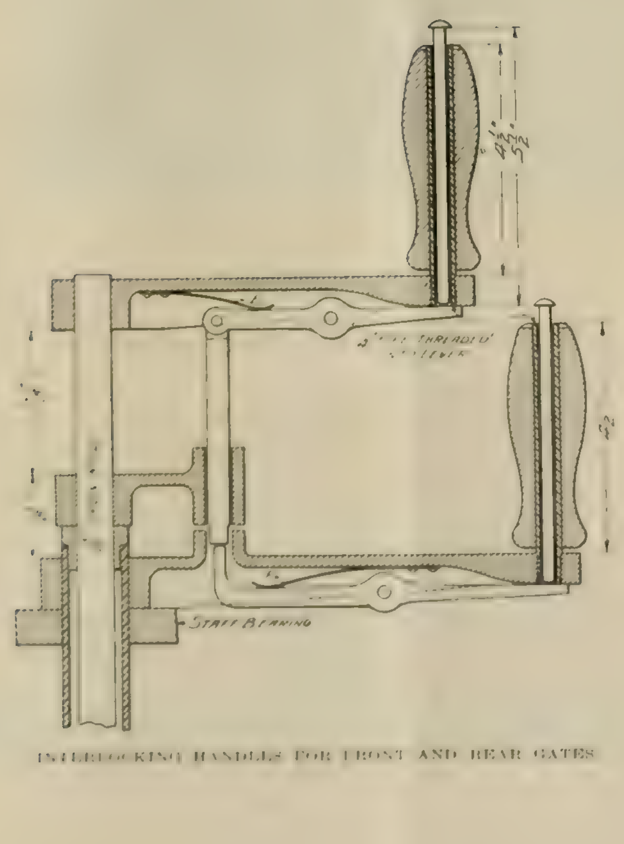




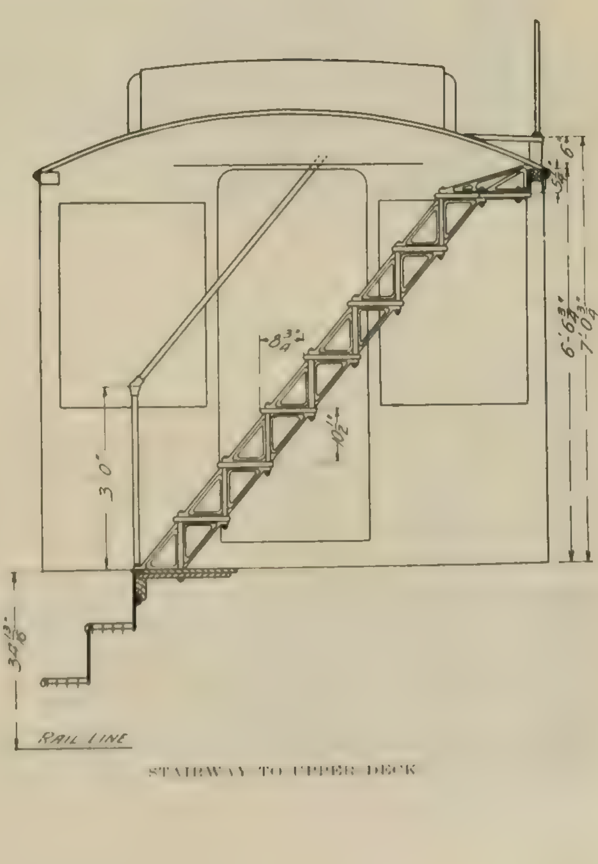
PLAN AND ELEVATION OF UPPER DECK STRUCTURE.



ROOF CONSTRUCTION OF DOUBLE-DECK CAR.



INTERLOCKING HANDLES FOR FRONT AND REAR GATES.



STAIRWAY TO UPPER DECK.

the roof covering. The roof over the front vestibule, as well as the overhang of the deck roof, is made to be removed when the upper deck is used, the front vestibule then being covered by a platform having a hatch with a stairway, and providing a passage from the stairs to either runway, making an easy access to both ends of the seats, which are placed crossways on the deck roof. These seats accommodate four persons comfortably. The stairway runs transversely at the rear of the front vestibule, and is accessible only to passengers entering at the front of the car. Both front and rear entrances to the car are made by two-tread steps, and are provided with standard safety gates.

The upper structure consists of a frame work of 1-in. gaspipe bolted to a 2½x5-in. sill, which rests on castings built permanently into the roof and is held by bolts passing through this casting and through the plate of the car. The roof is arched 2 in. and at

DIAGRAM OF GATE LEVERS

the ridge running from front to rear are two 6-in. planks, the lower cutting in between the piping of the frame, and the upper continuous. Toward the rear a short plank, about 10 ft. long is added on each side for supporting the trolley base. On the under side of this ridge-plank are mounted signal bell and light equipments.

The top has a covering of awning material, and above this is one thickness of painted ducking. A strip of awning material 18 in. wide is placed just above the sills, and the remaining space may be closed by sliding curtains, which are normally strapped to the posts. The pole side is entirely closed by wire screens, and the remaining space, to a height of 3 ft.; at this point, is a heavy hand rail, and about one foot higher, a light guard rail.

The equipment complete weighs 26 tons and will seat 48 persons on the upper deck and 51 below, with standing capacity below of 65.

The car is mounted on Brill trucks, with four GE-57 motors, geared to about 26 miles per hour.

THE MOTORMAN.

The man who will take you in safety to your destination ten thousand times or more, if you will only wait till the car stops before you get on or off. He doesn't want to be behind time, doesn't want to hurt anybody or have a collision with anything. Thoughtless and reckless people cause him more trouble and hard work than the doing of his regular duty. Fool drivers cut in ahead of the car and think he is to blame if they get a broken leg or a wheel smashed. Careless mothers allow their children in the street and his "heart is in his mouth" for fear they will be run down by the car. Sometimes he is delayed by slippery track, a broken-down wagon or other cause beyond his control. More often he is behind because he waited for some person who was behind time and half a block away. You can help him by being ready to get off when the car stops or by being at the proper stopping place ready to get on when it stops.

The Westinghouse Machine Co., of East Pittsburg, Pa., is ably represented at the convention by John B. Allan, western representative, Chicago, S. N. Branan, of Boston, and A. H. Charles Dalley and C. C. Chappelle, of Chicago.

The United States Electric Signal Co., of West Newton, Mass., which has a working exhibit in the Electricity Building, is represented by Mr. John J. Ruddick, inventor and electrician. The president of the company, Mr. John H. Nickerson, has been at the Fair during the summer, but is not here now. This is the first convention he has missed since the company started.

Prominent among the visitors to the convention this week is Mr. George H. Hastings, of Cleveland, O.

HOW GENERAL HARRIES DID IT.

The Saturday Evening Post tells the following story on Gen. George H. Harries, vice-president of the Washington Railway & Electric Co.:

Brig.-Gen. George H. Harries, of the District of Columbia militia, was for many years an active newspaper worker at the Capitol. Some years ago, when a Senate investigating committee was trying to ascertain who gave the press information concerning their executive sessions, George Harries entered a committee-room where Senator Faulkner, of West Virginia, and Senator Bate, of Tennessee, were discussing the question, and Senator Faulkner said: "Harries, I wish you would frankly tell me how you newspaper fellows get information concerning the transactions of our secret sessions."

After a moment of reflection Harries replied: "I should have no objection to telling you if I knew you were authorized to receive the information."

"Then why don't you tell the committee?" inquired Senator Faulkner.

"Is the committee properly constituted and duly authorized to receive such information, Senator?"

"Of course it is."

"How do you make that out?"

"Why, it was constituted by the Senate in the regular way, under the Dolph resolution," replied Senator Faulkner. He then went on to give every detail of the manner in which the Senate, in executive session, discussed and adopted the resolution; how the committee was constituted, and that it was empowered to make the investigation. When the Senator had concluded Mr. Harries said:

"Well, Senator Faulkner, that is the way we newspaper fellows get our information concerning all the details of the proceedings of the secret executive sessions of the Senate."

Senator Faulkner did not catch the full significance of Harries' remark until Senator Bate quietly and good-humoredly said: "Faulkner, if every Senator were as easy to pump as you are we might as well hold our secret sessions on the portico."

"EAST SIDE TROLLEY OUTINGS."

"East Side Trolley Outings" is the title of a very neat publication issued by the East St. Louis & Suburban Railway Co., briefly telling where to go for a pleasant outing on the lines operated by this company, which include the St. Louis & East St. Louis bridge, East St. Louis city lines, East St. Louis & Belleville, East St. Louis, Collinsville & Edwardsville, and the East St. Louis, O'Fallon & Lebanon lines. The pamphlet is profusely illustrated with scenes along the lines, street scenes in the different towns through which the cars run, and cuts of the exterior and interior of the cars. Information regarding private car parties, time cards, and descriptions of the various points of interest along the lines are included in the publication, as well as a map of the lines and rates of fare. In all, it is a very attractive issue and contains such information as would enable one to take advantage of an opportunity to see and enjoy the territory so readily accessible by the east side trolley lines.

SMALLEST ELECTRIC MOTOR.

The smallest electric motor in the world has been built by a watchmaker whose work has trained him to handle delicate machinery with the exquisite care required in making a motor that moves with all the regularity of a big machine, and yet is so small that its owner wears it as a scarf-pin.

Viewed from a little distance the article has the appearance of a very valuable and rather curiously-designed pin. It is only when standing near to it that its nature can be discovered.

The first thing to attract attention is the buzzing of the machine, which, by means of a current obtained from a small battery carried in the vest pocket, is kept in operation at a high rate of speed, with a noise like a bee buzzing.

Mr. Barry Dibble, E. E., of the Jackson-Battle Creek Traction Co., registered at the Mechanical and Electrical headquarters Tuesday.

EXHIBIT OF NATIONAL ELECTRIC CO.

The National Electric Co., successor to the Christensen Engineering Co., Milwaukee, has an extensive exhibit at the Louisiana Purchase Exposition, showing to advantage the well-known Christensen air brake equipment and electrical machinery. The company's space at Section 6, Electricity Building, is handsomely finished and inviting to visitors.

A large 400-kw., direct current engine-type generator is the largest unit shown at this space; a 150-kw., 500-volt, direct current generator is driven by a 20-h. p., 220-volt motor, and in addition to these there are in operation a 150-kw., 3,200-volt alternator, a 10-kw. motor-generator set and a 60-kw. 500-volt direct current generator belted to a 30-h. p., 220-volt motor.

A three-car train showing the operation of the company's air brake control, such as is used by the South Side Elevated (Chicago), the Boston Elevated, and the Exposition Intramural railways is shown, together with a straight air brake equipment, used for the instruction of motormen by electric railway companies to show in detail the operation of this brake.

Three hundred cars at the Buffalo Exposition were equipped with Christensen air brakes, and all cars operating within the grounds of the St. Louis Fair are controlled by this brake. It is interesting to note that 11,000 are used in America and more than 1,500 in Europe, Asia, South America, Africa and Australia.

Stationary and portable compressors are also shown. At block 46, Machinery Building, may be seen the National 1,500-kw. 6,600-volt, three-phase, 25-cycle alternator, running at 85 r. p. m. This generator is direct connected to a 2,250-h. p., compound vertical engine and the entire machine represents one of the most modern generating units of the present day. This machine furnishes power to operate the pumps supplying water for the Cascades, the largest artificial waterfalls in the world.

The National Electric Co. extends a cordial invitation to all visitors to call at its space and inspect the exhibit. Visitors are requested to register, and attractive souvenir literature will be mailed to the home address of all interested callers.

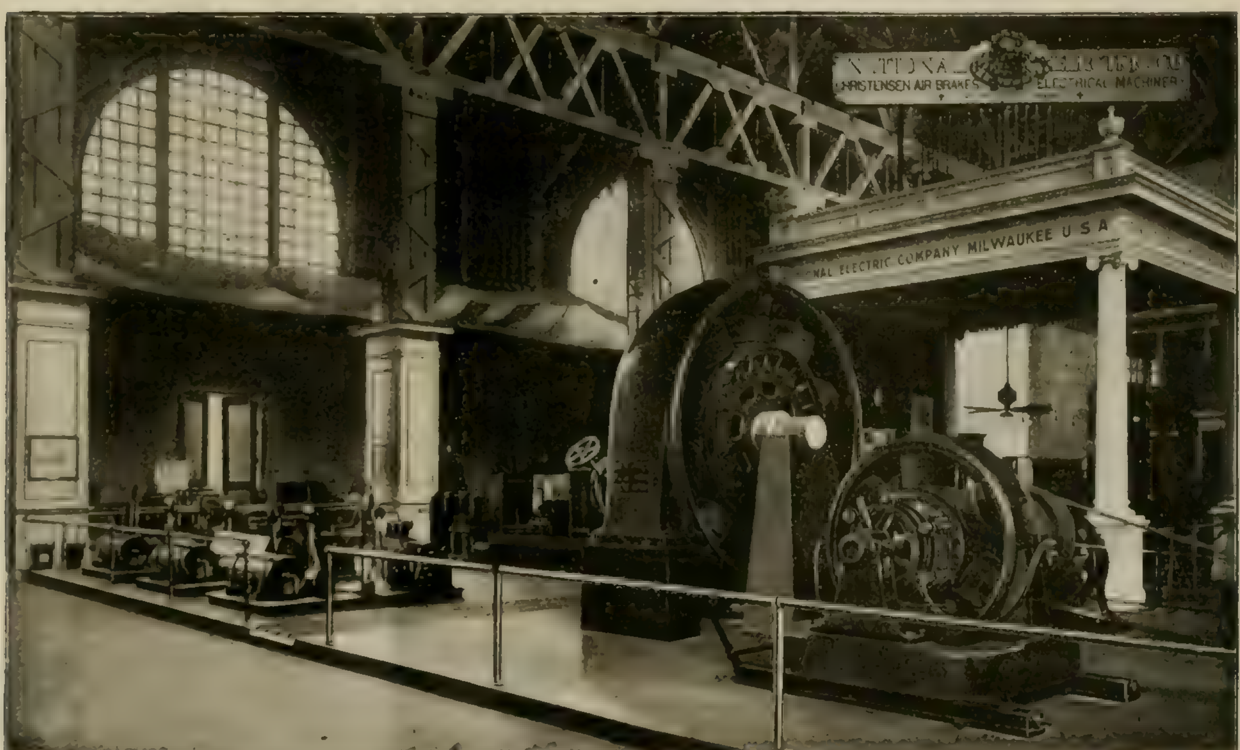


EXHIBIT OF NATIONAL ELECTRIC CO.

BULLOCK ELECTRIC MANUFACTURING CO.

The Bullock Electric Manufacturing Co's. space in block 15, Electricity Building, covers an area of 100x54 ft. Bullock apparatus will also be found in blocks 36 and 46, Machinery Building, in connection with Allis-Chalmers and other engine installations, and also in the Allis-Chalmers-Bullock exhibit in the Mines and Metallurgy Building.

In the center of the company's space in the Palace of Electricity is an ornamental pavilion in which are displayed framed photographs of interesting Bullock apparatus.

Chief of interest among the exhibits is a complete railway sub-station in operation, comprising a 500-kw. rotary transformer and switchboard. The sub-station is designed to transform 6,600-volt, 25 cycle, three-phase current to 550-600 volt direct current. There is also shown a 200-kw. motor-generator set for changing 60-cycle, 2,200-volt current to direct current suitable for railways.

Another feature which will prove of interest to electric railway men is a complete car equipment, consisting of four 50-h. p. Bullock motors, mounted, with controllers and wiring complete.

There is also exhibited a multiple voltage outfit, comprising various machine tools driven by Bullock motors controlled by special multiple voltage controllers and a balancer. A complete line of type N motors, adapted for direct connection to machine tools, and a complete line of type B small motors, for driving all kinds of machinery, are shown. There are also several alternators, ranging in capacity from about 50 kw. to 350 kw.

The Bullock exhibit also includes a turbo generator set, consisting of a 200 kw., 575 volt generator, directly connected to a De Laval steam turbine.

This entire exhibit is arranged as a model test floor, with the requisite instruments, switchboards and test tables. The Bullock company also has a completely equipped car on the electric railway testing track near the Transportation Building.

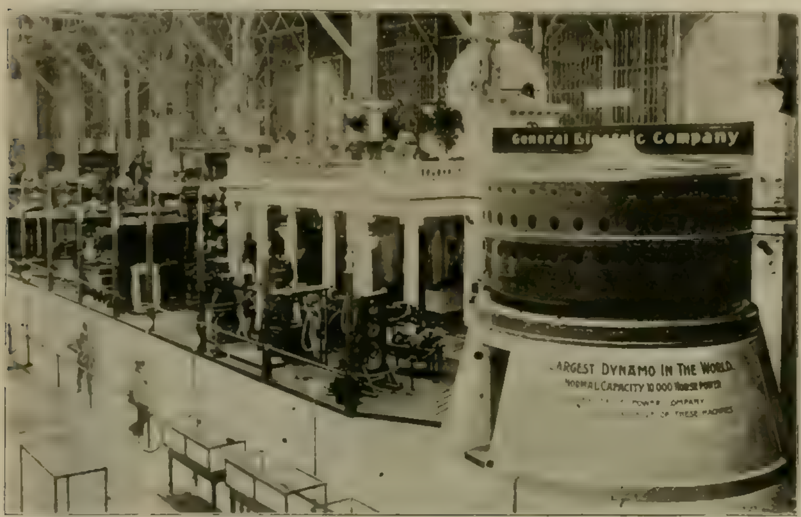
Mr. George C. Lucas, general manager of the Cleveland Frog & Crossing Co., and Mr. George Stanton, of the same company, are on hand to extend the courtesies of their house.

GENERAL ELECTRIC CO.

The General Electric Co. occupies in the Electricity Building the largest space used by any individual company and practically all the apparatus shown there is in operation. The company's railway exhibit is a reproduction of the equipment furnished for the cars of the Interborough Rapid Transit Co. On the under side of the suspended floor framing of a car, are shown all of the electrical and air brake equipments, the wiring being of fire-proof construction. At one end of the framing is a typical cab in which are the master controller and other parts of the equipment, and under the opposite end of the platform is a Hedley truck with two G. E. No. 69 200-h. p. motors. Several types of controllers are shown; also the G. E. No. 70 motor used on the Intramural Ry.

An interesting feature of the General Electric exhibit is a 3,000-h. p. Curtis steam turbine directly connected to a three phase, 6,600-volt, 25-cycle generator. This is the first of these units to be built with the condenser in the base.

Another conspicuous feature of the exhibit is a model of a 10,000-h. p. generator similar to those furnished for the new Canadian Falls power house of the Niagara Falls Power Co. This exhibit includes a stationary armature, the interior of which is utilized as a picture gallery in which are shown photographs of Niagara Falls and drawings of various electrical works in that neighborhood.



GENERAL ELECTRIC CO EXHIBIT

Other features of the General Electric exhibit are a 60,000-volt oil break switch, a 14,000-lb. mining locomotive with new cable reel attachment, small motors applied to 20-odd kinds of machines, switches and switchboard devices, wires and cables and wiring devices, the largest transformer at the Exposition (over 2,300 kw. capacity), air blast transformers, type H oil-cooled transformers and voltage regulators of different types. The company is exhibiting the first time its new mercury vapor arc lamp, used for photographing and other purposes. There are also shown the new "orthocrome" lamp, which is the mercury arc lamp adapted for general illumination and devoid of the defects due to the color of the naked mercury lamp; the luminous arc lamp developed by Professor Steinmetz, and a complete line of the company's meridian lamps. A mercury arc rectifier is shown in operation on a single phase alternating current charging the batteries of an automobile.

In addition to the comprehensive exhibit made by the company there have been a large number of applications of General Electric apparatus to various purposes throughout the Exposition grounds.

Two of the generators in the Exposition company's power plant were furnished by the General Electric Co. These give 6,600 volts, 25 cycles, at 83½ r. p. m., and are of 2,000 kw. capacity.

The General Electric Co. furnished the entire car equipment for the Intramural Ry., consisting of 57 four-motor equipments, 51 of which comprise G. E. No. 70 motors with the Sprague-General Electric multiple unit control, and 6 of the cars are equipped with G. E. No. 67 motors with K-6 controllers.

The incandescent lamps used by the Exposition were furnished by the General Electric Co. There are more than 500,000 lamps, of which more than 80,000 are colored lamps for use about the Cascades. This represents the largest incandescent lamp order ever placed. The G. E. series alternating street system is used for lighting the outlying parts of the grounds, the exterior of the buildings and the Pike, 1,800 lamps of 7½ ampere capacity being required for this service. The General Electric Co. also furnished the searchlights used by the Exposition company, as well as the searchlight built for the Lewis Publishing Co., and which throws a ray 80 in. in diameter, it being the most powerful searchlight ever built.

General Electric oil-cooled and water-and-air-cooled transformers are used in all the sub-stations of the exhibit buildings; and the power house for lighting the Administration Building is equipped with General Electric apparatus. The electric fountain in the Tyrolean Alps and the Scenic railway in the Alps are equipped with General Electric motors. Altogether the General Electric Co. furnished more than 11,000 h. p. in generating apparatus at the Exposition, and more than 41,000 h. p. of all other apparatus.

The General Electric Co. has exceedingly attractive reception quarters in the Electricity Building, done in white, green and gold, and artistically decorated and illuminated, where visitors are cordially welcomed. One of the reception rooms is furnished in Old English style and is devoted especially to the British Thomson Houston Co.

U. S. ELECTRIC SIGNAL CO.

The United States Electric Signal Co., of West Newton, Mass., has an exhibit in the northeast corner of the Electricity Building. Here are shown a complete working block of the company's automatic signals as used on single track electric railways; an improved form of signal box recently placed on the market, and a new type of trolley switch which depends for its operation upon the lifting of the trolley wire by the trolley wheel as the car passes. These devices are attracting con-considerable attention and are, in truth, well worth inspection.

CONSOLIDATED ENGINE STOP CO.

At block 36, aisles G and 7, Machinery Hall, the Consolidated Engine Stop Co., of New York City, demonstrates its very efficient device for stopping steam engines in case of emergency. The device consists of a small motor connected with the steam valve of the engine by means of a belt or chain, so that the valve can be instantly closed by starting the small motor, which can be done by pressing a push button located at any convenient point. The device also includes an automatic mechanism for closing the steam valve of the engine after a predetermined speed has been reached.

N. A. CHRISTENSEN COMPRESSORS.

N. A. Christensen air compressors can be seen in practical operation in connection with the exhibits of the Standard Railway Equipment Co., Pneumatic Signal Co., and the Weber Gas & Gasoline Engine Co.

The St. Louis Car Co. has issued an invitation to American Street Railway Association members and their friends to visit the company's plant at any time during the week. The private car "Mabel" has been placed at the disposal of the visitors at 2 p. m. daily, including Friday, and may be found at the Administration entrance loop.

INTERESTING CARS FOR PETALUMA & SANTA ROSA RAILWAY.

Four cars for the new interurban lines of the Petaluma & Santa Rosa Railway Co. have lately been completed and shipped by the American Car Co., of St. Louis. The cars are of a unique type and one which will appeal to railway men as an excellent arrangement. The special feature of these cars consists of a center vestibule which gives direct entrance from either side of the car to both compartments and has the advantage of keeping the ends of the car free for the swing of the trucks and also obviates the disadvantage of passengers entering or leaving through what is virtually the motorman's cab. The general design of the cars was suggested by the president of the road, Mr. George A. Batchelder, who desired that they should be exceptionally fine, as he believed traffic is encouraged by having cars with all the modern conveniences and of an attractive appearance.

BRILL SEMI-CONVERTIBLE CAR FOR CALIFORNIA.

The windows of the passenger compartment are of the Brill patented semi-convertible system. This compartment seats 40 passengers. The seats are 36 in. long, are upholstered in cane and have reversible backs. An unusual feature is a partition of heavy plate glass set in ornamental brass between the motorman's cab and this compartment. It gives a handsome appearance to the end of the door and affords a clear view looking forward. The interior finish is of mahogany richly

INTERIOR OF PETALUMA & SANTA ROSA CAR

carved and inlaid and the ceilings are full empire style with stained glass in the arched ventilator sashes. The continuous parcel racks, electroliers and other metal work were especially designed for these cars. At the end of the compartment next to the entrance doors is a special form of water cooler designed by the builder. It is suspended from the ventilator rail close to the end and does not interfere with seated or standing passengers. At the bottom of cooler is a drain pipe which also serves as a support. The arrangement is considered excellent and promises to be much used in the future.

The baggage compartments are finished in mahogany, as they will probably be much used by smokers, for whom folding seats are furnished. A screen door, designed by the builder, closes the opening when the baggage door is open, and when the door is closed acts as a protection to the woodwork of the side of the compartment. A fire extinguisher and a case with axe, crow bar and saw, for use in case of emergency, are located in this compartment. The vestibule is guarded on either side by high folding gates.

The length of the cars over vestibule sheathing is 46 ft. 1 in., and over bumpers, 47 ft. 9 in.; width over sills, including sheathing, 8 ft. 8 in.; centers of posts, 2 ft. 8 in.; thickness of corner posts, 3¾ in. and of side posts, 3¼ in.; side sills, 5x7¾ in. and 2x6 in. The sill plates are 12x⅜-in. and extend the full length of the car. The center-sills are composed of 7 in. I-beams with yellow pine fillers. The steps are 16⅞ in. from the rails and the risers are 14 in. apart. The cars are mounted on Brill No. 27-E 2 trucks having 6-ft. wheel base, 33-in. wheels and equipped with motors of 40 h. p. capacity.

STANDARD UNDERGROUND CABLE CO.

The Standard Underground Cable Co. is making an interesting exhibit in conjunction with the McRoy Clay Works in block 3, aisles A and T, Electricity Building. The chief feature of the exhibit is a cross section of conduit consisting of 72 ducts, with a manhole at each end. Extending the length of the conduit is a trench, 7 ft. deep and 5 ft. wide, which enables a close inspection of the manner of constructing the conduit and appurtenances.

At one end, in the manhole, is shown a capstan rigged for drawing in a cable which is attached to a reel at the other manhole. Part of the ducts are split, to show the method of fastening cables to rope, etc. The method of distribution to aerial cables is shown by means of distributing poles and the terminals used to protect the ends of the cable in such work are exhibited, also. The Standard company also shows samples of the various cables and appliances which it makes.

The McRoy Clay Works exhibits piles of raw clay and the various processes through which it goes to produce the finished duct.

RODGER BALLAST CAR CO.

The Rodger Ballast Car Co., of Chicago, has an instructive exhibit at aisles H and 4, Transportation Building, where it shows three types of Hart ballast cars, as follows:

Hart convertible ballast car, class C. S.; length 36 ft.; capacity, 80,000 lb.; weight, 37,300 lb.

Hart convertible ballast car, class F. H.; length, 34 ft.; width, 9 ft. 8 in.; height 2 ft. 3¾ in.; weight 30,400 lb.; capacity 60,000 lb.; working limit 66,000 lb.

Hart convertible ballast car, class C. S.; length, 39 ft.; weight, 48,200 lb.; capacity, 100,000 lb.

THE KNUTSON RETRIEVER AT THE FAIR.

The Trolley Supply Co., of Canton, O., which makes the Knutson trolley retriever, advises us that the cars of the Intramural Ry. at the Exposition have been equipped with the Knutson retriever and the company invites those who are not familiar with this device to take advantage of this opportunity to study the action of these retrievers under actual service conditions. In addition, the Knutson retrievers and the "American" trolley catchers are on exhibition at the exhibit of the company's agent, the Wesco Supply Co., which will give courteous attention to all inquirers and take pleasure in demonstrating and explaining the machines.

The Knutson retriever is in the shape of a disk which is placed upon the dash of the car, out of the way of all car equipment. It comprises a weak spring, a heavy retrieving spring, an actuating disk and a reel controlled by an automatic locking and releasing device. To wind the retrieving spring and set the retrieving mechanism the rope is pulled out until stopped by the automatic action of the locking bolt, when, by releasing the rope, the mechanism will release the heavy spring from engagement, leaving the weak spring alone in action to keep slack out of the rope and allow it to play freely in and out. No matter what the elevation the trolley pole when it jumps the wire, it is designed that a jerk upward of from three to four inches will throw out the governors on the reel, causing one of them to engage with the trip latch and trip the locking device of the retrieving mechanism, thus throwing into action the heavy retrieving spring, which engages with the reel and instantly pulls down the trolley pole and holds it from three to four feet below the wire.

The features emphasized by the company are: The automatic retrieving mechanism, which is reset by simply pulling out the rope four or five feet until the mechanism automatically locks; the retrieving spring is not subject to adjustment by the operator and cannot be rendered inefficient by carelessness; the retrieving spring cannot be reset until it is wound up so that it will retrieve the pole to such a distance below the wire that damage cannot occur to the overhead equipment.

The Knutson retriever has withstood the test of severe usage during several years. Aside from having equipped a number of important roads in this country, the company has made shipments to England, France, Germany, Japan, Australia, India and elsewhere.

THE PANTASOTE CO.

The Pantasote Co., of New York, has an exhibit in the Palace of Varied Industries, where the well-known product of this company is displayed to advantage classified in three sections. One section shows the application of Pantasote to waterproof clothing, sporting goods, etc; the second is devoted to furniture upholstered in Pantasote and designed to illustrate the beautiful effects produced by the use of Pantasote in house furnishings; the third section consists of a Brill semi-convertible car fitted with Pantasote curtains and car seats and chairs covered with Pantasote leather.

The Pantasote Co. distributes interesting literature and callers at the booth are sure to be instructed and entertained.

UNDER-FEED STOKER CO. OF AMERICA.

The Under-Feed Stoker Co. of America, Marquette Building, Chicago, has no Exposition exhibit, but its product is very much in evidence in St. Louis and vicinity, where it has practical exhibits in large power houses. The United Electric Light & Power Co's. Biddle St. plant will be equipped entire with Jones stokers, the orders received by the Under-Feed Stroker Co. calling for 84 stokers, probably making this the largest internally fired plant in the world. In the Imperial station of the same company, at 10th and St. Charles Sts., there are 19 Jones stokers under Heine boilers. The St. Louis & Suburban Railway Co. has given five orders for Jones stokers, covering equipment aggregating 8,500 h. p., Heine boilers. When this installation is completed there will be 45 stokers in this company's boiler room.

ANNIVERSARY OF THE "PROVIDENCE CAR FENDER

Not only is this year distinguished by the celebration of the anniversary of the Louisiana Purchase, but it is also an anniversary—the tenth—of the birth of the Consolidated Car Fender Co., of New York, makers of the well-known "Providence" fender. During the 10 years this company has been doing business it has equipped with its life-saving devices more than 17,000 cars, having furnished upwards of 90 per cent. of the standard fenders used in the world.

The "Providence" fender has evidently come to stay; it has passed from "childhood" to "manhood" and now has a "family" which numbers more than 250 members, including the largest electric railway systems in this country.

The company's new model "C" fender reduces to a minimum the liability of serious accident resulting from a front-end collision.

The company carries in stock not fewer than 1,000 complete car fender equipments which can be delivered within 24 hours from the receipt of orders.

The Consolidated Car Fender Co. also makes the favorably known "Campbell" snow sweeper, which insures freedom from snow blockades; also the "Millen" car-step lifter, which makes boarding and alighting from high open cars a pleasure, as thousands of car patrons attest.

General Manager Woodworth, of the Consolidated, can always be found at the office of the company, 39-41 Cortlandt St., New York, ready to "swap stories" and smoke cigars with customers and friends.

CONSOLIDATED ELECTRIC HEATERS.

The Consolidated Car Heating Co. has issued an attractive booklet of 50 pages, dealing with the subject of electric car heating in all its phases. The book contains a number of articles on this important subject, the topics treated including, "First Principles," "Cost of Electric Heating," "How to Select an Equipment," etc. The pamphlet is profusely illustrated, and includes engravings and descriptions of all the types of electric heaters made by this company. A valuable feature is a collection of wiring diagrams, showing best methods of wiring each type of heater for cars of different lengths.

From the pamphlet we quote the following on the points to be considered in selecting an electric heating equipment:

"1. The amount of current needed. This is affected by all of the following conditions:

a. Average winter temperature.
b. Lowest winter temperature.
c. Exposure, as in city, suburban or elevated service.
d. Construction of car body.
e. Use of vestibules and frequency of stops.
f. Average number of passengers carried per car in winter.
g. Average actual voltage on the line.

"The radiation loss from a car is much affected by (a), (b), (c) and (d). Much heat is lost by open doors, especially with frequent stops. Vestibules properly used save most of this. A crowded car needs less heat, due to the bodily heat of passengers. There are frequently sections of the line where the voltage is low and less heat is obtained.

"Some judgment is required to decide all these points, but we always advise that the maximum requirements be provided for. This does not interfere with the economical operation of the equipment, as the temperature regulating switch is furnished for this purpose.

"2. Type of heater to be used. The casings vary to suit cars with

a. Longitudinal seats with risers,
b. Longitudinal seats without risers,
c. Cross seats, reversible or not,
d. Baggage and chair cars without fixed seats.

"3. Number of heaters to be used. This depends on (1) and (2), and is restricted by the requirements of

a. Good distribution,
b. Safe temperature of heater, both for life of resistance coil, and safety and comfort of passengers."

M'GUIRE-CUMMINGS CAR WORKS.

The McGuire-Cummings Manufacturing Co., of Chicago, is erecting a car works at Paris, Ill., on 30 acres of land which was given to the company by the city of Paris. The walls of most of the buildings comprising the new plant are pretty well up and it is planned to begin operation at the works Jan. 1, 1905. As is well known, the McGuire-Cummings Manufacturing Co. makes practically everything that enters into the construction of cars, except the car bodies, and the company is erecting the Paris plant with the view of shipping there the trucks and other car parts made in Chicago and assembling the completed cars at Paris.

The following buildings are in course of construction: Erecting shops, 152x565 ft.; blacksmith shop, 65x75 ft.; machine shop, 60x75 ft.; truck shop, 60x75 ft.; wood shop, 152x200 ft.; cabinet shop, 152x200 ft.; varnish shop, 152x160 ft.; dry kiln, 70x102 ft.; dry room, 50x90 ft.; iron storeroom, 40x60 ft.; warehouse, 40x60 ft.; power plant, 90x100 ft. These are all one-story brick buildings, with saw-tooth roofs and factory ribbed glass. Provision has been made for the extension of the shops as business may require, so that in time it is expected that the plant will be practically doubled. The plant as it is being erected will cost nearly $300,000 and will employ about 600 men.

J. J. CUMMINGS

The new works will be equipped with the following machinery, and other apparatus to be decided upon: Three 150-h. p. boilers, one 350-h. p. engine, one 150-kw. and one 100-kw. generator (or one 250-kw. generator), 60 a. c. motors ranging from ½ to 20 h. p., 450-h. p. boiler feed pump and feed-water heater in proportion, air compressor furnishing 500 cu. ft. of free air per minute at 80 lb. pressure, a hot blast and ventilating plant, besides machine tools and small tools requisite for car building. A 50-ton overhead electric crane has been purchased from the Northern Engineering Works, of Detroit.

All the machinery and apparatus will be entirely new and of the latest improved pattern.

Three railroad lines pass through the plant—the main line of the Big Four, Cairo division of the same road and the Vandalia road.

The McGuire-Cummings Manufacturing Co. is the outgrowth of the old McGuire Manufacturing Co., which was organized 20 years ago by Mr. William A. McGuire (deceased) and Mr. W. J. Cooke, vice-president of the present company. Jan. 1, 1904, the McGuire Manufacturing Co. and the Globe Iron Works, also of Chicago, were consolidated as the McGuire-Cummings Manufacturing Co. The consolidation was effected for the purpose of increasing the facilities of both companies.

The McGuire Manufacturing Co. had a world-wide reputation for a number of years. The Globe Iron Works, although a younger concern, had built up an enviable business in metal work during four or five years, the business of 1903 exceeding $300,000.

The officers of the McGuire-Cummings Manufacturing Co. are: President and treasurer, John J. Cummings; vice-president, W. J. Cooke; secretary, F. Byrne. Mr. Cummings was president of the Globe Iron Works for two years previous to the consolidation, and Messrs. Cooke and Byrne were formerly vice-president and secretary, respectively, of the McGuire Manufacturing Co.

Mr. Cummings has accomplished wonders in a very few years. He is only 29 years old and began working when 13 years of age as water boy on the Chicago & Alton R. R. Later he took up engineering, educating himself nights, and graduating from the Armour Institute of Technology at the end of a three years' course. He was a poor boy, but is now not only the head of the McGuire-Cummings company, but is interested in several other large corporations.

W. J. COOKE

Mr. Cooke, the vice-president of the company, is known throughout the length and breadth of the land as a salesman of high merit. His courtesy and congeniality have caused the appellation of "Chesterfield of American salesmen" to be applied to him and as such he has been known a good many years.

A BOER WAR SOUVENIR.

Last evening visiting electric railway men and their friends attended the Boer War entertainment, which is believed to be the best attraction on the Pike. The leading parts in this spectacle are taken by Generals Viljoen and Cronje, and officers and men, both Boer and British, who faithfully portray actual scenes through which they passed during the late Boer War. A suitable and attractive souvenir of this entertainment consists of a portfolio which can be obtained only at the entertainment. This portfolio is entitled "Photographic Views of the Boer War Spectacle." It contains 21 half-tone views, artistically arranged, including battle scenes, portraits of Generals Viljoen and Cronje and all the British officers. The portfolio is published by the St. Louis Publishers' Co., which is composed of Messrs. T. M. Jenkins and A. F. Bollinger, of the St. Louis Chronicle, and Mr. F. W. Swan. The compilation was by Mr. Jenkins.

The delegates to the Mechanical and Electrical convention were photographed in a group in front of one of the Exposition buildings.

Mr. Frank A. Barbey, of Boston, representing Thomas Prosser & Son, of New York, is at the convention, as many of the delegates have good reason to know, for Mr. Barbey knows how to make the most of his time, whether seeking business or pleasure.

Mr. Harry W. Frost represents the well-known varnish house of Berry Bros. at the convention.

DAILY STREET RAILWAY REVIEW

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In the United States, Canada or Mexico:

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Application made for entry as second class matter.

6th Year, No. 3 — THURSDAY, OCT. 13, 1904. — Serial Vol. XIV, No. 9 C

SAVE THE "DAILY REVIEW."

Special attention is called to the fact that the "Daily Street Railway Review," published at St. Louis October 11th to 14th inclusive, this being the sixth successive year, is in its nature supplementary to the "Street Railway Review" published monthly. Nothwithstanding the "Daily" is a separate publication it should be bound with the monthly for convenient reference and in order to facilitate this, the pages of the "Daily" are given numbers consecutive with those of the next preceding monthly issue. Reference is again made to this fact for the reason that very frequently the "Daily" is entirely overlooked by subscribers when sending the "Review" to be bound, and as soon as the binder discovers that 150 pages or so are missing, we receive a request to furnish the missing numbers, which unfortunately we are not always able to do.

THEATER ANNOUNCEMENT.

In order that none who desire to attend the theater Thursday night may be overlooked, the Entertainment Committee will arrange to have representatives at the theater door the evening of the entertainment to provide tickets for all convention visitors wearing badges.

TODAY'S PROGRAM.

9:30-10:00 a. m.—Band concert, Transportation Building.

10:00 a. m.—A. S. R. A. Convention meets.

Discussion of Report of Executive Committee.

Presentation of Papers.

Reports of Committees.

Election of officers.

1:00 p. m.—Convention adjourns.

2:30-4:00 p. m.—Band concert at Michigan Building complimentary to Mr. J. C. Hutchins.

3:00 p. m.—Eighth annual meeting of Street Railway Accountants' Association.

Annual address of the President F. E. Smith, Chicago, Ill.

Annual report of the Executive Committee.

Annual report of the Secretary-Treasurer.

Report of the committee to make new collection of blanks and forms, Elmer M. White, Hartford, Conn.

Appointment of Convention Committee on Nominations.

Appointment of Convention Committee on Resolutions.

8:00 p. m.—Theater party at Music Hall, 13th and Olive Sts.—"Louisiana."

F. E. SMITH.

Mr. F. E. Smith, president of the Street Railway Accountants' Association, holds the office of auditor for the receivers of the Chicago Union Traction Co., and auditor for the Chicago Consolidated Traction Co. Prior to his going to Chicago five years ago he was general auditor for the Massachusetts Electric Companies of Boston, to which position he was appointed after the merger of the Lynn & Boston system, on which he had held the office of auditor for five years. Previous to his work in Massachusetts he had held the position of auditor for the Zanesville and Ohio River Railway Co.

Mr. Smith has been closely identified with the work of the Accountants' Association from the first and his practical training has been of inestimable value to it.

AMERICAN ASSOCIATION OF STREET RAILWAY CLAIM AGENTS.

At a meeting of the representatives of the claim departments of the various street railway companies throughout the country, held in the Transportation Building at the Fair grounds Wednesday afternoon at 2:30 o'clock, the formal organization of the American Association of Street Railway Claim Agents was perfected. The following officers were elected for the ensuing year.

President, W. A. Dibbs, general claim agent, New York City Ry. Co., New York, N. Y.

Vice-president, E. W. O Connor, claim adjuster, Savannah Electric Co., Savannah, Ga.

Secretary and treasurer, B. B. Davis, claim agent, Columbus Railway & Light Co., Columbus, Ohio.

The Executive Committee of this association is composed of the following members: W. A. Dibbs, the president, chairman of the committee ex officio; W. H. Renaud, jr., New Orleans Railways Co., New Orleans, La.; Wm. White, Chicago City Railway Co., Chicago; B. B. Davis, secretary of the association, and J. P. Feeney, Public Service Corporation, Newark, N. J.

The organization of this association is due to a very great extent to Mr. W. A. Dibbs, its president. Seeing the results that have been obtained by the other street railway associations in the interchange of views, the reading of papers and the discussion of the many vital problems of street railway organization and operation, and realising the mutual benefits that may be derived from a similar organization of the claim departments, Mr. Dibbs undertook the project. Correspondence developed the fact that the majority of the street railway companies are favorable to and enthusiastic about the association, and with such an efficient corps of officers and executive committee and the hearty support of the railways throughout the country, there is no doubt but that the American Association of Street Railway Claim Agens will be an important factor in the street railway world.

All delegates and their guests wearing badges are entitled to one souvenir ring at the exhibit of the National Lead Co., Block 65, Liberal Arts Building.

The Detroit United Railway has recently placed an order with the J. G. Brill Co. for 25 cars and trucks, and with the St. Louis Car Co. for 25 cars and trucks. The orders were placed September 21st and call for 29-ft. double truck closed passenger cars.

Mr. S. L. Nelson, general manager of the Fort Wayne & Southwestern Traction Co., accompanied by his two daughters, arrived Tuesday.

THE AMERICAN STREET RAILWAY ASSOCIATION AND THE "DAILY STREET RAILWAY REVIEW."

Some Facts That Delegates Should Know Before Acting Upon the Censor Resolution Now Before the Association.

THE OBJECT OF THE "DAILY."

The object of the "Daily Review" is to give better service to subscribers than could be done were our convention reports published in a weekly or in monthly paper. Our business success is based on giving good service, just as is that of a street railway company.

What the approval of the public means to a street railway was stated more eloquently by President Francis in his remarks concerning the street railways of St. Louis than lies in our power. The subscribers to the "Street Railway Review" are our public, and the "Daily Review" is one of our means of giving this public good and prompt service.

THE RESOLUTION NOW IN FORCE.

Passed at Saratoga, Sept. 4, 1903. See pp. 237 and 238, Proceedings 22d Annual Meeting A. S. R. A.

REPORT OF THE SPECIAL COMMITTEE ON PUBLICATION OF DISCUSSIONS.

To the American Street Railway Association:

Gentlemen: Your special committee, after duly considering the question of the revision of papers and discussions prior to publication, reports as follows:

We recognize the importance and desirability of encouraging and securing a comprehensive and even confidential discussion of topics presented before the Association.

We also recognize the importance and utility of the press, and the desirability of not unduly restricting its privileges.

We are of the opinion that the realization of these two objects necessitates intelligent censorship of the proceedings.

We recommend for adoption the following rules:

First. Upon the request of any delegate any remarks or data submitted by him shall be considered privileged communications and withheld from publication in both the press and the annual report.

Second. At the first session of each meeting of the Association the Chairman shall appoint, from the delegates in attendance, a Censorship Committee of three members. All reports of proceedings shall be submitted to this committee and approved by at least one member thereof before being made accessible to the press.

So far as feasible, all persons participating in the discussion shall be given an opportunity by the committee to revise and correct their remarks before publication.

The committee also recommends that, to promote the best interests of the Association the technical press be respectfully requested to refrain from the daily publication of the proceedings.

Respectfully submitted,

(Signed) C. O. MAILLOUX,
JOHN I. BEGGS,
J. G. WHITE.

THE PROPOSED CHANGE.

At the first meeting of the Association, held in St. Louis Oct. 12, 1904, Mr. J. C. Hutchins offered the following resolution:

"Whereas, We consider that it is an advantage to the Association for the widest publicity to be given to all its proceedings that are not of a confidential or privileged nature, be it

"Resolved, That so much of the resolution regarding Publication of Proceedings and Censorship (recorded at pages 237 and 238 of the Proceedings of the Saratoga Convention) as requests the technical press to refrain from the daily publication of proceedings be and hereby is rescinded."

After a brief discussion of this resolution it was ordered carried over until today.

HOW MATTERS STAND.

As the record now is, the Association requests the technical press NOT TO PUBLISH DAILY REPORTS OF THE PROCEEDINGS.

"Proceedings" is a broad word and includes not only discussions, but also papers, reports and even the president's annual address.

What Mr. Hutchins has proposed is to amend the record so as to make it a request not to publish daily reports of uncensored VERBATIM DISCUSSION.

"Verbatim discussion" is very different in meaning from "Proceedings."

ACTION OF EXECUTIVE COMMITTEE.

The report of the Executive Committee laid before the Association on yesterday recited that at the meeting held in New York Feb. 28 and Mar. 1, 1904, a communication from the publishers of the "Street Railway Review" bearing on the subject of the publication of the "Daily Street Railway Review" at conventions was read; and that on motion it was voted that inasmuch as this matter had been passed upon by the Association, it was considered that the proper course was for the communication in question to be brought before the Association for action.

The report of the meeting of the Executive Committee held in St. Louis Sept. 10, 1904, recited that Mr. Royse appeared before the committee, and that after considering his statement, the committee voted that the president should, at the first session of the convention, appoint a committee to pass upon the matter to be released for publication.

Inasmuch as the communication received from the "Street Railway Review" at the February meeting, and the remarks of Mr. Royse at the September meeting were not made part of the minutes of these meetings as printed, the membership of the Association has had no opportunity as yet, other than the brief discussion at yesterday's session, to judge of the merits of the question.

In order that the membership may have opportunity to learn the nature of the communication of the "Review" to the Executive Committee, without trespassing too greatly upon the time of the convention, we give below the substance of the statement made by us to the Executive Committee.

OUR RECORD.

The action of the Association indicates that the daily publication of proceedings has caused embarrassment in the past, or the fear that it may do so in the future. The fact that the "Review" has published daily reports of the discussions before the Association for five successive years, and in this time has received but one complaint, and that one on a very trivial matter, is submitted as indicating that the editor of the "Review" has sufficient intelligence and discretion to avoid the publication of matter calculated to embarrass the Association or its members.

WHAT IT WAS SAID WE DID.

However, in the discussion at the Saratoga meeting as to whether speakers should be given the opportunity to revise their remarks, which preceded the appointment of the committee to consider this subject, a statement was made, which, in view of the fact that the "Daily Street Railway Review" is the only street railway periodical that was published daily at the New York meeting, constitutes a charge of serious indiscretion on the part of the editor of the "Review."

Mr. E. E. Myers (page 87 of the Proceedings of the Saratoga Meeting) said that a remark made by Mr. Vreeland at the New

York meeting appeared in the daily report of the proceedings published by "one of the street railway periodicals" and that this remark was picked up by certain papers in New York and made capital of.

WHAT WE DID.

The circumstance to which Mr. Myers referred is as follows: Mr. Vreeland made an address before the Street Railway Accountants' Association at its meeting in New York, in the course of which he made some remarks that it was not desired to have appear in the published proceedings. One or more reporters representing the New York daily papers were present at this meeting, and the reports which appeared in the New York papers were prepared by them. The "Daily Street Railway Review" was requested by Mr. Vreeland and by the Accountants' Association not to report Mr. Vreeland's address, and no report of this address other than a few lines in which the speaker complimented the Accountants' Association upon its work was published in the "Daily Review" for that year. This is a matter which can easily be verified by referring to the files of the paper.

OUR POSITION.

The "Review" has not offended in the past, but it will welcome the assistance of the Association, acting through a censor committee or otherwise, as mistakes would thus be made practically impossible.

We are heartily in sympathy with any plan that will tend to promote the interest and utility of the meetings of the Association, and do not consider that exception can be properly taken to censoring the proceedings with a view to eliminating remarks that might be embarrassing to the speaker, were they made part of that report, or suppressing information of a more or less confidential nature, that speakers may be willing to give to the members, but not to the public in general.

We believe that the resolution requesting the technical press to refrain from daily publication of proceedings was passed hastily and without considering that while general in its provisions, it is in fact a discrimination against the "Daily Street Railway Review."

It is, of course, entirely within the province of the Association to determine whether its proceedings shall be given to the press, but if publicity is permitted, it is manifestly unfair to impose conditions which would prevent us from using the proceedings because they appear each day instead of at the end of the week, or of the month.

We are sure the Association has no desire as a body to inflict injury upon the "Daily Review," which the great majority of its members, as individuals, consider a meritorious enterprise, and accordingly we ask that the action of the Association be so modified as not to discriminate against the daily papers.

MR. MYERS' REMARKS AT SARATOGA.

Mr. L. E. Myers, Peoria:—"As long as this subject is up, it gives me an opportunity to say something I have had on my mind for some time, and it is on the subject of restricted discussion, because of the publicity given to what is said in the meeting. I remember well, and I imagine Mr. Vreeland does, of a casual remark he made at the New York meeting—I do not recall the nature of it—but it was very properly taken down by the reporter, and on the following morning it appeared in the daily report of the proceedings, published by one of the street railway periodicals, prompted, no doubt, by a spirit of progress. That remark was picked up by certain papers in New York and made much capital of. I do not mean to raise any criticism of the stenographer or the enterprise of the trade journals which print these reports, but it does seem to me it would be proper courtesy that the report of the remarks should first go to the speaker before they are given to the wide world. I believe we would get much more general discussion of the subjects which come before us if the reports were not given for publication till they were revised by the speakers."

HOW OTHER ASSOCIATIONS REGARD DAILY CONVENTION REPORTS.

In view of the frequent references made in the electric railway conventions as to the able way in which the steam railroad associations carry on their work, the following statements made to the editor of the "Review" by the secretaries of three of the leading steam railroad technical associations will be found pertinent.

THE MASTER CAR BUILDERS' ASSOCIATION.

667 Rookery Bldg., Chicago, Feb. 10, 1904.

Daniel Royse, Esq.,
Editor "Street Railway Review,"
45-47 Plymouth Court, Chicago:

Dear Sir: Replying to yours of February 9th, in regard to policy of these associations covering the matter of reporting the discussions at our meetings, and answering your questions as asked, would say:

1st.—We furnish the railway press with printed copies of all the committee reports at the time they are sent to the members, which is usually about two weeks before the conventions.

2nd.—The understanding is that they are not to be published until read in convention.

3rd.—We have no objection to allowing the technical press to make stenographic reports of the discussions, of course, it being understood that they are not official—the report of proceedings, as issued from this office, giving the official discussions.

4th.—For a good many years the Railway Age has issued a Daily Edition at our conventions, giving a stenographic report of the conventions at each day's meeting, and I believe the members, generally, consider this advance publication of the discussion of advantage to the Association.

5th.—We do not exercise any supervision over the reports of the discussions furnished by the railway press because it is understood that the official proceedings will come out later.

The above applies equally to both the Master Car Builders' and American Railway Master Mechanics' Associations.

Yours truly,

(Signed.) JOS. W. TAYLOR,
Secretary.

AMERICAN RAILWAY ENGINEERING & MAINTENANCE OF WAY ASSOCIATION.

Monadnock Bldg., Chicago, Feb. 15, 1904.

Mr. Daniel Royse,
Editor "Street Railway Review,"
Chicago, Ill.:

Dear Sir: I beg to acknowledge receipt of your favor of the 9th inst requesting an expression as to the policy of this Association with reference to the publication of reports and discussions by the technical press, and in reply would say:

(1) The reports and papers to be considered at each convention are published in monthly bulletins during the year, and copies are furnished the technical press as issued. It is understood, however, and a notice to that effect appears in each issue of the bulletin, that the reports and discussions are not to be published by the press until after presentation at the annual convention.

(2) The reports are released for publication after they have been acted upon by the Association.

(3) The press is at liberty to make stenographic reports of our annual meetings, and every facility is afforded their representatives to get an accurate report.

(4) The members of the Association seem to appreciate the publication of the reports and discussions by the technical press, and many have so expressed themselves. Personally, I believe it is of great benefit to the Association, in that it gives wide publicity to its proceedings.

(5) The Association has not heretofore exercised any supervision over the reports of discussions by the technical press. It is assumed that each publication will endeavor to have its report of the convention as accurate and reliable as possible.

Yours truly,

(Signed.) E. H. FRITCH, Secretary Pro. Tem.

THE OPINION OF AN UNPREJUDICED PAPER.

We believe that the occasion is a fitting one to reprint an editorial which appeared in the "Western Electrician" of Sept. 12, 1903, commenting upon the action at the Saratoga Convention.

"It is rather surprising that the American Street Railway Association should have deemed it necessary to provide for a censorship committee which shall pass on "all reports of proceedings" before the latter are "made accessible to the press." This action is to be regretted, we think, because it conveys the impression that the association has something to conceal from the public, which we do not believe to be the case. Street railway transportation is a straightforward, legitimate, honest business, surely, and an industry in which an exceptionally large proportion of the general public is interested. Is the enlightened American Street Railway Association of the United States of America well advised in establishing a censorship? Does not the very word "censor" savor of repression, of military occupation, or of the reactionary methods of the government of the czar? We can well understand that in the freedom of debate statements may be made or expressions used which can serve no useful end it published, but might, on the other hand, prove embarrassing. But cannot the discretion of the technical editors be trusted in these matters? Presumably these editors are experts, who know enough to sift the grain from the chaff. Possibly, too, the gentlemen of the association could be somewhat more guarded in their remarks.

"The technical press has been of great value to the electric-railway industry, and the establishment of a censorship by the association seems but an ungracious return for faithful, honest work. To censor the whole proceedings to prevent the publication of an occasional inadvertent remark—with the vexatious delays and red tape that would ensue—is like swinging a giants bludgeon to crush a gnat. And is the censorship adequate for the end desired? Of course the association can make such regulations as it pleases in relation to its official report. But unless representatives of the daily and technical press are excluded from the sessions, unofficial, but nevertheless truthful, reports may be made. And in these days of municipal ownership agitation and industrial unrest it would doubtless be unwise for the association to adopt a star-chamber policy by excluding representatives of the public press."

The "Western Electrician" takes an eminently fair attitude, although it is one of our contemporaries, which, publishing weekly, necessarily finds itself anticipated by the "Daily Review."

"COMPETENT OPINIONS."

One of the speakers yesterday having urged the "worthlessness of a daily publication, we consider it appropos to reprint some of the following "competent opinions" from our issue of Oct. 11, 1904. They say about the "Daily Review":

C. S. Sergeant—"Has appealed to me as of a special value."

J. C. Hutchins—"Has been particularly valuable to me, my whole staff, and to the Association generally."

G. Tracy Rogers—"Its worth to the Association has been inestimable."

G. F. Chapman—"Of value to those who attend and to those at home."

E. G. Connette—"Appreciated by all street railway men."

R. E. Danforth—"Valuable in determining the business transacted."

T. E. Mitten—"Valuable to all street railway men in that it gives a minute account of the proceedings."

H. F. Grant—"Great value to all who stay at home."

C. L. S. Tingley—"I always preserve it to refresh my memory concerning the convention."

John W. Ogden—"A step in advance."

S. F. Hazelrigg—"Appreciate it very much."

E. R. Gilbert—"Of great service to our officers."

Warren Bicknell—"I have been an interested reader from the first."

W. P. Reed—"I cannot speak too highly of it."

Howard Fravel—"It is full of 'pay dirt.'"

E. L. Kirk—"The best medium to bring street railway men into touch with each other."

Geo. O. Nagle—"Has a very wide influence."

T. F. Grover—"My employes who cannot go to the convention are always well posted when I return."

James F. Lardner—"Valuable for the men at home."

BALDWIN & ROWLAND SWITCHES AND SIGNALS

The Baldwin & Rowland Switch & Signal Co., of New Haven, Conn., in a new 30-page catalog just issued, calls the attention of electric railway men to the switches and signals made by this company, and which are growing in favor. The company's modern switches are in use on at least 11 of the large electric railway systems of the country and are said to be ginving eminent satisfaction. Especial attention is called to three types of switches, viz., the "Little Giant," the "Sandard" and the "Metropolitan."

The "Little Giant" switch is the culmination of years of special work and is believed to be not only in the front rank, but is also claimed to be the cheapest switch made. It will handle the switch tongue under all conditions, and in case of a sewer backing up and flooding, even, this switch will not become inoperative. It has a gravity locking device with a pressure of from 15 to 20 lbs. for holding the switch tongue in position, and the vibration of passing cars tends to lock the tongue more securely. The motorman may operate the switch at will while the car is in motion and the car may be backed over switch without difficulty.

The "Standard" switch is familiar to railway men. This style of switch was installed at Toronto in 1903 and has been working continuously since. Two of these switches were installed by the Coney Island & Brooklyn Railroad Co. six years ago at points where four switchmen were being paid $2,200 per annum to operate by hand. The "Metropolitan" is used by the Metropolitan Railway Co., of New Yor, at Lenox Ave. and 116th St., and at Lexington Ave. and 116th St. These switches paid for themselves in less than four months.

Another specialty of the Baldwin company is the "Invincible" signal, designed so that only one wire is required to operate a purely block system with one 110-volt lamp at each end of the block. The motorman controls the signal by his controller handle while the car is in motion, and is held responsible for it. He lights his signal when entering the block and extinguishes it when leaving. Magnetism and gravity are the only forces employed in the operation of this signal, and it is claimed to be impossible for the lamp to burn at only one end of the block. An open circuit is used, and the installation is accomplished by means of an insulated sleeve 30 in. long attached to the trolley wire. The company also makes a gong signal.

Still another specialty made by this company is Baldwin's switch tongue lock, which, it is said, will positively prevent the splitting of a switch. The company will be pleased to send its literature to interested persons and answer all inquiries.

INTERNATIONAL REGISTER CO.

The International Register Co., of Chicago, has a well arranged exhibit on aisle C of the Transportation Building. This was one of the few exhibits completely installed on the opening day of the exposition. Mr. A. N. Loper, formerly with the New Haven Car Register Co., installed it and has been in charge since. Messrs. John Benham, vice-president, W. G. Kirchhoff, general superintendent, and W. H. Brown, secretary, will make the exhibit their headquarters during the convention, where they will be glad to meet those of their friends who find time to stop for a minute's rest in spite of the multitudinous other attractions. All the various types of "International" and "New Haven" registers shown in its new catalog No. 4 are exhibited in a manner convenient for their inspection and operation. In a handsome mahogany revolving case are shown its attractive enamel badges and the ticket punches. Polished bronze register fittings in greater variety than made by any other manufacture are shown to advantage. The "New Haven" trolley cord sold by this Company is also exhibited.

TWENTY-THIRD ANNUAL MEETING

AMERICAN STREET RAILWAY ASSOCIATION

St. Louis, Mo.—Oct. 12-13, 1904.

WEDNESDAY SESSION.

President W. Caryl Ely, of Buffalo, called the meeting to order at 10:15 o'clock, and said:

Gentlemen, the convention will please be in order. We will proceed directly to business, as we have with us the President of the Louisiana Purchase Exposition, who has taken of his valuable time enough to come here and say something to us, and we will not detain him by proceeding at the present time with any roll call or any regular order of business, and I will there fore introduce him to you at once. He is chargeable probably with the getting of this great Exposition here more than any otner person,—in fact all St. Louis unites in saying that not only more than any other one person, but that he is the only person, almost, who has builded this great Exposition. Certainly one who has the ability to bring together such a great collection of buildings and such a great installation of exhibits therein, is a man who is worthy of filling any position, not only by his ability, but by the tried qualities that are exhibited in the doing of a thing of that sort. I take pleasure in introducing to you the Honorable David R. Francis, President of the Louisiana Purchase Exposition.

ADDRESS OF HON. D. R. FRANCIS.

Mr. Chairman and Gentlemen: If I did not know that the American Street Railway Association is composed of such genial men, such progressive men, flattering introduction of your president would have embarrassed me. I am glad of this opportunity to rise before you and entertain you for a few moments only. I am here, not only as the president of this Exposition, but as a street railway man myself. I have long desired to get into the transportation business myself—I made several efforts to get into the steam railroad business, and was partially successful, until I found others came along and insisted on taking the property away from me. About ten years ago I made my first venture as the constructor of an electric railway on the east side of the river. From a small beginning it has gradually extended until now it runs to the city of Alton. We have great hopes of branching out this road until it may reach the Atlantic coast, and possibly the Pacific coast. (Laughter.) At any rate, that is the way the street railroads of this country are developing today, and I think very few of you gentlemen even anticipate what their work will be in the future.

Through such an Exposition as we have here, where are assembled all kinds of machinery, and where you are making tests in your respective lines of work; where the exhibits are not dead exhibits but exhibits of processes, every line of human endeavor is given a new impetus. I think there is no line that will feel this impetus more than the line of street railroads. We have a model street railway of our own here, as a live exhibit within these grounds. We suggested to the street railroad organizations of this city that they extend their lines into these grounds,—that they operate a line, rather, within the limits of the Exposition, that would be the joint property of the two companies, and upon the tracks of which line they could run the cars from their systems throughout the city. When I went to Europe in the interests of this fair, early in 1903, it was my understanding that we had about perfected an arrangement whereby an intramural road could be constructed and would be the joint property of the cities' street systems, the St. Louis Transit Co. and the St. Louis & Suburban Ry. system. Upon my return—and I was not gone over six weeks—I found the entire project had been abandoned. I found that the Suburban company had become discouraged because of a fire which destroyed about fifty or sixty of its cars, and that the Transit company had found that it was making such extraordinary preparations for the Fair that it had incurred a larger debt than it desired. I found furthermore, that the Exposition management had about decided that the crowds within these walls could be handled by automobiles. I threw up my hands in dispair and said that the idea of handling the crowds that would come within these gates by automobiles, without fixed routes, was in my judgment a very erroneous one. I said that it was necessary to have an intramural road, or the crowds which would come to the Exposition could not be handled with any satisfaction, if at all. They said, "You will have to build it yourselves." That meant the Exposition authorities. I have no personal interest in anything on these grounds unless it is the entire grounds. I am staking more on this Exposition than I have staked on any enterprize in my life and I do not know why, unless the Exposition microbe got into my veins and I cannot get it out. It might get into the veins of any man who will associate himself with an Exposition and who has a love for his fellow man and desire to make progress. (Applause.)

I immediately set about, therefore, to arrange for an intramural road that would be operated within the grounds as the property of the Exposition and be under the control of the Exposition authorities. In order to utilize the tracks already laid it was necessary that the gage should be the same upon the street railway or intramural road as upon the steam road, which, as you know has the standard gage of 4 ft. 8½ in., instead of 4 ft. 10 in. which is the gage of the street railways in the city.

Without going into the details, we ask you to look at the road. It is operated daily except Sunday. The Government does not permit us to open the Fair on Sundays. I do not know your ideas about Sunday observance, but I wish to say that that prohibition by the Government has cost this Exposition one million dollars. If we had been permitted to operate this Exposition on Sunday it would not only never have injured the morals of the people who patronized it, but it would have attracted them to pursuits less injurious than many of them now indulge in on Sundays in consequence of the Exposition being closed. However, that may be, the Exposition is not open on Sunday, but on every other day the intramural road is in operation. The results to us have been more than satisfactory. Not a person has been killed and not over three injured during the operation of this road. It carries an average of 55,000 persons a day. It carries nearly, or quite, 55 per cent. of the paid admission to these grounds, and is one the best sources of revenue that the Exposition management has. (Applause.)

Now, imagine, gentlemen, how we could have transported the crowds if you can imagine it—I cannot—without an intramural road. Think of having 150,000 people a day on these grounds depending upon roller chairs, automobiles and jinrickshas. And think of the magnificent distances between these buildings! The grounds are two miles east and west, and one mile north and south. We have two sections of land partly within these grounds. You men who live in the west know what a section of land is. You men who followed the plow, as some of us have, know what six hundred and forty acres of land is, or a ten acre field is. When I tell you who have not been on a farm, and do not compute areas by sections, that the area of this fair is about twice that of the Chicago fair and equal to that of the Chicago, Buffalo and Paris Expositions combined, you will have some idea of the extent of the territory covered by this Fair; and if you then attempt to walk through the grounds without going on the intramural road or taking some other means of transportation, you will have an even better idea of the

area of the grounds.

Furthermore, gentlemen, we would not only have been unable to transport the crowds within the grounds, but we never would have been able to bring the hundreds of thousands of people from the city to the grounds without electric street railways. If we had not electric street railways, and depended upon horses and mules, we never could have operated an exposition of this magnitude. I mean by all this to demonstrate to the public. I do not think you need any such evidence to convince you of the truth of this statement—what a great factor the application of electricity to street railways is in the progress of a community, of a state, or of a nation. It has marked the beginning of a new epoch, in the history of the United States at least. There is hardly a town in the country, certainly not any city of any magnitude, that cannot attribute the greater part of its progress, its increase in wealth and in population, to the advent of the electric street railway. The management, therefore, gentlemen, is very proud to welcome the representatives of this great interest within the gates of this Exposition.

This is a UNIVERSAL EXPOSITION in which all sections of our country co-operate and in which all civilized governments on the earth have participated. There is no distinction here, as you know, of race or creed, or nationality. We have here not only the most cultured people on the globe, but the most primitive people as well, and you gentlemen know what a task it is to get together in an area as small as this the best products of every country on the globe, and what it means to make this Exposition, as we had promised to make it, and as we think we have made it, a marker in the progress of civilization. It could not have been here if the street railways of this country were not performing the very great functions which they are performing from hour to hour and from day to day.

There is no doubt that the interest which you represent has not reached the peak of its development. We flatter ourselves that in our Palace of Machinery and in our Palace of Electricity are installed exhibits, which have been inspected by you with interest, and which will be taken advantage of by you to promote the already admirable facilities which you employ. As to the results to follow from the installation of this machinery I will not attempt to make a prophecy, but in general terms I think I am justified in making the statement that there is no line of human endeavor that will not from this Exposition gain a new impetus. When you think that within the short period of seven months —and I believe any intelligent man could with benefit devote the full period of seven months to the inspection of the exhibits in this Exposition—but if not seven months, we will say within a period of sixty days, an intelligent careful observor can see what has been accomplished by every country on the globe, by every race on the earth, you will get a clearer conception of the great work which has been done here. Bear in mind that in addition to the material exhibits, we are holding in connection with this Exposition, International Congresses that show the advance in ever line of human thought; that as the cap sheaf of these congresses, the cap sheaf, if you will, of all the work of this exposition, we have held an International Congress of Arts and Sciences, which has been an effort to unify all human knowledge and to show the relations to each other of all branches of science. That Congress has been participated in by savants from all over the world, who were selected for their fitness to write upon the subjects assigned to them, and all of the papers and addresses at this Congress will be published in book form. Taking as the capsheaf of all the congresses that International Congress of Arts and Science, I think you will agree with us that we have a right to claim that this is an universal exposition. It will be a mark in the intellectual progress of the world as well as in the material development of the world.

We welcome you for what you represent, and we will welcome you for what we think you can gain from this exposition; but in addition to that we welcome you for your own personalities. We know you; we have the pleasure and privilege of a personal acquaintance with many of you. But if we did not know of you, and were not acquainted with you, and were disposed to measure your merits by the men in our midst who are engaged in the same pursuit, we would know that you are all good fellows together and we would welcome you heartily.

I did not come here to touch on the local situation but I am sure I will be pardoned for doing so in this presence. One of the great problems which this exposition management had was how to convey the people from different parts of the city to these grounds. The two great railroad systems of this city made very liberal preparations and expended a great deal of money in consequence thereof. There seemed to be, however, a want of confidence on the part of the public as to the ability of these street railway systems to comply with their promises, or to meet the requirements of the exposition. I was too much engaged myself to investigate the cause of this want of confidence—I only knew that it existed. Sometime before the Fair opened there was a change in the management of both of these lines, especially was there a very radical change in the management in the Transit company. I do not know that the present management is any more competent than the previous management. I do not know that the man who at present controls this immense railroad system is any more capable in his line than the men who preceded him, but I do know this that the present management of the Transit company has behind it the good will of the community and that means more than I can express in the management of any public utility such as a street railway line. I have known street car managements that were not excused for accidents which they were unable to prevent, and were not pardoned for situations which they could not remedy, because they did not have the good will of the community in which these roads were operated. I do know that it is different in St. Louis today. I do know that this is the most trying time that the street railway system of St. Louis ever experienced and I believe it will not have an experience again as trying as this; but at the same time it is a source of great plesaure to me and ought to be the cause of ineffable gratification on the part of the management of the street railway systems that they have the good will of the people of this town and the good will of the hundreds of thousands of strangers that come here and patronize the street railways. In other words if there should be an accident or delay, my observation and information is to the effect that the public is willing to excuse, and to make allowances. That is the first thing to gain in the successful operation of a street railroad system or in the operation of any public utility—the good will of the patrons of that public utility. Without it it is impossible to succeed and with it if a man does not succeed it is because the elements of success are not in him. If we did not have the good will of the people of this country in this Exposition we never could have advanced it to its present stage.

We do not measure the success of this exposition by the same criterions by which you measure the success of a street railway system, and that is by its revenue. We never expected to make any money on this exposition, we never expected to get back the fifteen million dollars put up for its inauguration, and we will not be disappointed. Whether we get back any of it or not—and I might say in passing we are paying back to the Government what we borrowed, $4,600,000, and it is interesting to see the expression of amusement on the faces of some senators when they say they never expected the Government to get back any of this loan,—we are satisfied with the result of our effort. As a matter of fact we have paid $3,500,000 to the Government on account of the loan and will pay another $500,000 on Saturday. Outside of that, this city has contributed $10,000,000, the Federal Government advanced $5,000,000, at the time of the inauguration of the Exposition, in addition to what exhibitors and our own and foreign states have contributed toward the fund. The total installation represents an expenditure of over $45,000,000. Of course we will not get the money back. But that is not the measure of success; that is not the standard. WWe wish to ask the people who come to this Exposition and the people of the world whether we have fulfilled our promise to make this Exposition truly representative of the industrial and intellectual progress of the world. If we have done so, then this exposition is a success. It will go down in history long remembered as a Universal Exposition the equal, if not the superior, of any ever held up to its time.

I believe it will be a long time before another universal exposition is held in this country. There will be expositions, international in character, but a universal exposition that takes in every line of human endeavor and every subject upon which the

human mind has labored is a great undertaking. The only criticism that we have heard of this exposition is that it is too big. What would you think of it, if we did not have the intramural electric railroad in operation inside? Gentlemen, I did not mean to detain you so long—you want to get to your business. I only wish to state that we are glad to have you here. We are proud that you are holding this meeting on the grounds and to this association the exposition management extends the most cordial welcome.

President Ely: We must not detain the Governor any longer. I merely wish to express our thanks to him for having come here and welcomed us, and also for the great amount of information he has given us concerning this exposition and its buildings and what it represents. A statement made by him was of great interest to me. I had to do, as a member of the board of directors and of the executive committee, with the Pan-American Exposition at Buffalo. I worked long and hard to open the gates of that Exposition on Sunday. The president of that exposition, a very able man, worked very hard to close the gate of the exposition on Sunday. He was influenced in that by the tremendous amount of pressure brought to bear by the various Sabbatarian organizations throughout the land. I have no doubt but that it was due to that influence that the unfortunate proviso concerning Sunday closing contained in the original governmental act in relation to the St. Louis Exposition was introduced there. I was much interested in the statement of Governor Francis that he believed that this Sunday closing had cost the Exposition one million of dollars, because there were those in Buffalo who attributed a large portion of the misfortunes of the Buffalo Exposition in a financial way to the fact that we had opened it on Sunday. It never had seemed that way to me.

Another thought that underlay the efforts of those who worked for Sunday opening was that without Sunday opening the benefits of the Exposition would largely be withheld from a very large class of citizens, of laboring men and the poorer classes generally, who would find it difficult after the summer holidays were over, to go to the Exposition unless they could go on Sunday. Even if only a part had been open, the amusements on the Pike closed, as they could have been, it does seem to me that this Fair at St. Louis would have been of a great deal more benefit to mankind, and especially that part of it in this neighborhood if the gates could have been opened.

One more thought about this Exposition. Governor Francis said that he believed that we knew what it meant to have an exposition like this. There is no man, who has not been directly concerned in it, who can realize, or begin to realize, the enormous amount of labor that is required in the holding of an exposition like this. This Exposition is one of the most tremendous achievements of men. This Exposition, the building of it in a short time, to lay out its scope, what it should be, what it should comprise,—I mean in all departments—and then lay it out on this magnificent scale and build these great buildings, and install the exhibits, and bring together these International Congresses, attended by delegates from all over the world, these things require an enormous amount of effort, and that effort must be exercised along the best and most intelligent known lines. Then all these exhibits must be arranged in a proper way, so that they may be submitted in an intelligent manner to the jurors who are to pass on the various excellencies of the things shown in order that the prizes and premiums may be fairly awarded. All of these things have to be looked after. Then the diplomatic side of the matter is a tremendous affair; and if it had not been for the heroic work of David R. Francis that has characterized every step of this thing from its very inception—you might say the exposition was almost conceived in his brain—it is difficult to imagine what the result would have been. I remember well having had the pleasure of meeting Mr. Francis in Buffalo when he was about entering upon his task and it seemed to a good many of us that he had but slight idea of the enormous and gigantic thing that lay before him, but we were entirely mistaken; and I wish to congratulate the people of the state of Missouri, of the city of St. Louis and of the whole country upon having had at the head of this Exposition a man who realized from the outset that if it was to be successful, somebody had to devote his life to it; somebody had to give up his business; somebody had to sacrifice his social relations and family ties and everything of that kind and devote his life and soul to the object; and from all that is known of this thing, from all that is said about it and heard all over the country, Governor Francis has entered upon this work in the most soul-stirring and self sacrificing manner; and I congratulate him and congratulate the people of all countries upon the magnificent success of this grandest of all expositions.

I wish to say to Governor Francis, before he leaves us, that in this Exposition there has been most fittingly celebrated the grand accession of territory that the fair is designed to celebrate and perpetuate, and in the part he has played in it I am sure it will be the acclaim of all his fellow citizens that he has made a name and fame that will be perpetuated so long as the English tongue is spoken.

In the absence of Mayor Wells the chair called upon Professor Goldsborough, who addressed the convention.

ADDRESS OF PROF. W. E. GOLDBOROUGH.

On behalf of the electrical fraternity here at the Exposition, it gives me a great deal of pleasure to welcome you. We have been preparing for the coming of our electrical friends for something like three years, and you can well imagine how disappointed we would have been if you had not come. The fact, however, that you are here and that you have faced a situation which I believe the street railway association has never had the temerity to face before, that is holding its convention in an exposition city, is a compliment to us which we appreciate most heartily.

President Ely asked me some time ago if I would tell you something of the things which would particularly interest the street railway men at the exposition. Owing to the large number of the badges of the association which I have seen within the last two days on all parts of the grounds, I am led to believe that you have ferreted out all of the good things in the Exposition for yourselves, and that it is hardly necessary for me to run over the list. I think it may be of interest to you to know something of the way that an Exposition man, or a man who has tried to be an exposition man goes about his work, and the spirit which animated and underlies the exhibits which you see here.

You probably know that the main feature of this Exposition was to have been a presentation of processes, not so much a showing of manufactured articles as a showing of these articles in process of manufacture, or the industrial appliances in process of being used. We wanted, moreover, to present all these to you in the best way possible from all standpoints. We wished to have the exposition of these processes appeal to the engineers on one hand, and to the scientists who are linked with our profession, on the other, so that all could join in getting something of value from it, and to enable them to learn some lesson which might not have been taught in their every day work, which the visiting technical men might come in contact with.

I think an engineer in studying the engineering work here, especially if he is engaged in street railway work, which begins with the power plant, should start in in the Machinery Building. There you have every element presented which deals with the generation of power. We may not have there the largest units which the world has seen installed, but we have a wide variety of steam and electrical macninery presented arranged in order, each set representing a complete installation in its self, and each set presenting for your inspection the most modern appliances which the different manufacturing firms of both Europe and America have been able to devise to increase the economy of the installations. The direct connected 500-volt generator driven by a marine type of engine of large capacity which is such a prominent factor in our modern plants, is also very well illustrated, and in addition to this we have the new steam turbine showing an application in which every engineer is very deeply interested at this time, owing to the great promises that have been held out to us by the manufacturers as to the ultimate economies which would be produced thereby. The fact we have not the great gas engine exhibits here, which we anticipated at one time, all of us regret; but some of our foreign friends were not

able to meet the measure of what they thought they would be able to do. However, we have very good examples, indeed, of modern gas engine practice, and I, for one, have been more than gratified and pleased to notice with what regularity and how little noise the present gas engine does its work.

In the Electricity building you have another phase of our engineering work shown you. There the exhibits have been installed by the manufacturers with the sole intent of enabling you to see the operating of the device and the perfection to which their present product has been brought. You will find there little warehousing of machinery and apparatus, by which I mean the mere placing on a space of a number of electrical items without these items being connected up and their operation shown. On the eastern side of the building, next to the lagoons, you have the installation of the General Electric Co., in which I think every item of its manufactures in some form is presented in working condition. I doubt if any exhibit has ever been installed which has been so complete in showing no apparatus not connected, and so complete in showing so large a variety of apparatus connected to demonstrate its utility. The company has there modern street railway apparatus connected for operation so that each step of the mechanism can be seen and tested for any object. It has all of its modern central station instruments, switches and appliances connected for testing and illustration in the same way; and the number of favorable things I have heard said concerning this installation makes me feel that it is worth your while to visit it and inspect it carefully.

Across the aisle from the General Electric Co.s' space is the installation by the National Bureau of Standards. I do not know that the name of this bureau will at first impress you with the true importance of the Bureau to us, and I want to ask if possible that every one of you will visit the installation by the National Bureau of Standards. It contains probably the finest equipment for the scientific testing and accurate calibration of electrical instruments and appliances that has ever been brought together in any one place. It has received unqualified commendation and endorsement from the best engineers of Europe and America who have been here to visit it. The National Bureau of Standards as you may know, has been organized in Washington by the Government to give us a place to which we can send all instruments and station apparatus which we desire to have calibrated,—steam gages, thermometers, or electrical apparatus. We can send them there and at moderate cost get them accurately standardized and this refers to both instruments of very large capacity, requiring very high pressures or very large currents, and in the same measure it applies to all types of wattmeters and other delicate apparatus. This labratory is completely equipped with cold storage plants so as to control the temperature and is a complete working labratory, with some twenty assistants in attendance. It has been invaluable to the international jury of awards for electricity in making their determination of the excellence of the products shown here, and I think it is fair to say that the jury which completed its labors at the end of September has in the Electrical Department done a higher grade of work, because it has the tools to work with, than has ever been done at any international exposition or other exposition prior to this time.

Those of you who may in connection with the ramifications of street railway work be interested in lighting effects should visit the exhibit of the Holophane Co., as it shows some very fine things. That exhibit is also in the southeastern quarter of the Palace of Electricity. The Weston Electrical Instrument Co. also show a peculiarly fine assortment of its instruments also in the same part of the building.

Over on the western side of the building you have some very interesting exhibits, the Westinghouse exhibit and the Bullock exhibit particularly. In the Westinghouse exhibit is the new single phase motor. We had hoped to have some of these alternating current equipments operating on the ground, but that proved impossible. We have the single equipment which shows the company's new single phase motor adapted for railway work, with the control system. The turret control system of the Westinghouse Co. for railway work is also shown. A large variety of other station equipment, including 25-cycle rotaries as well as 60-cycle rotaries, is also in working operation, and I think it will pay you all to study the installation there, not only with reference to the apparatus which bears directly on the street railway work, but also in connection with several lighting systems which are shown in working operation as well.

In the exhibit of the Bullock Electric Co. you will find a most interesting installation which to my mind is quite unique in exposition work, in that it has been organized by the engineers of the company into a laboratory for demonstrating and testing electrical machinery of all classes. It has there a very fine testing table, complete with instruments and switches and auxiliary apparatus needed for these tests, and there you can make tests upon machines of considerable power for handling direct and alternating currents, rotary converters, motor generators, street railway motors, and other apparatus. I doubt if such a complete experimental equipment on an engineering scale has ever before been installed at an Exposition, and I feel that it has peculiar merit from this standpoint. The company also has some very nice adjuncts shown there, illustrating the multiple control system, and as the shop is an important adjunct of the street railway system, you will doubtless be interested in that as well. In fact, all the western half of the Palace of Electricity contains machinery and apparatus which must necessarily be of interest to you, as it enters so largely into your work.

Whether or not you will ever ultimately wish to carry on the control of your system by using wireless telegraph communication between the central office and the different cars as they go out over the country is yet to be determined, but taking time by the forelock—I think this may come some day—it may be well for you to investigate the wireless telegraph stations in the building which are very interesting and very complete. The telephone today is an important adjunct to the street railway work, and I think the telephone installations should also come in for a share of your time.

In the Transportation Building here you have a very fine series of exhibits illustrating the progress which has been made in the construction of trucks and cars, peculiarly adapted for street railway work. These have been so well displayed, most of them on the tracks of this building, that you will find little or no difficulty, I am sure, in examining them and finding what it is you wish to see. There are several exhibits here showing the progress in construction of street cars which are particularly interesting, especially to those who may not have had an opportunity of going through any of the great car works.

Along with the general exhibit work at the Exposition, we have one other element which will probably be of interest to you. The Electric Railway Test Commission organized under the auspices of the Exposition has been, through a corps of assistants and three superintendents, doing a large amount of experimental work in testing the quality of modern electric railway apparatus and in determining various factors which bear upon the operation of street railway equipments, which have as yet not fully been tested up. This work has covered the operation of the braking system, both in its relation to the air storage in central tanks, from which car reservoirs are supplied with compressed air from a central storage plant, as well as the operation of individual cars equipped with their own compressors.

It has also taken in the matter of the reactance of rails; the resistance which is due to the flowing of an alternating current through a rail, and which is very much in excess of the resistance which is due to the flow of direct currents through these rails. As we approach the problem of alternating current traction, the matter of the resistance offered to the passage of the alternating current through the rails becomes a matter of prime importance, and that has been given especial attention by the men working under the direction of the commission. In addition, we have on the north side of the Transportation Building, two tracks, 1,400 ft. in length, on which you will see three modern equipments which have been placed at the disposal of the commission for test in operation. These tracks, I believe, are the first that have ever been devoted to demonstrations of this character at any exposition.

In concluding the work, the Commission contemplates conducting a series of experiments on an eight mile tangent, over in Indiana, where cars will be operated at very high speed, and where elaborate preparations will be made and are just being completed, for the accurate determination of the wind pressures on

the car, the pressure occurring on the car body will be determined and in addition different shaped vestibules will be placed on the fore end and rear end of the car in order to determine wind resistance pressures there also. We hope that these experiments may be carried on at speeds of 70 and 80 and if possible 90 miles an hour, and if possible the commission will have for you something that will be extremely interesting, as electric railway men are beginning to branch out into what might almost be termed trunk line service between cities.

What I have said may indicate to you in a measure the great effort which has been made to bring together here at the Exposition something for you to see and interest you, not only from the standpoint of casual observers, but from the standpoint of students. A great many men have been employed in the task, and I think after your investigation you will join other engineers in saying that the presentation is good. Out on the Exposition Grounds you have another display of electricity in the illumination which has been developed by the mechanical and electrical department of the Exposition. Thus every engineering man who is in any way connected with the electrical work can feel a pride in the Exposition, inasmuch as it has brought so much of enjoyment and pleasure to thousands of visitors who have come here.

President Francis and President Ely have both given you some estimate of the measure of the work which confronts any set of men who undertake to organize an international exposition, but I am quite sure, gentlemen, that if this Exposition could have been placed here in all of the beauty and in all of the completeness of the ideas which were developed in the minds of the men who have been working upon it, it would be transcendantly superior to what it now is; and the fact that you can award to President Francis and the directors of his division the credit of having made a complete success here is to my mind but an indication of what the successful man must do. He must plan something far in excess of possible accomplishment. He must work to an ideal, and must finally present to his fellowmen a small measure, possibly of what had been the full measure of the plans which he contemplated. I know this statement will probably go home to every one of you as being a true picture of what the engineer is often confronted with. Probably there is not a man in this room who has not had to measure his strength in this way against a great problem and I am quite certain that the unwritten history of the development of electrical engineering is a history of great achievement, but a history which can never be put in print, because it is buried in the hearts of the men who have made a success of our profession.

President Ely: I am sure the remarks of Prof. Goldsborough have been intensely interesting, and in your behalf, gentlemen, I extend to him the thanks of the association for his courtesy, not only in this regard, but for his uniform courtesy and devotion to this convention since the first time that it was brought to his attention.

A thought in connection with the Exposition that I think must impress every reflective-minded man is the wondrous pity that, after expending millions and millions upon the erection of this great work, that it must be all obliterated and swept away, and not a vestige of it, perhaps, remain. I know that it seems as if there was a tremendous mistake somewhere. It possibly may be necessary, it possibly may be best, that the expositions of this country shall be held in different cities, in different parts of the land, so that their benefits may be received by possibly greater numbers than would be possible if an exposition were held here every ten or fifteen years, as is the case in France, in some one particular place, but if an exposition were to be held at one point, in some permanent building there would remain some things of great utility and benefit to succeeding expositions until as time went on there would be a great collection of exposition buildings and exhibits that would be permanently constructed, in which the exhibits might be permanently installed, and the tremendous waste of money in that way averted. However, it is not so, it does not come about that way, and as "whatever is is right," possibly we are working in the best lines and to the greatest advantage as we are now doing.

The arrival of Mayor Wells, being announced, President Ely introduced him and he spoke as follows:

ADDRESS OF HON. ROLLA WELLS.

First I desire to apologize for the lateness of my appearance, but as some of you in this room are aware our speed limit in the city of St. Louis is rather low, and consequently I could not hasten; otherwise I fear I would have been under the painful necessity of placing myself under arrest. If I ever experienced any regret in having assumed the responsibilities devolving upon the executive in the management of a large city, that regret is now dispelled, for the reason that my position gives me this pleasant opportunity of appearing before my old colleagues, those engaged in the management of street railways. In explanation, it may be possibly of interest to you to know that I am a child of the street railways. My father constructed and operated the first street railway west of the Mississippi—the Old Missouri Street Railroad Co. in the city of St. Louis. (Applause.) The first car started on July 4, 1859. This reminiscence affords me great satisfaction from the fact that the brightest thing in my life is to recall that my father placed sufficient confidence in me, his son, to appoint me the general manager of that railway at the age of twenty-two years. Although I was not in the city of St. Louis at the time of the Louisiana Purchase, I have been here a sufficient length of time to see the rapid and enormous growth of this, what we consider a typical splendid American city, and I know from my own observation that that growth should be in a large measure due to the street railway systems.

This city, gentlemen, is unique in its history; it is not as old as the cities of the east, but one hundred years ago this locality was simply a trading post. This locality has since that time experienced a peaceful transition of its change from Spanish to French and from French to American rule. Located as we are on the borderland, we know north, know south, know east, know west. Our people come from every section of the United States and when I hear that this Exposition is a success, which it is and look around my present surroundings, I realize, why, to a certain extent, this Exposition is a success. That success I large attribute to the intelligent, and I migh say patriotic interest that has been taken in it by the owners and managers of the street railway systems in the city of St. Louis for the purpose of bringing the people to these grounds in comfort and ease.

Now, gentlemen, I am expected to receive the Italian flag presented to the city of St. Louis by the Italian Government, as I am now a little late in getting there, I will close by thanking you for the courtesy of this invitation to appear before you and extend to you the greetings of St. Louis and the courtesy of our city.

President Ely: Mr. Mayor, I present to you the thanks of this association for coming here and honoring us by welcoming us to the city, and also for the remarks that you have made. I fancy, Mr. Mayor, that this body of intelligent and progressive men will carry away from St. Louis an adequate conception of your city and the splendid Exposition which you have here. I congratulate you upon the success of the Exposition, and I congratulate the city of St. Louis upon it. I hazard the prediction that notwithstanding the foreboarding of the croakers, and there are croakers everywhere, the time will come when the business men and those who have charge of the best interests of the city will unite in an expression that the Exposition has not only been beneficial to the country but beneficial to the city. I had to do with the Buffalo Exposition, and I was an earnest worker on its behalf from the inception of the idea; and I remember well the difficulties we met with from certain conservative elements in the community who were opposed to the fair, and I suppose you have had your fair share in St. Louis. I therefore am pleased to state to you that our experience in Buffalo with the exposition was of great importance to the city and of lasting benefit to it and that the croakers are all silenced and now unite in the general expression that it was a good thing. I thank you very much indeed for coming to speak to us.

President Ely then presented the following address:

PRESIDENT ELY'S ADDRESS.

One of the most difficult tasks that fell to the lot of your executive committee during the past year was that of making the choice of location for the holding of this year's convention. After several meetings of the executive committee, at which the question received the most careful consideration, it was finally determined to hold the convention at St. Louis during the exposition. As we are assembled here in the midst of the glorious creations of this greatest and grandest of all world's fairs I cannot but feel that the Executive Committee and the members of this association are to be congratulated that the choice was so wisely determined. This splendid exposition typifies and presents the best and most glorious of all the achievements of men. By assembling here we are enabled to view not only the highest results of the inventive genius and the progressive labor of man in our special line of transportation, but also the best examples of all that has been attained in allied branches of transportation, and in the arts and sciences, trades and manufactures, brought here and assembled together from the different parts of the world, and so arranged that we may view side by side with examples of the first and weakest attempts in all the various lines of work the most finished productions of human endeavor, illustrating in the most forcible and striking manner possible the progression of useful improvements and inventions from the most primitive times to the glorious realities of the present moment. By the kindness of Professor Goldsborough we have had presented to us a statement concerning the things that will be found to be of greatest interest to us in our respective lines of work, so that during the limited time at the disposal of the most of us we will be enabled to reap the greatest possible benefit. That most unique of modern philosophers, Mr. Martin Dooley, has said "that f'r wan man that goes to a wurruld's fair to see how boots is made they'se twinty goes to see th' hootchy-kootchy an' that's where th' wan lands fin'lly." Far be it from me to lay upon you an injunction that would prohibit the enjoyment of the alluring attractions of the "Pike," but I know that you will pardon me if I earnestly request and suggest that the seductive tones of the "spieler" on this most enticing of all modern Midways shall not be permitted to interfere unduly with the proper contemplation of the vast collection of useful exhibits here assembled together, which constitutes one of the greatest monuments of civilization, a tremendous milestone marking the endless highway of the world's progress.

The American Street Railway Association year now drawing to its close has witnessed many things of supreme interest to the electric railroad world. During the present year the New York Central & Hudson River Railroad Co. has matured its plans for the electrification of its great trunk lines entering the city of New York and the lines radiating therefrom for a distance of 35 miles; the Pennsylvania Railroad Co. has determined upon the electrification of that section of its line which will enter the city of New York in two great subterranean tunnels underneath the waters of the Hudson River; the Schenectady Railway Co. has begun the operation of cars propelled by means of single-phase alternating current motors in regular service carrying passengers, and the General Electric Co. at the recent meeting of the New York State Street Railway Association at Utica has exhibited in practical operation a car propelled in part over the tracks of a city system by direct current and in part over connecting interurban lines with the single-phase alternating current. Purchases of street and interurban electric railway systems of considerable magnitude have been made by the New York Central & Hudson River Railroad Co. in the central portion of the State of New York and this great corporation has announced its intention of electrifying a portion of its West Shore railroad tracks in connection with the street and interurban railway systems thus acquired.

The electrification of the Manhattan Elevated Railway system, which was finally completed in June 1903, in which month the last steam train was taken off, has during the past year enabled a direct comparison to be made between the operation of the system by electricity and steam. It has been determined that the substitution of electricity has increased the carrying capacity of the road 33 per cent. as indicated by the actual increase in car-mileage, the passenger traffic has been increased 30 per cent.; the operating expenses have decreased from 55 per cent. of the gross receipts in 1901 to 45 per cent. in 1903, and all obnoxious vapors, smoke, steam and cinders incidental to steam locomotive operation have been eliminated from the streets traversed by the railways of the system. The wisdom of the enormous expenditure of money necessary to make the change has been fully demonstrated by the benefits which have inured not only to the people of the city but to the intelligent management which at such great cost made the change. This great system which carries nearly a million of passengers each day has been leased to the Interborough Rapid Transit Co., which during the past four years has been engaged in constructing underneath the city of New York a vast system of subways, which are now completed and a portion of which will be put in operation during this present month. This system comprises 15 miles of subway and five miles of elevated structure, providing for 63 miles of single track to be electrically operated by the protected third-rail system and trains operated by the multiple system of train control. But little over four years have been occupied in the construction of this great work, and when the difficulties encountered beneath the streets and the buildings of the great metropolis are taken into consideration in connection with the magnitude of the work itself it is to be doubted if the record made in this construction has ever been equalled in the history of engineering or construction achievements. On Wednesday last it was my privilege upon the invitation of the general manager and the general superintendent of the Interborough company to join a large party of railway men in the inspection of that portion of the subway upon which trains are now being operated preparatory to the formal opening to the public during the latter part of this month. The ventilation of the subway is well nigh perfect and all parts of the work, including the railroad and its equipment, leave nothing to be desired. Being practically familiar to some extent with the underground railways of London and Paris, I was enabled to make direct comparison between them and this latest of modern subways. It is gratifying to be able to state that the points of superiority in this newest work are many and so self-evident that they may be at once detected not only by the skilled railway manager or engineer but by the every-day traveler. The benefits that are to flow from this great system of underground railways to the varied interests of the inhabitants of the great metropolitan city and those who do business within its boundaries are difficult of adequate conception. Our train left the City Hall Station at the Brooklyn Bridge and in less than 17 minutes we were at 146th St., a distance of about nine miles, and impossible of accomplishment in any other way in less than an hour or an hour and a half. The speed of the train at some points was nearly a mile a minute, but so smooth was the track and so perfect its grades and alignment that the great speed was practically unnoticed and almost before one had realized that we were off on the journey the arrival at its end was announced. It is almost impossible to realize what the works alluded to mean to the city and state of New York and that portion of New Jersey bounding the great metropolitan city. It is estimated that the city and its neighboring cities that ought to be considered as within the metropolitan area contain about 4,500,000 people. The growth of the city and the metropolitan district has been very much hampered in the past by the inadequate facilities of transportation between the homes of the people and their places of work, business and recreation, and the discomforts of life owing to the insufficiency and inefficiency of transportation facilities have been so great as to constitute a real hardship to those who were forced to dwell within the area described.

But great as will be the addition to the comfort and convenience of the people caused by the additional railroad trackage included in these works, after all the most inestimable benefits flow from the utilization of the subtle element electricity in connection with the works. By means of it ventilation is secured in the subterranean tunnels and the foul air is made sweet; the cars and the subway are lighted and heated by it, and the dark places wherein danger lurked when the operation was by steam are made light and safe; cleanliness is made possible everywhere and the highest degree of comfort and convenience that could be dreamed of seems to have at last been attained

It is by the mastery and the utilization of this same agent that you in the operation of surface street and interurban railways have in these later days wrought a grand transformation. You are so familiar with all these things that I fear lest I be guilty of overdescription in what I have said concerning them, but I am bound to congratulate you upon having given so good an account of your stewardship of this great modern agency of motive power, heat and light in its application to your business and those who have been contending with the great problems of steam railroad transportation have found it both advantageous and necessary to take it up and still further exploit and use it for the benefit of mankind. In a paper recently presented at the International Electrical Congress held at this exposition, Mr. Frank J. Sprague, writing of the history and development of electric railways, in which he has played such an important part, says:

"What the electric railway has done may only briefly be referred to here, but the writer may be permitted to repeat the substance of remarks written some nine years ago, for it has become a most potent factor in our modern life, and left its imprint in the indelible stamp of commercial supremacy. It has given us better paved streets, greater cleanliness, more perfect tracks, and luxurious, well-lighted and well-ventilated cars; and with the higher speeds it has made possible the extension of the taxable and habitable areas of towns and cities in a much greater ratio than is represented by the increase of speed.

"It has released from drudgery tens of thousands of animals, and increased the morale of transportation employes. It has given employment to an army of men, and hundreds of millions of capital. It has improved and extended the telephone service by forcing the abandonment of ground circuits. It has built up communities, shortened the time between home and business, made neighbors of rural communities, and welded together cities and their suburbs.

"Will it replace the steam locomotive?

"Perhaps the best answer is that its future is not in the wholesale destruction of existing great systems. It is in the development of a field of its own, with recognized limitations but of vast possibilities. It will fill that field to the practical exclusion of all other methods of transmitting energy; it will operate all street railway systems, and elevated and underground roads; it will prove a valuable auxiliary to trunk systems; but it has not yet sounded the death-knell of the locomotive any more than the dynamo has that of the stationery steam engine. Each has its own legitimate field which will play its proper part in the needs of all civilization."

But its work within the sphere to which it is at present confined has brought about social and economical results which are being constantly more and more forcibly impressed upon the minds of the observers of conditions of growth and settlement in this country. A writer in the Yale Review recently pointed out the results attendant upon the electrification of the street railways and the construction of the interurban railways, which have been connecting up and binding together the cities and populous places throughout the country, and the New York Sun in an able editorial reviewing the article mentioned, remarked that the whole country was becoming urban, and humorously stated that the "hayseed" was disappearing from the land. Present results are really wonderful. It is difficult to correctly divine the future, or to make any prognostication concerning the ultimate social and economic results that may flow from the elimination of the line between the city and the country. We can only judge of the future by the past. It is safe to say that this latest and most beneficent of servants given by nature to man will continue to be utilized for his betterment in a ratio that will constantly increase with the passing of time. With the ever growing intelligence of the people concerning this great modern agency, and the increased recognition of the beneficial results to accrue to the public from an intelligent co-operation by it with your efforts, you will find your burdens lighten as time goes on, until finally there will come a period when with mutual recognition of the duties and obligations which each owe to the other you will secure the widest radius of beneficial action and the maximum both of pecuniary results and public recognition.

I am now about to touch briefly upon a matter of great importance to this Association. For a number of years past there has existed a feeling and an opinion that the growth of the interests which had come to be represented by this Association required a remodeling of the form and scope of our organization and its work. The first visible effect of this growing feeling was the formation about eight years ago of the Street Railway Accountants' Association of America, an auxiliary association with a membership comprised of the accountants of the different companies, members of this organization.

Within the last three years the feeling has been further evidenced by the organization of another auxiliary association, the American Railway Mechanical and Electrical Association, with a membership composed of the mechanical and electrical engineers of our companies.

During the past year the project of still another subsidiary organization, with a suggested membership of electric railroad way engineers and superintendents has been actively agitated through the medium of correspondence between various officials of different companies and to a limited extent in the columns of the technical press. The discussion of the advisability of the formation of this third auxiliary association, or of rendering the same unnecessary by enlarging the scope of the American Railway Mechanical and Electrical Association sufficiently to include not only the engineers and superintendents of way, but also several other important branches of the business wherein the need of investigation, comparison and discussion had come to be recognized, has finally involved the discussion of the main question, namely: that of a reorganization of the parent body. A very ingenious and well considered suggestion in this regard emanated from the superintendent of construction and maintenance of way of the Milwaukee Electric Railway & Light Company. An outline of that plan was printed in the street railway papers several months ago and has been quite extensively commented upon.

At Saratoga last fall there was an open and avowed expression of desire for a change in the method of conduct of Association affairs and the scope of Association work, and a discussion of nearly two hours' duration in the session of the executive committee brought out warm expressions of hope for work along new lines and not a single voice was raised in opposition. Later on debate upon the subject was precipitated during the discussion of one of the papers in the convention and reference to the minutes of the last convention reveals the fact that while several of the leading members of our profession spoke in favor of a change, not one person spoke against it. The discussion in the convention resulted in the matter being duly referred to the executive committee with broad power to act. The first branch of the case taken up by the executive committee was a proposition to relieve the Association of the duty of preparing space and arranging the details of the installation of the exhibits of manufacturers of electric railway supplies held annually at our conventions and in connection therewith. This duty has of late been almost, if not quite, the most onerous and difficult devolving upon the secretary's office and has consumed the greater amount of that officer's time. The supplymen's exhibition has grown gradually from small beginnings and latterly has come to be one of considerable importance, occupying a large amount of room, and the preparation of space and making of arrangements for the accommodation of such exhibits. Allotting space to individual exhibitors and collecting the revenues therefrom has called upon the officers of the Association for the performance of duties not within the scope of the work of the Association as the same is defined by the constitution and by-laws. The proposition to rid the Association of all care in relation to this exhibit and to leave it to the supplymen themselves was informally discussed at Saratoga, and several energetic and intelligent gentlemen at once took great interest in the matter and effected an informal organization to take up the work in an orderly and effective way, and proceeded to sound the manufacturers as to their views. Upon investigation it was found that the manufacturers themselves for the most part were perfectly willing to take the burden off our hands and to assume and perform the whole task without any cost of time or money to this Association. In May last a formal organization was effected and a committee was organized representing the technical press and a number of prominent manufacturers. This committee formulated a circular explanatory of their plan and distributed the same extensively, with the result

that a large number of manufacturers have already come forward and joined the association and others have expressed their intention so to do. It is proposed that the function of this Manufacturers' Association will be to take the entire charge of making the annual exhibit, and in addition to this the Manufacturers' committee has suggested that it would be their desire to do something in the way of entertainment, subject in every way to the wishes of the officials and executive committee of this association, and with their complete sanction and co-operation. This matter has received the sanction of your executive committee and a report will be made to this convention, expressing the satisfaction of your executive committee with the change.

It would be quite proper to mention at this time the fact that this Manufacturers' committee procured the beautiful badges for this convention and presented them to our association, and also provided the attendance of Reeves' celebrated band of Providence throughout the entire convention week to supply music at our various meetings and entertainments. Furthermore all of the entertainment which is noticed in the voluminous program of the convention has been provided by this committee. All of this has been done with the knowledge and approval of your executive committee.

The desirability of this change which is now suggested by your executive committee seems so obvious as to require no argument or explanation from me. When this association in convention assembled shall have approved of this action of your executive committee and the holding of this exhibit shall have been entirely divorced from the work of the association then the association will be in much better condition for the performance of its legitimate work.

Reference has been made by me to the creation of certain subsidiary or auxiliary associations, and the desire for the creation of still others. This thing cannot go on indefinitely or we will be confronted with a large number of organizations, each pursuing its solitary way unmindful of the others, until finally all will be chaos and we will be involved in an intricate maze of technical work, the value of which, owing to its chaotic state, will largely be lost. We should therefore, it would seem, at this time take up the matter of a reorganization of the entire work. I will not attempt to outline any plan for such reorganization or reformation of the lines of work. That should undoubtedly be left to the committees of the different organizations, working together with great care and deliberation and taking all the time necessary to bring about a satisfactory result. Since assembling here for this convention, representatives of the auxiliary associations have met with your executive committee and important action has been taken in this regard, which will be duly reported for your approval.

A careful inspection of the proceedings of the conventions of the last few years reveals the fact that the most of the time of each convention has been occupied with the reading and discussion of papers embracing subjects which for the most part relate to the small technicalities of the business, nearly all of which might have been profitably committed to proper auxiliary and subsidiary organizations. Broad fields of co-operative effort in the most important lines of our work have remained almost untouched. It becomes immediately apparent upon investigation and discussion of the situation that we might profitably enter upon the discussion of the greater questions affecting our welfare. The confusion of laws throughout the country affecting our corporations is a matter to which we might well devote attention. There are also such great questions as taxation, municipal ownership of street railways, franchise rights and obligations, statutory laws affecting our class of companies, municipal laws and ordinances, and other questions of importance to which your minds will readily refer. The collection and preservation of data tending to throw light upon the problems of great importance that confront us is also a matter deserving of attention, and in this regard it would seem that through the medium of the secretary's office and of appropriate standing committees an invaluable collection of data could be made and permanently preserved in such form as to be conveniently accessible to any member of the association upon merely making request of the secretary. If the work of the secretary's office should be made continuous there would thus grow up in time a vast repository of valuable statistical and historical information, readily available as matter of right to every member. This branch of the work alone, if properly prosecuted, would render membership in this association so valuable that it is difficult to understand how any street railway corporation would feel justified in remaining outside of this association. It is our duty to keep in step with the changes in conditions that confront and surround us; we must be in synchronism with the spirit of things; we must not hesitate to make necessary and beneficial changes, nor should we be deterred by our consideration of the past.

"Upon the stepping-stones of our dead selves
We rise to better things."

It is undeniable that notwithstanding the fact that the intelligent and broad-minded policies that today characterize the operation of the great properties represented in this association, and notwithstanding the fact that inestimable advantages have been and are being thereby conferred upon the entire public within your individual spheres of action, there exists today a tremendous amount of misunderstanding of your labors and the effect thereof upon individuals and communities. Intelligence must replace ignorance; darkness must give way to the light. There are today no matters or things really in difference between yourselves on the one hand, and the public on the other. With right understanding there will come about perfect accord. The remnants of old suspicions founded upon misconception and misunderstanding must be swept away. It is only by a general diffusion of information concerning our properties and our work that public appreciation may be obtained. Let us bury all questions of prerogative, precedence and personal advantage and unite in a vigorous and persistent effort to bring out of present conditions such a state of organization and work as will not only meet with the intelligent and hearty approval of all those comprised in our different organizations, but will also put us in closer touch with the public whom we serve, and tend to the creation of such a condition of things as will enable us best to work out legitimate ends and purposes.

Congratulating you upon the things that you have attained, and extending to you my sincerest wishes for still higher attainments, I await the pleasure of this convention.

President Ely: The next order of business is the report of the Executive Committee on the management of the association during the past year. Before we enter upon that, I wish to extend to our friend, Captain McCulloch, our united felicitations upon the things that have been said of the street railways of St. Louis.

Vice President Shaw in the Chair.

The secretary read the report of the executive committee which consisted of the minutes of the various meetings of the executive committee held on Feb. 29, March 26, Sept. 10, and Oct. 11, 1904, at which meetings the various arrangements were made for the St. Louis convention.

At the meeting held Oct. 11, 1904, the following resolution was passed:

"Whereas, during the past year many suggestions have emanated from different sources concerning the desirability of rearranging the lines and methods of work of the American Street Aailway Rssociation and its existing auxiliary organizations, the Street Railway Accountants Association of America and the American Street Railway Mechanical & Electrical Association, to the end that through the medium either of these existing organizations or such other and additional organizations as may be deemed desirable, the work which was originally embraced within the scope of the objects of the parent organization, the American Street Railway Association, may be so enlarged and so prosecuted as to bring about results of greatest value to the streeet railway corporations of America, and at the same time that whatever organizations may be deemed most desirable to conduct such work shall be brought more closely together along systematic and correlated lines of work and procedure; and,

Whereas, at this convention the matters above mentioned have taken such form that representatives of the different organizations have met in an official way and have made some progress in the consideration of the matter, now, therefore, be it

"Resolved, that it is the sense of the executive committee of the American Street Railway Association in a formal meeting assembled, that it is desirable that a closer working arrangement

should be effected between the different organizations conducting street railway work, and to that end be it further

"Resolved that the Executive Committee of the American Street Railway Association hereby recommends to its convention about to be assembled such amendments to its by-laws as may be necessary to provide for increase in the size of its Executive Committee sufficient to accommodate as members thereof, by virtue of their office, the presidents of such auxiliary organizations engaged in street railway work as may be approved and fostered by the American Street Railway Association; and be it further

"Resolved, that the American Street Railway Association be requested to commit all matters and things concerned in bringing about the above named objects, to its executive committee, with power to act."

On motion the report of the Executive Committee was received, and because of the consideration necessary to be given to the resolution above referred to, its consideration was postponed until Thursday.

Mr. J. C. Hutchins, of Detroit, offered the following resolution:

"Whereas we consider it is an advantage to the association that the widest publicity shall be given to all its proceedings that are not of a confidential or privileged nature, be it

"Resolved that so much of the resolution regarding the publication of proceedings, and the censorship referred to on pages 237 and 238) of the proceedings of the Saratoga convention, as requests the technical press to refrain from the daily publication of proceedings be, and hereby is, rescinded."

There was a protracted discussion on the resolution, in which Messrs. C. O. Mailloux, John I. Beggs, Daniel Royse, C. H. Spencer, W. Worth Bean, J. C. Hutchins, and L. E. Myers, participated, and action on the resolution was postponed until Thursday.

The President then announced as the censorship committee the following named gentlemen: J. C. Hutchins, C. O. Mailloux, John I. Beggs.

Mr. Vreeland offered the following resolution:

"Resolved that the thanks of this association be extended to Captain McCulloch, of the St. Louis Transit Co., for his courtesy in furnishing special tickets for the transportation of the members."

The resolution was unanimously adopted.

The President appointed the following named genelemen as the nominating committee, to nominate officers for the ensuing year:

J. C. Hutchins, of Detroit; C. S. Sergeant, of Boston; Robert McCulloch, of St. Louis; H. M. Littell, of Chattanooga, and John I. Beggs, of Milwaukee.

The secretary announced that the service of the local and long distance companies would be open to the free use of the delegates; that of the long distance service only between the hours of six p. m. and ten a. m., at the telephone booth in the Southern Hotel, upon presentation of delegates badges.

The secretary announced that Messrs. Cagney operating the Miniature Railroad on the Fair Grounds would honor the badges of the attendants at the convention for transportation.

The meeting then adjourned, at 1:45 p. m.

THE INGERSOLL CONSTRUCTION COMPANY.

The Ingersoll Construction Co., of Pittsburg, Pa., was organized in 1901, by Frederick Ingersoll and E. E. Gregg, and the business was conducted under a partnership arrangement until January, 1904, at which time, owing to the rapid manner in which it had grown, a corporation was formed under the laws of Pennsylvania, with a capital of $100,000.

The object of the company was to install and operate amusements in parks and summer resorts operated by street railway companies, a plan that at once appealed to street railway managers, many of whom being unfamiliar with the various kinds of amusements, were unwilling to risk so great an investment. To invest $15,000 or $20,000 in a park amusement which could not be operated more than four months in a year, did not look encouraging to the average street railway official, but the members of the Ingersoll Construction Co., being thoroughly familiar with the business, were able to submit plans whereby they could erect and operate amusement features at its own expense and risk, paying to the street railway company a percentage of the gross receipts as rental, the only requirement being that the street railway company furnish the light and power.

The feature which was chosen as a leader and which has since proved to be the best paying and most popular amusement known, was the figure 8 roller coaster, the patents for which had previously been secured by Frederick Ingersoll, senior member of the company. Four of these were erected and operated the first season and so pronounced was their success that the company was besieged with letters from all over the country asking to have them installed in various parks. Thus the business grew until during the season just closed 23 figure 8 roller coasters, 4 old mills and 36 laughing galleries were installed and operated by this and affiliated companies, scattered from the Atlantic to the Pacific, and as far south as Chattanooga.

The company not only builds and operates for itself, but does a general amusement construction business and is prepared to erect and equip figure 8 coasters for others.

The success of this company and perhaps the chief reason for its being the leader in its line is, aside from the personalities of its promoters, the fact that nothing illegitimate has ever been permitted to occupy a moment of its time.

Frederick Ingersoll was for several years previous to the organization of this company, a prominent inventor and manufacturer, having invented various kinds of amusement devices, all of which proved popular and are still in great demand. E. E. Gregg, general manager, was for several years a well known newspaper man and later manager of all the amusement parks controlled by the Pittsburg Railways Co., is also a thorough and well trained business man who is well known by the street railway officials throughout the country.

THE MANUFACTURERS AGAIN ENTERTAIN.

The street railway associations certainly made no mistake when the entertainment of the delegates and their guests was turned over to the Manufacturers Committee. These royal good fellows and their guests gathered at the entrance to the Boer War, where they had the pleasure of listening to a short concert by Reeves' Band, which organization has been retained by the Manufacturers Committee to furnish music during the conventions. This jolly crowd then proceded in a body to the famous battle ground and witnessed one of the best attractions at the Fair.

Most of us are familiar with the history of this recent conflict between the British and the Boers, and with the valor and daring of their armies and the individuality of their bravest officers, and to have the horrors and reality of it presented to us in this magnificent performance was certainly appreciated. The efficiency of the management of this living panorama is attested by the very interesting and thrilling performance that was given.

At the close of the Boer War (last evening) we followed the band to the Machinery Garden landing of the Lagoon and there enjoyed the further hospitality of our entertainers. The great army of the street railway aossociation and their guests there embarked in the famous fleet of gondolas and launches of the exposition, specially chartered by the manufacturers for the occasion. After a very pleasant cruise on the Lagoon, the main army answered the bugle call of taps while the rear guard departed for "sentinal" duty on the pike.

KRUPP STEEL TIRED WHEELS.

There is a small, but none the less interesting, exhibit at the foot of the stairs leading to the convention hall in the Transportation Building. It consists of a pair of Krupp steel tired wheels for electric high-speed service, the product of the Fried. Krupp Steel Works, of Essen, Germany. The exhibit is being made by Thomas Prosser & Son, of New York, representatives of the Krup company, and is in charge of Messrs. F. A. Barbey of the Boston office and George H. Bryant, of the Chicago office.

THE FEATURE OF TRANSPORTATION DAY.

Of the various special days which have been observed since the opening of the Exposition none has made a more profound impression than "Transportation Day," which was celebrated on July 30th last, and no feature of that interesting occasion was more favorably received, or is more pleasurably remembered, than the part the St. Louis Car Co. employes played in the big land transportation parade in the afternoon. In fact, the St. Louis Car Co. display on that memorable event was designated "the feature of Transportation Day." The St. Louis Car Co. had 3,000 of its employes in line and the splendid showing they made was generally commented upon.

For several days previous to the parade this big body of employes had been drilled, and upon Transportation Day the officials of the company gave the men a holiday and paid their fare into the grounds. The employes of the various departments wore different uniforms and carried tools and implements illustrating the different branches in car construction. There were also a military company composed of young employes, the company's volunteer emergency fire department, a procession of automobiles and tally hos containing the officials and the office force, and several large floats typifying various departments. Prizes had been offered for the best showing and this resulted in a spirited yet friendly rivalry between 30 departments.

The crowning feature of the parade was an immense globe, faithfully reproduced, surmounted by a miniature trolley car, symbolizing the fact that "the sun never sets on St. Louis Car Company products." This suggestive feature of the occasion is shown in the accompanying illustration.

ST. LOUIS CAR CO. IN TRANSPORTATION DAY PARADE.

CONSOLIDATED CAR HEATING CO.

What is believed to be the largest display of electric heating apparatus at the Fair is comprised in the attractive exhibit of the Consolidated Car Heating Co., of Albany, N. Y., which will be found at post 57, aisle K, Transportation Building. Here are shown the standard and special types of electric car heaters which have been developed by the company, including samples of heaters especially designed for the entire equipment of the Manhattan Railway Co. and the Interborough Rapid Transit Co., of New York. There are also displayed several styles of cross seat heaters in which the heating elements are identical, but the cases are constructed so as to be adaptable to any of the cross seats on the market. A panel carrying a large variety of switches for car heating service shows the various designs made by the company.

Among other features of the exhibit is a full line of steam car heating apparatus, with full-size models having the special devices in sections, so that they may be readily examined. The McElroy automatic lighting system, in operation, forms an important part of the exhibit, the conditions of actual service in regard to change of speed, etc., being reproduced as far as possible.

Visitors are cordially welcomed at the Consolidated Car Heating Co's. booth.

There is no danger that the delegates will be allowed to forget that the Baldwin & Rowland Switch & Signal Co. is in the market as long as Mr. George D. Foote, the company's representative, is on deck. Mr. Foote loses no opportunity to call attention to the merits of his company's devices.

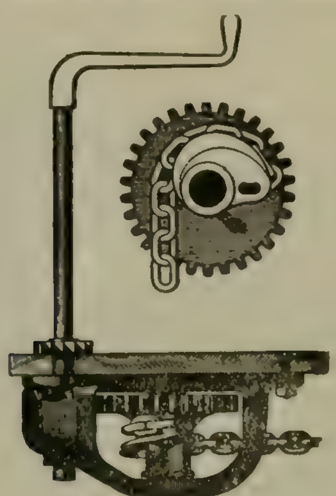
SEE THE BATTLE OF SANTIAGO.

One of the most enjoyable and at the same time significant entertainments on the Fair grounds is the Battle of Santiago, which is reproduced under the auspices of the Naval Exhibit Co. This is a realistic exhibition in which real boats and real water are used to portray that famous incident in the late war, when Admiral Cervera's fleet was destroyed by the American warships. The miniature battleships, cruisers, torpedo and submarine boats, and sailing craft, employed in the exhibition are manipulated with surprising skill, while the blockades and the remarkable running naval fight which characterized that epoch in history are faithfully portrayed. It is an exhibition that cannot fail to thrill, and patriotic enthusiasm is at the highest pitch at every performance. Mr. James L. Phelps, of the Naval Exhibit Co., has supervision of the exhibition.

THE "PEACOCK" BRAKE.

We illustrate herewith the "Peacock" brake, the latest pattern of car brake which has been produced by the National Brake Co., of Buffalo, N. Y. This brake is now being successfully used on more than 100 roads in the United States and Canada. It is adapted to any kind of car and is easily operated and quickly applied, the drum working on roller bearings.

The "Peacock" brake is designed to take up slack chain quickly.



THE "PEACOCK" BRAKE

The chain winds over a spiral drum (no sprocket) with an eccentrically-geared cam, the drum being extended sufficiently to provide for the taking up of any surplus chain. No special chain is required and any size chain may be used.

The "Peacock" brake has been adopted by 23 of the large roads in this country, among them being the International Railway Co., of Buffalo, N. Y., and the National Brake Co. has received a letter from that company stating that the "Peacock" brake was experimented with upon a number of cars during the past year, "the result being so satisfactory as to warrant its being considered for general adoption" upon the company's heaviest type of cars, which are run on the Niagara Falls line.

STANDARD STEEL CAR CO'S. EXHIBIT.

The exhibit of the Standard Steel Car Co., of Pittsburg, will be found at post 51, aisle E, Transportation Building. Here the company shows two new trucks for electric railways. These trucks are sure to attract considerable notice from street railway men, because of distinctive features of merit. Both trucks are of the equalizer bar or M. C. B. form, and one of them is stated to be the first short wheel base truck to be designed with equalizer bars. They are forged steel trucks, the side frames being solid forgings of open hearth steel without welds. They have no gray iron castings, except the wheels and brake shoes.

The journal boxes inside and the sides of the journal boxes are machine finished, and the journal boxes are tied together by equalizer bars, preventing all lost motion between them, so that the axles and wheels remain a fixed distance apart. The motors thus cannot force wheels against the brake shoes and cause a heavy waste of power.

The brake shoes are carried by the equalizer bars, so that they retain a fixed height on the wheels, and the wheels being a fixed distance apart permits of a very close shoe adjustment. As the shoes require so small a movement to reach the wheels, and the wheels do not give way to their pressure, but little power is required to apply the brakes.

Both of these trucks are provided with curved brake eveners, the curvature of which is such as to cause the brake shoes to slack away from the wheels when the car is in sharp curves. Both of the trucks have the brake shoes secured to the brake heads with the M. C. B. key, so that worn shoes may be easily replaced.

The car body center plates are cast hollow and provision is made for pouring oil from under the car without raising the car body. Where oil is used instead of grease in the center plates it stays there a long time and lubricates them so well that roller side bearings are not needed.

For the required strength these trucks are believed to be the lightest made. One of the trucks is especially adapted to city service and the other for interurban use.

WESTINGHOUSE TRACTION BRAKE CO.

A noteworthy feature of the Convention is the new prominence assumed by traction brake interests, both in exhibits at the Fair and in personal representation among the delegates and supply forces. The wide adoption of power brakes in street railway service within the past few years has resulted in an important addition to the scope of convention study and discussion. The Westinghouse Traction Brake Co. is giving constant demonstrations of the operation of its straight-air and automatic-air brake apparatus in its space in the Palace of Transportation, and has two trucks equipped with the magnetic brake in operation in the Palaces of Transportation and Machinery, and a car equipped with the combined brake and heater in operation on the tracks north of the Palace of Transportation. The company is represented by Joseph R. Ellicott, manager, and C. W. Townsend, in charge of its exhibits, by B. M. Hartsock, G. Baron, G. A. Hagar, George E. Baker, H. S. Clark, and A. E. Ferguson, in the work of reception and demonstration, and by W. S. Bartholomew and F. V. Green in the Convention rooms.

The Westinghouse Air Brake Co.'s exhibits are in charge of S. D. Hutchins, H. S. Kolseth and L. Lytle.

At Rooms 213-14-15, Frisco Building, Olive St. and Ninth St., the Crane Co. has established a Bureau of Information and Offices, for the convenience of customers and friends. No expense has been spared in fitting up these offices. There is a waiting room for ladies, a smoking room for the men, and a representative of the company and a stenographer are in constant attendance. Necessary stationery and telephone are furnished without charge. Letters and telegrams may be sent in care of the office. All patrons and friends of the company are cordially invited to make free use of these offices during their stay in St. Louis, and all persons interested are earnestly requested to make it a point to visit the Exhibits.

The Crane Co., Chicago has issued a special 94 page Pop Safety Valve catalog, 7x10½ in., which is known as Catalog No. 100 and will be sent to the trade upon request.

Mr. P. Albert Poppenhusen, president of the Green Engineering Co., of Chicago, personally conducts visitors to the installations of Green traveling ling grates at the Exposition.

The Star Brass Co., of Kalamazoo, Mich., is distributing a very useful as well as attractive souvenir among its friends. It is an aluminum letter opener, on one side of the handle of which is shown its new trolley wheel.

The Brown Corliss Engine Co. advises us that it has just shipped a large compressor to the J. I. Case Plow Works, Racine, Wis.

CONTINUOUS RAIL JOINT OF AMERICA.

The Continuous Rail Joint Co. of America, of Newark, N. J., has an exceptionally complete and interesting exhibit in aisle C, posts 7-8, Transportation Building, where are shown every variety of "Continuous" rail joints applied to a wide variety of rail sections, including T-rails from 30 lb. up to 100 lb., and girder sections from 5¾ in. to 9 in. in height. The exhibit includes

CONTINUOUS RAIL JOINT EXHIBIT

samples showing how every type of accepted rail bond on the market can be applied with the "Continuous" joint and there is also shown an entirely new form of bonding which has just been placed on the market by this company for use with its joints.

Another new specialty is a cross-insulated joint for use wherever an insulated rail joint is required. The exhibit also contains a sample of rail recently developed by this company for the New York Central & Hudson River R. R., illustrating a method whereby, by adding a lip or tram to existing T-rail all the advantages of a grooved girder rail can be secured. The Continuous Rail Joint Co. is also exhibiting for the first time samples of products from its English factory.

With the new form of bonding referred to a strip of copper 1-16 in. thick and 1 in. wide is placed on each side of the rail between the flange and the base of the fish plate and running the entire length of the plate. The under side of each fish plate is milled out to receive the copper strip and by special machinery the bearing surfaces on the fish plate and the rail flange are planed to give good electrical contact.

In forming the cross-insulated joint alluded to a sheet of fiber is placed under the rail flange the full length of the fish plates. For insulating the sides of the rail a sheet of fiber is inserted between the rail and one of the plates up to the end of the rail and is then continued on the opposite side of the rail to the end of the fish plate. The insulation between the ends of the two rails, known as the end post, is also of fiber. By placing the insulating material for half the length of the joint on opposite sides an actual metal bearing is secured equivalent to one-half the length of the joint, thus economizing the insulating material and securing greater mechanical strength.

JAS. G. WILSON MANUFACTURING CO.

The Jas. G. Wilson Manufacturing Co. of New York City has an exhibit on aisle E, post 50, Transportation Building, where are installed several types of steel and wooden doors and shutters for car houses, freight sheds, storage buildings, round houses, etc. The samples include Corrugated, double-edge, self-coiling steel shutter, sliding swing door; "Interlooping" corrugated rolling steel shutter, and "Salamander" fire proof rolling shutter. It will repay street railway men to inspect this exhibit,

GOULD STORAGE BATTERY CO.

The Gould Storage Battery Co's. exhibit will be found in block 16, aisle A, Electricity Building. Here the company shows practical adaptations of storage batteries to engineering work, the central feature of the exhibit being a battery of 60 Gould accumulators of the O No. 515 type. This is shown doing work under conditions which demonstrate the wide range of its applications in both central station and electric railway work.

By means of an induction motor coupled to a double generator or rotary converter in connection with a booster set various conditions can be artificially produced. Thus, for example, by using the induction motor to drive the generator as a direct-current generator, charging the batteries in connection with the booster set, will be represented a direct-current power house operating with a regulating battery in connection with a booster; also, when the induction motor is disconnected to operate the rotary representing an ordinary rotary sub-station in connection with battery and booster. Other combinations demonstrate the possibilities in close regulation of which the battery is capable under the most severe conditions.

A unipolar generator and two U type cells having from 3,000 to 5,000 ampere capacity are also installed to work in connection with the battery and motor-generator set for the same purpose.

A group of four cells are displayed, one of them being the large cell which was exhibited at the Pan-American Exposition, and which has a discharge capacity of 27,000 ampere hours at a 2,000-ampere discharge rate.

AMERICAN FROG & SWITCH CO.

The American Frog & Switch Co., of Hamilton, O., has an exhibit covering 1,000 sq. ft. of space between posts 13 and 14 in aisle C, Transportation Building. The exhibit comprises chiefly three different styles of split switches, from a light rail

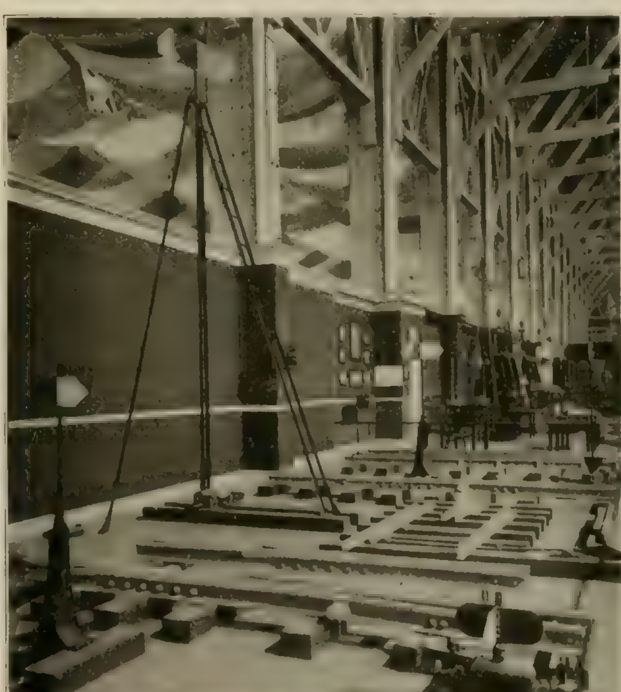
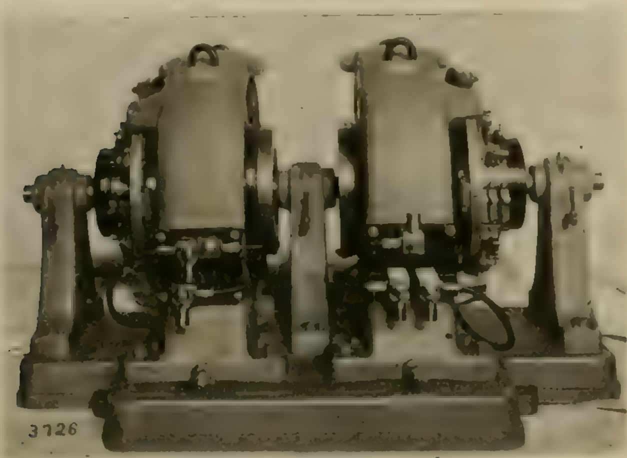


EXHIBIT OF AMERICAN FROG & SWITCH CO.

switch up to the latest design of a reenforced split-switch with adjustable head bars, and two styles of spring frogs, designated the "Des. 1" standard and the "Des. 18" hinged wing rail frog. In addition, the company shows three rigid frogs and six types of switch stands, ranging from the plain ground throw to the high ladder stand with connecting rods. These products are well known to electric railway men, as all of those comprising the exhibit are similar to those with which the company has already equipped a number of suburban and interurban systems.

WESTERN ELECTRIC CO.

One of the most interesting exhibits of modern electrical apparatus at the Fair is to be found in space 17, located near the southwest corner of the Electricity Building, occupied by the Western Electric Co., of Chicago and New York. For the visitor's convenience the space has been divided by aisles into five parts, in each one of which apparatus pertaining to some particular branch of the lighting or power business will be found. Walking from the main aisle to the central enclosure the visitor comes to a large motor generator. The motor part of this set takes current from the 500-volt power circuit of the Exposition



WESTERN ELECTRIC MOTOR GENERATOR SET

company and the generator delivers current of 220 volts at the distributing switchboard located nearby. This motor generator operates in conjunction with a compensator so that current of 110 and 220 volts is available for distribution with the result that from this unit power motors, fan motors, arc and incandescent lamps of 110 and 220 volts are operated in different parts of the Western Electric Co's. space.

Some of the advantages derived from an installation of this character are shown in a striking manner in the corner of the Western Electric Cofi's exhibit, given up to motor driven machine tools. Here, aside from furnishing the light, current of 110 and 220 volts from the motor generator is used to operate a series of variable speed motors, direct connected to machine tools of different kinds.

The Western Electric Co.'s system of variable speed motors shown is a somewhat recent and very important development, and one of the chief points of attraction in the exhibit.

WhWere these variable speed motors are installed for machine tool work, a three-wire, equal voltage system, such as the one in use, is recommended, the potential of the outside wires being from 220 to 250 volts and that between the neutral and outside wires being from 110 to 125 volts.

Among the many points of advantage claimed, the following are the most prominent:

A perfect system of distribution for incandescent and arc lights.

A motor speed range from 4 to 1, or 6 to 1.

Minimum first cost owing to the simplicity of wiring.

The following tables of data relate to the individual machine tools seen in operation in this exhibit:

For machine tools requiring a great speed variation, the Western Electric Co. has designed a special controller, shown in active operation on the shaper and engine lathe in the exhibit. To those versed in the operation of machine tools an inspection of these controllers will prove of great interest, for aside from containing all modern improvements a special reversing attachment is included within the device, enabling the attendant to secure the same number of speeds in the reverse as are obtained in the forward direction.

In designing this controller the Western Electric Co. has taken into consideration the fact that all machinists who operate lathes are not electricians; hence, every safeguard has been used to prevent accidents or damage to the electrical apparatus through carelessness or unfamiliarity.

The controller at the head of the lathe is operated by means of a lever arranged upon the lathe carriage or apron so that it is always within reach of the attendant. As a further precaution a telltale lamp is mounted so as to be always within the direct range of the attendant's vision, and gives warning when the controller is not left on a regular running notch. Also there is an absolute stop of the handle at off position so that controller cannot reverse the motor if handled by a careless operator.

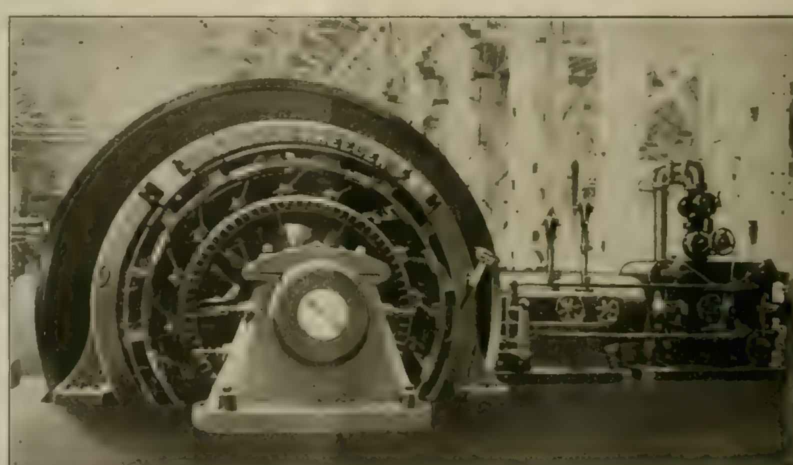
The compact manner in which the "live" parts are assembled within the controller case, all readily accessible and similar parts interchangeable, at once commends itself to the expert in these matters. With these controllers 15 different speeds in each direction between the maximum and minimum may be secured.

The machine tools operated in connection with the Western Electric Co's. exhibit include shapers, engine lathe, milling machine, upright drill, planer, radial drill and a gear cutter.

CROCKER-WHEELER CO.

The Crocker-Wheeler Co., of Ampere, N. J., furnished the electrical generating equipment for operating the Intramural Ry., there being seven units thus employed, located in Machinery Hall, the combined generating capacity of the units being 3,500 kw.

Each unit is a standard Crocker-Wheeler railway type generator direct connected to the prime mover, as follows: A 900-kw. generator, running at 100 r. p. m., is driven by a Buckeye cross-compound steam engine; a 600-kw. generator, running at 85 r. p. m., is driven by a Lane & Bodley horizontal cross-compound 20 and 40x54-in. engine; a 500-kw. generator, running at 100 r. p. m., is driven by a Murray Iron Works 26x48-in. single cylinder rolling mill type corliss engine; two 500-kw. generators, running at 135 r. p. m., are driven by Brown-Corliss vertical cross-compound engines; a 400-kw. generator, running at 150 r. p. m., is driven by



CROCKER WHEELER CO. EXHIBIT

a Harrisburg horizontal tandem compound 15 and 40½x26-in. engine; a 100-kw. generator, running at 700 r. p. m., is driven by a Doble water wheel.

These generators are of the same general type. The cast-iron magnet frame is of the internally flanged type, which gives a maximum magnetic reluctance and a maximum strength. The field coils are made up in three or four sections individually wrapped, taped and insulated, and separated by small wooden blocks to improve the heat radiating qualities. The pole shoes are detachable, so the coils may be removed or replaced. The armature is of the iron-clad type, consisting of a toothed core of

laminated mild steel in the slots of which windings are protected by wooden wedges fitting in notches near the tips of the teeth. Very careful attention is given to the insulation, the formed conductors being bound and varnished and the slots lined with heavy insulation.

The commutators are made of high grade drawn copper with ample surfaces to carry current without undue heating and to give a large radiating capacity. Each brush rigging consists of a rocking ring held by brackets bolted to the field frame, which in turn supports brush-holder arms with independent brushes on each. The brush holders are of the parallel movement type characteristic of Crocker-Wheeler apparatus. On each one four sets of laminated copper strips carry the current and control the movement of the brush from or towards the commutator, always maintaining the same angle with its surface. This causes the brushes to wear away evenly, and as they become shorter allows them to be extended and clamped in a new position without altering the surface of contact.

The brush pressure is regulated by a helical spring which does not carry current and hence is less inclined to heat and vary its tension. When desired, the brushes may be lifted from the commutator and held away from it by a half turn of the adjusting screw, a feature that is especially useful when it is expedient to test individual brush resistances, or certain windings for grounds. To compensate for inequalities among the magnetic circuits, or to secure the position of sparkless commutation, the brush-holder arms may be shifted independently. When the various circuits are in equilibrium the entire rocker ring may be revolved, by the hand wheel, sufficiently to give a further adjustment.

Besides the generators which the Crocker-Wheeler Co. has in the Intramural Ry. power plant, the model printing office in the Administration Building is equipped with Crocker-Wheeler motors, and a large number of this company's motors will also be found in operation in the exhibits of machine tools.

CLIMAX STOCK GUARD CO.

The Climax Stock Guard Co., of Chicago, has a practical exhibit in aisle J, post 95, Transportation Building, where the Climax cattle guard is applied to a section of track, showing the actual conditions as they exist when the guard is applied on the railroad.

EXHIBIT OF CLIMAX STOCK GUARDS

The Climax cattle guards have been designed so that they more than meet the requirements of surface cattle guards, as outlined by the committee of engineers of the Maintenance of Way Association. These guards have won the hearty commendation of both the engineering and maintenance departments of many companies in whose tracks they have been placed during the past three years, and the service that the Climax guard has given conclusively substantiates the claims made for it. In addition to its meritorious features it costs less for maintenance than any other.

The Climax guard is made from shale clay, burned hard and vitrified; it has a perfectly smooth glazed surface with inverted V-shaped ridges; it never needs painting, repairing or attention of any kind; it never warps or gets out of place; it can neither burn, rust nor decay; it is always free from snow, water, dirt and rubbish, for, having a perfectly smooth surface, it is cleaned by the draft of passing trains. These and many other merits of the Climax stock guard commend it to the attention of railway officials.

The Aurora, Elgin & Chicago Railway Co., the Canton-New Philadelphia Electric Railway Co., the Chicago & Milwaukee Electric Railroad Co., the Cincinnati, Dayton & Toledo Traction Co., the Cleveland, Painesville & Ashtabula Railway Co., the Cleveland & Southwestern Traction Co., the Columbus, Delaware & Marion Railway Co., the Dayton & Western Traction Co., the Des Moines Inter-Urban Railway Co., the Illinois Valley Traction Co., the Scioto Valley Traction Co., the Utica & Mohawk Valley Railway Co., and the Stark Electric Ry. are among the prominent roads which use the Climax stock guard with most gratifying results.

OIL AND WASTE SAVING MACHINE.

We illustrate herewith an oil and waste saving machine made by the Oil & Waste Saving Machine Co., recently incorporated, with office and works at Rochester, N. Y., and offices at 170 Broadway, New York City. This machine is known as the "Patterson Waste Machine." It is designed to afford an easy, complete, economical and safe means of reclaiming both oil and waste, saving 98 per cent of the oil or grease and all of the waste, so that they may be saved and used over and over again.

The oily waste is placed in a perforated metal basket which is surrounded by an outer casing. The basket is mounted on a vertical shaft running in phosphor bronze bushings and on ball-bearing steps. Attached to the shaft at the bottom of the basket

OIL AND WASTE SAVING MACHINE

is a series of turbine blades. A jet of live steam striking these blades causes the basket to revolve at the desired speed, after which the exhaust steam passes up into the basket and out through an exhaust pipe.

The exhaust steam from the turbine heats the waste and liquifies the oil, which is extracted by centrifugal force and runs out of the bottom of the machine, through a trap, into a receptacle.

The complete separation of the oil and waste is accomplished in less than 30 minutes, with a steam consumption equal to 15 lb. of water on a machine with a 20 in. basket, and 30 lb. on a machine with 36 in. basket.

The device is the invention of Thomas S. Patterson, a well-known mechanical engineer, and is protected by various patents, issued and pending, in various countries. The machine has a vertical shaft running in a well of oil; it has no outside running gear, no exposed parts, no stuffing boxes, and requires no attendance except for loading and unloading.

The Patterson waste cleaning machine has been installed in some of the largest power plants; it has been saving more than 100 gallons of oil daily for the last eight months at the Brooklyn Rapid Transit Co's. plant at 2nd St. and 3rd Ave., Brooklyn, N. Y.; it has reduced the consumption of waste in the 8,000-h. p. plant of the New York & Queens Light & Power Co., Astoria, L. I., to one pound per day, and it has shown similar results at other plants.

GALENA-SIGNAL OIL CO.

The Galena-Signal Oil Co., of Franklin, Pa., has a very attractive booth in aisles I and J, Transportation Building, furnished as a reception and reading room, where visitors are cordially welcome. This company, which is supplying lubricants under contract for use on 97½ per cent of the steam railroad mileage in this country and Canada, has established a street railway department. It is prepared to enter into contracts with electric railway companies to supply all the lubricating oils needed for power houses, repair shops and rolling stock, to be furnished under written guarantee that they are the best oils that can be manufactured for the purpose.

WESTERN CAR HEATER EXHIBIT.

The Franklin Railway Supply Co's. exhibit of car-heating material is located in the Transportation Building, aisle D, post 58, in charge of the company's St. Louis representative, Mr. William H. Davis.

The Western car heater is shown piped as it would appear in a passenger car and demonstrates the small amount of space taken up by this equipment. This heater has recently been placed on the new cars of the Metropolitan West Side Elevated Railroad

FRANKLIN RAILWAY SUPPLY CO. EXHIBIT.

Co., the Milwaukee Electric Railway & Light Co., the Rochester Railway Co., the Syracuse Rapid Transit Co., and many others.

Mr. Kenneth D. Hequembourg, manager of the car-heating department, applied last year for patents on the many improvements that make this system practicable and is advised by the U. S. Patent Office that several of his claims have been allowed.

Street railway officials will find it to their advantage to take this opportunity to examine this apparatus and will quickly see why the water-jacket heater has been so generally adopted during the past year.

SILVEY STORAGE BATTERIES.

At the present time engineers are much interested in the many unique features embodied in the construction of the central station type of Silvey storage cells manufactured by the Dayton Manufacturing Co., of Dayton, O. The positive plates are cast from lead containing a considerable proportion of antimony designed to make them very hard, so that it is practically impossible for them to warp or "buckle" during heavy charge or discharge periods. A large number of circular holes about one inch in diameter are spaced at regular intervals across the surface of the grid and in these holes are inserted rolls or "buttons" made up of long strips of thin corrugated lead ribbon. As the ribbon is rolled up a "paste" or active material is forced into the corrugations and when the plate is placed in service this "paste" forms up in a comparatively short period and as time passes the lead ribbon itself forms up and becomes active, due to the electrochemical actions which take place. For this reason the plate continues to increase in capacity with increase in age.

By this method it is not necessary to immerse the plates in nitric or other acid in order that the ribbon may be rendered spongy or porous. When nitric acid is used it must be removed by thoroughly washing and rewashing the plates, for if the slightest traces remain in the plates local action will result, troublesome "lead trees" will form and may bridge between plates so that the battery will rapidly discharge when standing idle.

In the Silvey battery the negative plates have a latticed framework which is pasted and hardened by a special process, making it practically impossible for the active material to be removed.

In assembling the cells each individual plate is bolted to the bus bar between cells, by two heavy ½-in. lead bolts and is then arc-welded. This method permits an individual plate to be removed from the cell at any time, as the weld is made light enough to be easily broken after the bolts are removed. A handsome new catalog just issued fully illustrates these cells.

GREEN TRAVELING LINK GRATES.

One of the interesting features of the "Service Exhibit" at the Exposition is the operation of the Green travelling link grates, which have been installed under the Heine boilers. This service power plant is operated by the Louisiana Purchase Exposition Co. and furnishes power and light which is used on the Exposition grounds. The Green traveling link grates are manufactured by the Green Engineering Co., of Chicago, and after their installation and the completion of the plant it was turned over to the Exposition company for operation. The Green Engineering Co. is the only stoker exhibitor which has not had its own fireman in constant attendance, all other exhibitors having their own experts to co-operate with the employes of the Exposition company.

ALBERT & J. M. ANDERSON MANUFACTURING CO.

It is to be regretted that the Albert & J. M. Anderson Manufacturing Co., of Boston, Mass., the well-known maker of electric railway, light and power specialties, is not exhibiting at the Exposition. We are advised, however, that the company has been and is extremely busy, both in the manufacture of line material and insulators and of switches and switchboards. In fact, this has been an unusually busy season with this company.

BURT MANUFACTURING CO.

The Burt Manufacturing Co., of Akron, O., is well represented by numerous installations of "Cross" oil filters (the company's specialty) at the Exposition. The main service plant is equipped with a large No. 3 "Cross" oil filter, and among the exhibitors' plants which are equipped with "Cross" filters are those of the C. H. Bradley Co., the Buckeye Engine Co., and the De Laval Steam Turbine Co. The Burt Manufacturing Co's. representative may be found at block 52, aisles G and 11, Machinery Building.

Mr. Giles S. Allison is dispensing hospitality and good cheer at the Security Register Co's. booth in the Transportation Building, at the same time taking advantage of every opportunity to display the merits of the various types of registers handled by him and the Skinner station indicator and car sign.

Paper cutters make good souvenirs and those Mr. G. E. Pratt, mechanical engineer of the Star Brass Works, is distributing are well worth taking home.

E. W. BLISS CO'S. EXHIBIT.

The E. W. Bliss Co., of Brooklyn, N. Y., manufacturer of the well-known "Bliss-Projectile Brand" gears and pinions for street railway motors, has a large attractive exhibit which occupies the whole of block 24, Machinery Hall. Here are shown special presses, punches, shears and machines for forming and stamping sheet metal, and there is also exhibited a motor gear, surrounded by and meshed with eight standard pinions, from 14 teeth to 21 teeth, 3 diametral pitch, the accuracy of gear and pinions being such as to permit all being revolved by the slightest pressure of the hand.

The Bliss company gears are made of high grade open hearth steel castings and the pinions of a special high carbon steel, each pinion billet being subjected to a pressure of over 1,000,000 lb., which solidifies and toughens the stock.

The company's armature notching machines and repair shop tools will also be of especial interest to railway men.

HEINE BOILERS AT THE FAIR.

The Heine Safety Boiler Co., of St. Louis, has three operative, or working exhibits at the Exposition, besides a still exhibit in block 53, aisle H, Machinery Building. Of the working exhibits the principal one consists of eight 400-h. p. boilers of the single shell type, set in four batteries of two boilers each. These boilers are equipped with Green Engineering Co's. traveling chain grates and induced draft apparatus. This exhibit will be found in the Steam, Gas and Fuels Buildings.

Located in the outside Mining Exhibit the Heine company has two 210-h. p. boilers of the single shell type in the fuel testing plant of the United States Geological Survey. Three Heine 250-h. p. boilers of the double shell type are used to operate the Ferris wheel.

In the still exhibit are shown parts of boilers illustrating constructive features and samples of tested material illustrating the quality of the materials used.

WOOL FELT FRICTION PLATE FOR EMERGENCY CAR BRAKE.

The accompanying illustration shows the wool felt friction plate employed under the Fresh emergency car brake, made by the Emergency Car Brake Co., of Cumberland, Md. The use of wool felt for brake friction was decided upon after the company had made many trials and had found it superior to emery, carborundum, wood, rubber, corrugated iron or steel and other material. It was found that neither expansion nor contraction injured the frictional qualities of the felt. In fact, when the felt comes in contact with water or ice it absorbs the moisture, thereby expanding and offering greater resistance between the wheels and the rail.

FRICTION PLATE

The elasticity of the wool felt obviates the jarring caused by using harder materials, and its adhesive quality enables it to retain its grip on the rail until the car is stopped. This material has proved fully equal to the hardest braking requirements; it is very durable and can be quickly replaced at small cost.

AMERICAN CONDUIT CO.

The American Conduit Co., of Chicago, New York and Los Angeles, has a very attractive exhibit, considering the nature of the product, which occupies a space 50 ft. long in the west colonnade of the interior of the Electricity Building. The main feature of the exhibit is a section of a city street, showing the details of construction of underground cableways when bituminized fiber conduit is used. At one end of the section is a manhole, where the 20 ducts terminate.

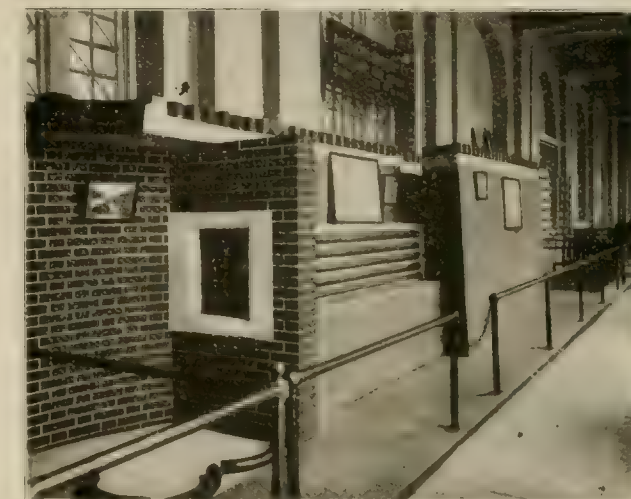


EXHIBIT OF AMERICAN CONDUIT CO.

A side view of the conduits shows them laid in cement, and the end of the trench is also shown, illustrating how the successive layers of the conduits are laid, and also the method of joining the successive 7-ft. lengths of conduits. This latter is done by a male and female joint turned in a lathe to an accurate fit. At the time of construction the female joint is dipped in a solution, which soon hardens and seals the joints between the various units, preventing leakage of water or gas into the conduit.

American bituminized conduit is constructed by rolling layers of specially prepared fibrous paper on a mandrel. The paper is saturated with a bituminous compound, which under high temperature and pressures employed in the rolling process so unites the layers that the product is a solid, stiff tube. Bituminized conduit is non-abrasive, moisture-proof and non-corrosive, and, it is believed, electrolysis-proof.

The American Conduit Co's. exhibit also includes conduits ranging from 1 in. to 10 in. in diameter, and the method of crating for shipment is shown. On the walls of the exhibit space are a number of photographs showing installations of this conduit in various cities.

INGERSOLL-SERGEANT COMPANY'S BIGGEST CONTRACT.

The Ingersoll-Sergeant Drill Co., of New York City, was recently awarded a contract by S. Pearson & Son, Incorporated, for two complete compressed air power plants, ready to operate, to be employed in building the Pennsylvania R. R. tunnels under the East River and Long Island City, N. Y. The combined capacity of the plants comprises 50,000 cu. ft. of low pressure air per minute and 12,000 cu. ft. of high pressure air per minute. It will be recalled that the Ingersoll-Sergeant company, a short time ago, received an order from the O'Rourke Engineering & Construction Co. for the compressed air plants to be used in building the Pennsylvania tunnel under the Hudson River.

The contract just awarded is the largest order ever placed in the history of the business. It includes 12 air compressors, 10 aftercoolers and 12 air receivers. The equipment for the two East River plants will include 10 Stirling boilers of 500 h. p. capacity each, 2 gravity oiling systems, 10 feed-water controllers, 4 forced draft fans and engines, 6 duplex feed pumps, 2 open feed-water heaters, 6 surface condensers, 6 air and circulating pumps for condensers, 2 hot well pumps, 6 centrifugal circulating pumps with engines, 6 oil separators, 2 air intake conduits and stacks and all piping, covering, rails and steam separators. The plants will be erected under the supervision of Mr. J. H. Jowett, sales manager of the company.

Thomas Prosser & Son, of New York, the American representatives of Fried. Krupp, of Essen, Germany, are represented at the convention by F. A. Barbey, of Boston, and George H. Bryant, western representative, with headquarters at Chicago.

Dr. C. B. Forward, representing the Eclipse Railway Supply Co., of Kansas City, Mo., gives daily exhibitions of the Eclipse car fender between stations 2 and 3 on the Intramural Ry., the exhibitions taking place between 1:30 and 5 p. m.

ONLY RUSSIAN BUILDING AT THE FAIR.

The only Russian building at the Exposition is a pavilion in the Palace of Transportation, which was erected by the Westinghouse Co., Ltd., of St. Petersburg, as a feature of the Westinghouse brake exhibits. It is representative of Russian art and workmanship and is recognized as the Russian rendezvous at St. Louis. In the Palace of Machinery the same company has furnished a small Russian kiosk, and at both places, as a manifestation of Russian hospitality, Russian tea and suchari are served to visitors by Russian girls wearing richly embroidered boyarin costumes.

The pavilion in the Palace of Transportation is 20x25 ft. in area and 25 ft. high. It was constructed by peasant builders in the Possade Sergiewo, near Moscow, after designs by the native architect, Baranowsky. The material used throughout is a white pine from the forests around Moscow, very effectively stained in the case of the carved furniture, all the interior decoration having been designed by Durnowo. The ornamental pottery and bric-a-brac were collected from various museums and the hangings in the pavilion and kiosk follow out the general design of the interior artist and were made of wool by peasant workers. One entire wall is covered by a hand-painted map of the world, by Ingenier Prochanof.

Mr. U. Grant Smith, brother of the general manager of the Russian Westinghouse company, is in general charge of the exhibit, and Gospodin M. N. Konshin, of St. Petersburg, receives and welcomes his countrymen at the Exposition.

Among the interested visitors at the Mechanical and Electrical meeting Tuesday was Mr. W. T. Van Dorn, of the W. T. Van Dorn Coupler Co. Mr. Van Dorn was accompanied to the Exposition by Mrs. Van Dorn, Miss Edith Van Dorn, Mr. Herbert E. Van Dorn, Master William E. Van Dorn and Miss Grace Brigmann.

DAILY STREET RAILWAY REVIEW

6TH YEAR No. 4 | OCTOBER 14, 1904. | SERIAL NO. VOL. XIV. No. 9 D

ADDRESS OF PRESIDENT F. E. SMITH, OF THE STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA AT THE EIGHTH ANNUAL CONVENTION.

We are assembled here for our eighth annual convention among surroundings more varied and of an entirely different character than any we have heretofore enjoyed. It is perfectly proper, however, that an Association which stands, as does ours, as typical of the advanced ideas of modern electric railroading, should hold its meeting at this exposition, where are shown the latest and best results of human ideas as exemplified in the arts and sciences. The outside attractions are so great we shall have to curb our natural desire for sight-seeing and attend strictly to business during the few hours which are allotted to us, if this meeting is to be as successful as those of former years. In this connection let me state that this session is held this afternoon in order that we may devote the whole of the two days allowed us in the Transportation hall, to the discussion of the reports there to be presented. It was felt by your executive committee that two sessions a day would not be practical, and we determined to start our meetings a little earlier than usual and continue them a little longer at the one daily session and let the members spend the rest of the day as they desired. We had expected this session would be held at the Inside Inn and so stated on our program sent you in advance. Finding, however, that the official programs that were being distributed here, stated that our meeting would be held in the Transportation Building, we thought it would be less confusing to come here.

Tomorrow we are to try an experiment in having a joint meeting with the Mechanical and Electrical Association and I shall be very greatly disappointed if we fail to find that this joint meeting has been productive of good results and that it is but the forerunner of many others of a similar character in years to come. It may not be out of place to state to you how this came about. Shortly after my appointment last year I began to think of this year's meeting and of suitable topics for papers and discussions. I took the matter up with the other officers and the executive committee. One of the subjects we decided upon was that of reports covering operations of car houses and car shops, and a committee was selected, subject to their acceptance of the appointment, to present a report. Before the matter had been taken up with this committee, however, the executive committee of the Mechanical and Electrical Association had held a meeting and selected a committee of one to prepare a paper on practically the same subject; it was then that the idea of having a joint report by committees representing both our Associations, to be presented at a session that we could both arrange to attend, occurred to me and the matter was taken up with the president of the other Association, who was heartily in accord with the idea and who has done his share in perfecting the arrangements. Tomorrow we are to have the result.

Our members must not forget that inasmuch as this meeting takes place on one of the days allotted to our Association, the members of the Mechanical and Electrical Association are in a [illegible] of ours and we should take especial pains to make them feel at home and feel repaid for waiting, as many of them [illegible] to take part in this discussion. I spoke of this as being an experiment for the reason that so far as I know, it is the first joint session ever held between the accountants of either steam or street railroads and any of the operating departments. [illegible] it will be the [illegible]. Managers are fast realizing [illegible] of good that can be obtained from our department if they will only call on us for the statistical information we are in a position best to provide them, and the idea that we were simply book-keepers and that to a large extent the department was a source of needless expense, has practically died out and we are looked upon as a necessary part of the organization of a railway company. We don't make the wheels go 'round but the inquisitive one who wants to see how they go is getting into the habit of looking through our specs to see if they are running right. Before we knew that our time was to be so limited we had anticipated having a committee prepare and present a report on the proper reports covering the operation of power plants, in so far as it affected the accounting department.

Your executive committee at its meeting in April last decided it best not to take up that subject this year. I learn a movement is under way to combine the maintenance-of-way department with the mechanical and electrical departments and have them all in one association. Should this be brought about there are a number of subjects for future joint meetings that can be most profitably discussed. We shall have for our discussion at the Saturday session the questions as submitted to the question box with such others as may be presented at that time. This question box idea is growing. It seems to be a short way to be of mutual help. I was quite a little surprised to see how few of our members had matters which bothered them, or, having them, cared to submit them to the association for discussion. I am particularly pleased to find that answers have been submitted by a number of companies which are not regularly represented at our meetings and that they did not hesitate to sign their answers. This shows that interest in the work of the Association is not confined to those representatives who are able to attend the meetings. It is a matter of regret that so many of the members located in the larger cities failed to send in answers, but I trust their representatives will attend this convention and take part in the discussions. From the answers submitted it will be seen that there is quite a diversity of opinion regarding the proper treatment of the matters covered by the questions and it would seem as though the discussions on the floor ought to be very interesting.

It is a pleasure to be able to state that there has been a slight net gain in our membership during the past year, as will be shown by the report of the secretary. The increase has not been as large as we had hoped. Your officers have written numerous personal letters with only moderate success, and had it not been for the booklet gotten out by our able secretary setting forth so admirably the advantages to be derived from being connected with us, it would probably have been my lot to pattern after some of the Russian generals and "regret to report, etc." I am of the opinion that the increase in the State Associations is having the effect of retarding our growth and that it will take the united effort of all our members if we are to have any substantial gains in the future.

The committee which prepared the "Report for Electric Railways" which this association approved in Detroit and which was approved and adopted by the National Association of Railroad Commissioners last year, thinking they had fully completed their labors asked to be discharged at the Saratoga convention and as they were not a standing committee, this was done. The members of that committee have had considerable correspondence during the year in connection with their report

and are liable to have more at times. It would seem to be, therefore, a good plan to have a permanent committee in charge of this subject, and I trust some action will be taken at this convention with that end in view.

You will remember that at the Saratoga convention Mr. Duffy, as chairman of the standardization committee, gave us an outline of a form of report that has been prepared for the Municipal Tramways Association of Great Britain and spoke of the efforts he had made to have them adopt the form prepared for use in this country. I think it is a misfortune that Mr. Duffy was unable to attend the Glasgow convention as he had expected, as I believe that he would have been able to persuade the members that our report could be made to cover their conditions and adapted to their ways (not only maintenance-of-ways but other ways) and that they would have adopted a report more nearly like our's than the one they finally adopted. We were invited again this year to have representatives of our association attend their conference but the invitation came too late to be acted upon. However, it is evident they look with favor upon our Association and it is to be hoped the kindly feeling will continue. We can assure them of our best wishes for their success.

There was held last month in Vienna the biennial convention of the "International Tramways & Light Railway Association," at which time there was presented a report from a committee on a standard form of monthly operating report. This report will be found in full in the Street Railway Journal of September 10th, 1904, and in the same issue is a most able editorial on the subject, in which there are pointed out many of the defects in the report and a plea is made for the adoption by them of the American report. The editor says in concluding his article:

"We must, however, again argue as we did a year ago for one standard international report. We believe it to be a necessity. The rapid standardization of operating practice must bring standard accounting. One cannot come without the other as it is impossible that standard operation can come except as it follows standard accounting. Operation cannot be compared nor can comparisons be utilized unless the accounting shall first be upon a similar basis.

"At this present time the situation is that America has a standard classification and form of report so firmly established and widely adopted by both operating companies and financial interests that it is an actual standard. Its predominant position has been strengthened in this country through its adoption by both the United States Government in its census work and by the National Association of State Railroad Commissioners. It has been in service for a long time, and by its flexibility and utility has given such satisfaction that it could not be changed without endless confusion. On the other hand, as we pointed out a year ago, there is nothing in any of the European forms of reports but could be adapted to the American with but slight changes. It seems to us, therefore, there is hardly more than one side to the question, and we hope that our European confreres are not permitting the word American to deflect them from endeavoring to obtain a standard report that will be actually international. They will certainly not be able to obtain the results which all desire from a standard report if they permit themselves to adopt three forms. Through the operation of the tremendously virile ideas of the last half century the world has become to all practical purposes very much smaller than it was fifty years ago. Securities are held in other countries than those in which the investments are located, and we submit that the time is coming when, among other demands, a standard form for electric railways will be one. We submit further, that the one which happened to be composed and adopted first in America, is by its simplicity and adaptability, one which can be without excess of confusion and no greater expense adopted by Europe, thus clearing what will eventually be, should this course not be followed, the atmosphere of confusion and uncertainty."

It seems to me that our association should take some action in this matter. We are the pioneers of street railway accounting. We have been exceptionally successful in our efforts so far and may reasonably look for the same success in the future. I think our association should appoint a committee whose duty it would be to get in touch with the associations of Great Britain (as I understand that beside the association of roads owned municipally there is another made up of the companies controlled by private capital) and also with the International Tramways & Light Railways Association and endeavor to bring about the preparation of a report that should become international. The advantages of such a report cannot be overestimated and I trust this Association will give the subject careful consideration and take such action in the matter as may bring about results which, it seems to me, are so promising for good.

Your president learned indirectly that some of the members of the International Tramways & Light Railways Association purposed visiting this country and attending the exposition at St. Louis and an invitation was extended to them through a friend of our Association who was in a position to bring it before them with the least possible delay, to so time their visit as to be here at this time and meet with us. I am afraid, however, that even with these precautions our invitation went forward too late to be acted upon this year. I trust it will serve the purpose of bringing our Association to their notice and that it will result in having them send representatives to our next meeting.

That this Association is held in high esteem by the National Association of Railroad Commissioners is again evidenced by the fact that, as your president, I have been called upon to name a committee of three who shall represent us at the annual meeting of that association to be held in Birmingham November 15th, 16th and 17th, and I have appointed as such committee Messrs. Ham, Duffy and Mackay, all of whom have represented us at other conventions of that association, and I am sure will do so most ably at the coming one. In the event that any of the gentlemen are unable to attend, Mr. Brockway will serve as alternate.

At the Saratoga convention Mr. E. M. White of Hartford was appointed a committee of one to collect and arrange a new set of blanks for the use of members. This he has done and you will find them displayed in the rooms set apart for our meetings in the Transportation building. I am afraid very few of us will appreciate the vast amount of labor it was to get this large number of forms so systematically arranged and I am sure I but voice the feeling of our members when, on behalf of the Association I thank him for the great service he has rendered it and assure him of our hearty appreciation of his work.

In concluding I desire also to thank the officers and committees who have served during the past year, for their hearty co-operation and earnest efforts for the success of the Associa-

STANDARD BRAKE SHOE CO.

The Standard Brake Shoe Co., with general offices and works at Aurora, Ill., has designated and is manufacturing steel back brake shoes with re-enforced lugs, for high speed service. This company is also placing on the market its well known composition inserted shoe, with corrugated pocket. Prompt deliveries, high class shoes and interesting prices is the company's motto. The Chicago office of this company is in the Railway Exchange Building. Mr. C. P. Wright, superintendent and treasurer, and Mr. F. C. Peck, general salesman, represent the company at the convention.

tion.

The Westinghouse publicity department has issued invitations to the delegates to visit the Westinghouse headquuarters in the Machinery Building, and to the further exhibits in the Electricity and Transportation Buildings; also to a special display of the Westinghouse biograph pictures to be given for the delegates in the Westinghouse Auditorium Friday afternoon from 2:30 to 4 o'clock. It is also announced that return tickets to points east of Pittsburg, Pa., via the Pennsylvania lines, permit stop-over at Pittsburg, and the delegates are cordially invited to avail themselves of this privilege and to visit the works of the Westinghouse Companies there.

Mr. A. J. Bemis, of the Brockton & Plymouth Street Railway Co., Plymouth, Mass., has been appointed general manager of the Cape Breton Electric Co., Ltd., Cape Breton, Canada.

STEAM TURBINE POWER PLANTS.

NOTES ON THEIR EQUIPMENT AND OPERATION.

READ BEFORE THE AMERICAN STREET RAILWAY ASSOCIATION OCT. 15, 1904, BY J. R. BIBBINS

The steam turbine has long ceased to be a novelty—it is an established factor in modern power undertakings, particularly those of great magnitude. Since its introduction to this Association in 1902, several forms varying more or less from the Parsons have been announced—the Curtis, Rateau, Reidler-Stumpf, Zoelly and others. The construction of these several forms has recently been presented in more or less detail before the several engineering bodies, so that this phase of the subject may be passed over in favor of the more practical questions arising in power plant work. Owing to the limitations of space and time available for preparation, it has been possible to consider only a few of the more important subjects, and to this may be attributed the topical nature of this paper.

Turbine Characteristics.

The service requirements of a prime mover in electric railway work are in many respects more severe than any other power service outside of the rolling mill. The fluctuations in load are so sudden and severe that the ability of the prime mover to regulate its speed is tested to the utmost. The simultaneous starting of many cars frequently creates an inordinate demand for power which can only be met by the prime mover possessing a large overload capacity. Furthermore, a high average or "all-day" plant economy must be maintained under these disadvantageous conditions.

The steam turbine seems to be almost ideal for fulfilling these conditions:

Its high speed constitutes an important regulating force;

Its overload capacity is large;

Its economy under fluctuating loads is exceptional.

First. As it employs simple rotary motion, the rotative inertia of the moving element becomes enormous at the usual operative speeds and automatically assists in the maintenance of uniform speed of rotation under wide variations in torque. Thus, the heavy fly wheels necessary for reciprocating engines to obtain the identical results are avoided. Independent of the inertia effect, the turbine governor has been brought to such a state of perfection that a normal speed variation can be obtained close enough to meet any commercial requirements, although a comparatively wide range is usually employed in alternating current work to facilitate parallel operation. In a recent test upon a 750-kw. turbine at East Pittsburg, a load of 2,014 h. p. was abruptly removed and it was found that the speed variation was but 3.07 per cent with this severe overload. Turbine No. 41, 1,250 kw., was tested under similar conditions by instantly throwing on and off 1,300 to 1,340 kw. by means of an oil switch. The speed variation was found to be 2.09 per cent average for three tests.

Second. High overload capacity may be secured by two methods. A turbine may be built with a maximum governing capacity of 1,500 kw. It may then be rated at 1,000 kw. with 50 per cent. overload capacity. But for normal loads it is evident that it will be largely underrated and, furthermore, its economy will be less at normal loads than at overloads, as the economy of the turbine increases progressively with the load. A more efficient method—and that employed in the Westinghouse-Parsons turbine—involves the use of a secondary admission valve identical in every respect with the primary admission valve but which operates only when a predetermined degree of overload has been placed on the turbine. The secondary valve admits high pressure steam to a later point in the expansion range of the turbine, thus for the time being increasing its capacity, with, however, a slight loss in economy. But its most important feature is that while enabling large overloads to be carried at a lower though still excellent economy, the best economy of the turbine is secured under normal loading, which condition prevails a large percentage of the time the machine is in operation. Thus the turbine formerly rated at 1,000 kw. may now be rated at 1,500 kw. or more, depending upon the overload capacity desired.

The curves, Figs. 3 and 4, indicate the practical range of overload capacity. In the case of the 400-kw. machine the speed curve shows clearly the point at which the secondary valve "took hold" and prevented further drop in speed. In this test the overload was only carried to 75 per cent, while in the test of the 750-kw. turbine it was carried to 2,147 h. p. or over 100 per cent.

An important difference is apparent between the character of the water rate curve for the turbine and for a reciprocating engine with cut-off valve gear. In the engine the point of maximum economy usually occurs at about three-fourths or eight-tenths full rated load. The turbine, however, reaches its maximum efficiency at about full load. As the rating of turbine and generator are identical, both may be operated at their respective best efficiencies at or near full load. The entire capacity of the turbine is thus made available for most efficient working. On the other hand, if the engine is running most efficiently, the generator is 25 per cent. below rating, and vice versa. Expressed in practical terms, this means that with turbines less power machinery is required for a given plant load, i. e., the effective capacity is greater.

Third. Economy: Many interesting discussions have lately appeared in the technical press relating to the comparative efficiencies of steam turbines and reciprocating engines, and in the end the general opinion seemed to be that each type of prime mover for some time to come will have a wide sphere of usefulness. There is no doubt that up to the present time no steam turbine has shown economies quite equal to those reported to be obtained with a European multiple expansion reciprocating engine tested under high vacuum and extremely high superheat. This fact is continually brought to our attention as a proof that the steam turbine is entirely without the pale of competition with the steam engine; but this is, indeed, a secondary consideration. Laboratory economics are interesting from a speculative point of view but the prime consideration is the comparative economy of

TABLE I.

TEST OF 750 KW. TURBINES, BUILT FOR BOSTON NAVY YARD AND MANILA TRAMWAYS.

Load, B. H. P.	Steam Pressure lbs.	Vacuum inches *	Superheat Fahr.	Speed, R. P. M	Water per Hour, lbs.	Steam Consumption per B. H. P. Hour.
Test A.		28 inches	100°.			
354.96	154.7	28	100.11	1,791.7	5,439	15.32
712	150.8	28.07	102.62	1,797.5	9,450	13.27
1,151.1	151.4	28.01	99.07	1,804.35	13,808.4	12.38
1,554.3	150.9	27.85	99.72	1,787.8	20,202.4	12.99
2,146.78	150.7	26.42	92.9	1,769.8	29,874	13.91†
† Vacuum 1½ inches lower in this test.						
Test B.		28 inches	150°.			
520.1	151.4	27.89	153.7	1,829.4	7,194	13.85
1,066.5	148.6	27.99	153.9	1,827.4?	12,580	11.79
1,345.8	149.9	27.99	152.2	1,807.8	15,370	11.42
1,529.3	149.2	27.76	153.5	1,792.9	17,592	11.50
Test C.		0 inches.	100°.			
761.06	153.5	.	93.94	....	18,303	24.06
1,544.56	149.2		85.33	..	36,248	23.46‡
‡ Superheat 15° lower in this test.						
Test D.		28 inches.	0.			
811.04	149.8	28.01	2.34	...	11,779	14.49
1,126.1	149.5	27.97	2.54		15,506.8	13.77
Test E.		0 inches.	0.			
1,074.7	190.1		[illegible]		3,037.1	28.26

* Vacuum referred to 30 inch barometer—sea level.

the steam turbine operated under its normal conditions with the average steam engine equipment now employed in power work and under the average conditions obtaining therein. A point to be borne in mind is that it is perfectly legitimate for comparisons of economy to be made between two prime movers under conditions which may be considered the most suitable and generally applicable. It is, therefore, held to be distinctly unfair to confine the turbine to a vacuum of 25 in. simply on account of the inability of the reciprocating engine to take advantage of higher vacuum; similarly with superheat. It is later shown that higher vacuum can be obtained in the case of the turbine at such small cost as to insure a handsome return under most conditions. The turbine is so constituted as to utilize the utmost benefits from this condition, and it should obviously be associated therewith.

As to actual economies obtained, results speak for themselves and it is unnecessary to institute comparisons for the sake of proving the superiority of any particular type of prime mover. The engineer and power plant manager are thoroughly acquainted with modern engine performance and they have been quick to appreciate and to adopt every commercially practicable means for further decreasing the cost of power at their station switchboard.

The range of economics obtained under definite conditions is well indicated by the following tests:*

The curves, Fig. 1 (Data in Table I.), represent the results upon a 750 kw. Westinghouse-Parsons turbine**tested under both excellent and poor conditions of service. With 28 in. vacuum and 100° superheat a steam consumption of 12.99 lb. per b. h. p. was observed at slight overload. A series of tests were run with superheat and without vacuum, and vice versa. It is interesting to observe that an economy of 13.77 lb. was obtained with 28 in. vacuum and no superheat, 23.46 lb with no vacuum and 100° superheat, and 28.26 lb. without either vacuum or superheat. The non-condensing results are excellent in view of the fact that the turbine was designed entirely for condensing service, and indicate what may be accomplished under conditions which are liable to obtain at any time in any power plant owing to loss of vacuum from accidents to the condenser or other causes. With the help of the secondary valve, an overload of 44 per cent. was carried during non-condensing runs, and over 100 per cent. condensing.

These results are in relatively close agreement with those obtained from the high pressure cylinder of a 1,250-kw. 2-cylinder turbine running non-condensing and tested independently of the low pressure cylinder. During normal operation of the complete machine, the receiver pressure approximates atmospheric at full load, and the high pressure cylinder may therefore be considered a non-condensing turbine.

TABLE II.

TEST OF 1,250 KW. STEAM TURBINE, BUILT FOR INTERBOROUGH COMPANY, NEW YORK

NON-CONDENSING HIGH PRESSURE CYLINDER ONLY

Load B. H. P.	Steam Pressure	Vacuum Referred 30 inch Barometer	Superheat F.	Water per Hour	Steam Consumption per B. H. P. Hour, lbs.
660	146.2	None.	None.	18,672	28.3
889.9	145.5	"	"	23,261	26.15
1,261	150.7	"	"	30,338	24.05

Subseqquent tests (B, Table I.) upon a 750 kw. turbine† of identical design with that above mentioned showed a steam consumption of 13.05 lb. per b. h. p. hour with 26 in. vacuum and 140° superheat at full load. At approximately full load, 28 in. vacuum and 150° superheat the steam consumption was reduced to 11.5 lb. These two machines are of the single cylinder type and identical in general design with the 5,500 kw. machines now nearing completion for large New York and Philadelphia power plants.

That these excellent economies are not alone obtainable in machines of considerable size is shown by tests conducted by Messrs. Dean & Main upon a 100-kw. turbine.* With 28 in. vacuum a steam consumption of 12.06 lb. per b. h. p. hour was obtained with 104° superheat, and with 182° superheat, 11.17 lb. These results are shown graphically in Fig. 5. Reduced to a basis of engine i. h. p. by the method indicated, this is equivalent to 10¾ lb. per i. h. p. hour, and is approximately constant throughout a wide range of load. Another turbine of the same size (x) was purposely tested under extremely unsuitable conditions: with 125 lb. pressure, 26 in. vacuum and no superheat a steam consumption of 15.41 lb. per b. h. p. hour was observed at full load.

TABLE A.

DATA ON TURBINE PLANT EQUIPMENT.

WESTINGHOUSE-PARSONS TURBINES.

A – B = inc. A, exc. B.

Pressure				Superheat				Vacuum			
No. plts	% plants.	% capcy.	Press. lbs. per sq. in.	No. plts	% plts	% capy	Superheat deg. F.	No. plts	% plants.	% capcy.	Vacu'm. inches.
6	13.	36.3	165	14	30.4	38.4	100	2	4.3	35.1	26.5
5	10.9	32.3	175	3	6.5	26.1	150	4	8.7	26.7	27.5
23	50.	19.8	150	21	45.6	20.2	0	17	37.	18.2	27.
3	6.5	3.5	160	1	2.2	7.3	180	16	34.8	14.1	28.
1	2.2	3.1	140	2	4.3	5.7	75	5	10.9	2.2	26.
3	6.5	1.7	125	3	6.5	1.4	125	1	2.2	3.1	24.
2	4.3	1.39	155	1	2.2	.6	10-20	1	2.2	0.56	25.
1	2.2	1.1	130	1	2.2	.3	50	1	2.2	0.56	0*
1	2.2	0.56	135								
1	2.2	0.28	200					* Part of time.			
Summary				Summary				Summary			
34	79.	61.	150-175	17	37.	39.8	100-150	21	45.6	44.9	27-28
5	10.9	32.3	175-200	4	8.7	33.4	150-200	7	15.2	37.3	26-27
6	13.	6.5	125-150	21	45.6	20.2	0	16	34.8	14.1	28+
1	2.2	0.3	200+ 125–	4	8.7	6.6	0-100	2	4.3	3.7	26–

Considered impartially these performances are excellent and indicate the ability of the turbine to operate under almost any condition arising in power plant work. To the practice of thorough testing—practically inaugurated in America by the Westinghouse company—may be attributed its success in eliminating the difficulties which have from time to time arisen, and the confidence which has been placed in its perfected product.

Modern Practice.

A good index or merit or demerit is found in the general trend of engineering practice. It is, therefore, of interest to obsrve present practice in regard to three important points in turbine work—Steam Pressure, Superheat and Vacuum. Data obtained from 46 turbine plants, varying from 400 to 40,000 kw. capacity, have been conveniently tabulated in Table *A*. These data in Table *B* are further arranged under three broad groupings, comprising electric lighting, power, and electric railway plants, in order to observe whether practice differs in different fields. All of the plants are equipped with Westinghouse-Parsons turbines and are either in operation or building, and the list comprises almost every form of power application:

Heavy railroad traction.
Elevated and subway traction.
City and suburban traction.
High tension transmission traction.
High tension transmission lighting.
Combined railway and lighting.

* It may be well to state for the benefit of those unacquainted with the methods of testing Westinghouse turbines, that every turbine before leaving the shop, is subjected to rigid tests for workmanship, adjustment, endurance, efficiency and speed regulation under contract conditions. Three testing floors are in use, accomodating respectively, four 500 kw., four 2,000 kw. and two 5,500 kw. turbines. Steam consumption is determined by weight after condensing in a surface condenser; vacuum by mercury column reduced to the standard sea level condition of 30 in. mercury, steam pressure and superheat by calibrated gages and thermometers, and horse-power output by special water friction brake or by measuring electrical power absorbed in a water rheostat. The equipment comprises a boiler plant, a gas-fired independent superheater, and four surface condensers, ranging from 1,600 to 10,000 sq. ft. in surface. It should be borne in mind that all power measurements are based upon useful horse-power, either brake or electrical, and not indicated horse-power.

** Built for the Boston Navy Yard.

† Built for Manila Tramways.

* Now operating at the S. D. Warren plant, Cumberland Mills, Maine.

(x) Now operating in the plant of the Rockland Light and Power Co., Nyack, N. Y.

Municipal lighting.
Private lighting.
Mine haulage, light and power.
Industrial works and mills.
Copper rolling mills.
Railroad shops.

The total capacity of the forty-six plants is 143,750 kw. or an average of 3,125 kw. Comparative results are expressed in the tables, page 764, both in per cent of total plants and in per cent of total capacity under consideration. The latter evidently is of greatest importance.

In all plants the limits are found to be:

Pressure	125 to 200 lb.
Superheat	0 to 180
Vacuum	24 to 28 in.

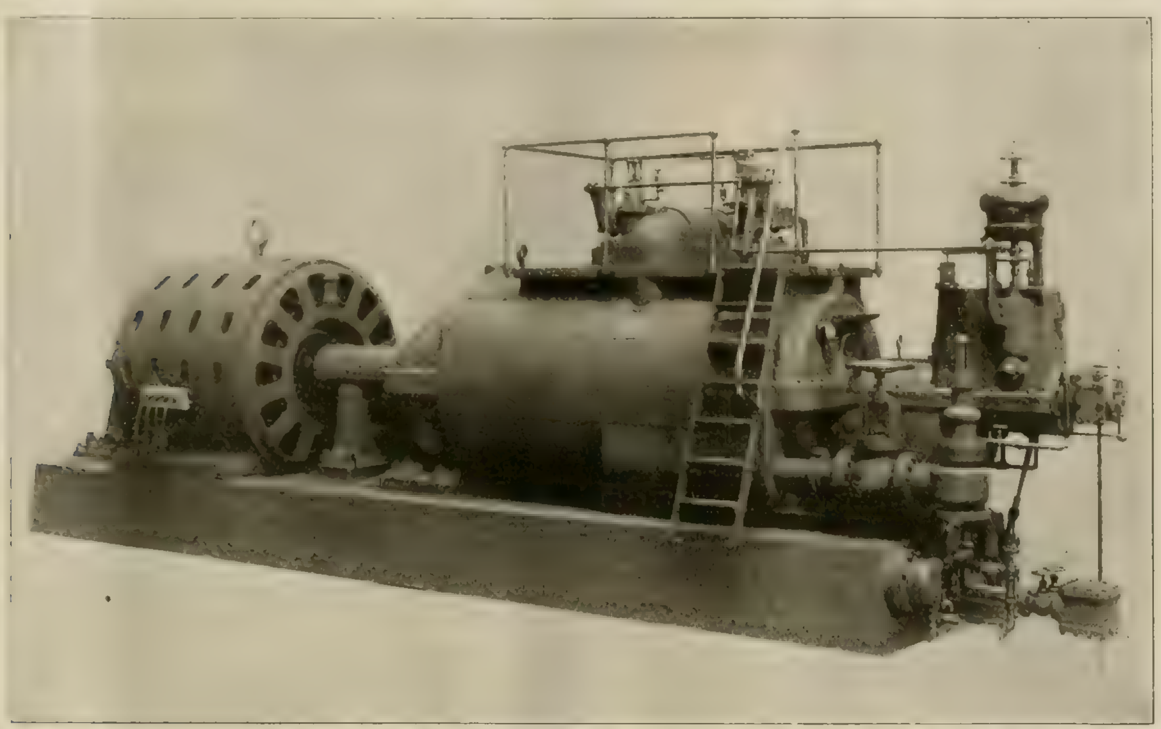
It is evident from these figures that practice in the average plant is far different from that upon a basis of total capacity—thus the former indicates no superheat; the latter, 100°.

In the special fields practice differs somewhat from that given above:

Comparing with the general average, it is evident from agreement with the latter that electric railway practice has greatly influenced the general practice, and averages the highest in all particulars, excepting, perhaps, vacuum. The values representing "second majority" show the general tendency toward higher operating conditions.

Electric lighting plants, although beneath the average on pressure and superheat, excel in the matter of vacuum.

Power plants also exceed the average in the matter of vacuum. The second majority pressure is lower than the first, which is presumably due to the fact that steam turbines have been largely applied to factory driving in the form of extensions to power systems already in use, while the majority of lighting and railway plants have been designed with the use of turbines in view. The comparatively low average vacuum in railway plants (26.5 in.) is due to two important stations now building for heavy traction. Outside of these a higher vacuum is generally used.



WESTINGHOUSE PARSONS TURBINE AND GENERATOR ERECTED COMPLETE. RESULTS OF TESTS UPON THIS UNIT ARE REFERRED TO IN TABLE I.

The Economics of High Vacua and Superheat.

Much uncertainty seems to exist at the present time concerning the relative value of high vacua and superheat. By the term relative is here meant—not a specific gain in steam consumption per se, but the net saving to the power station at the coal pile.

Is high vacuum or superheat essential to economical per-

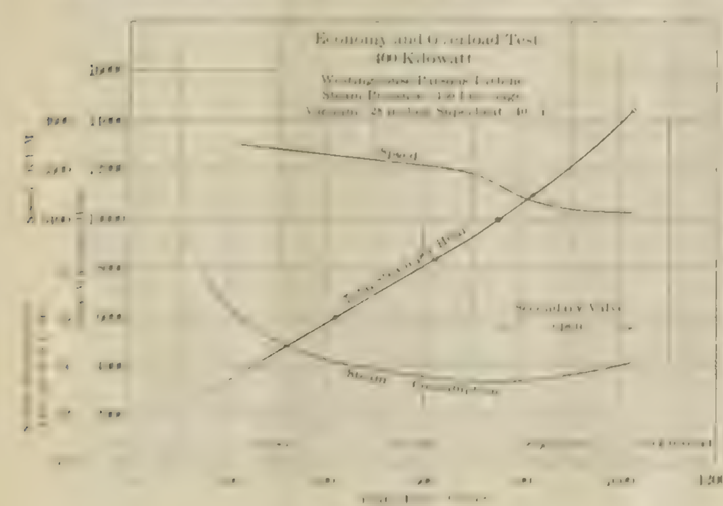


Fig. 4

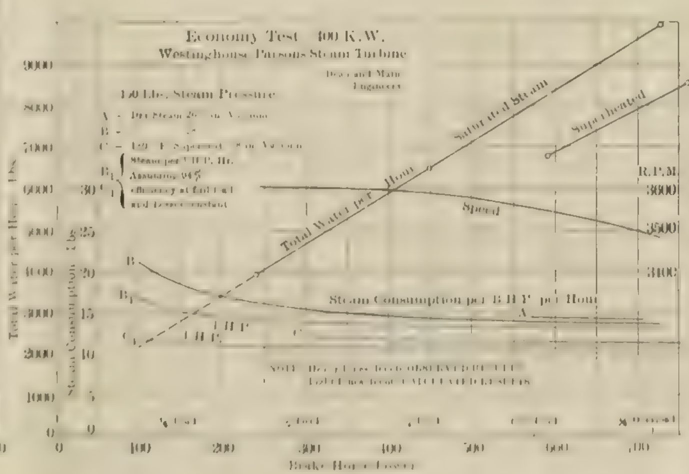


Fig. 5

furnaces, and if not, why employ them? The reason is not far to seek. In steam turbine work a distinctly new problem has arisen in the shape of enormous steam velocities and correspondingly high surface and peripheral speeds. If left unchecked, the fluid friction results in much lost power and more or less rapid depreciation. In some forms of turbines, more particularly the Parsons, these speeds have been reduced through compounding to such a point as to largely reduce the effects of steam friction. In all forms the loss from this and other sources may be greatly reduced by employing high vacuum and superheat. The former permits the low pressure section of the turbine rotor to move in a more rarified atmosphere, and the latter serves to

TABLE B.

TURBINE PLANT EQUIPMENT.

A − B = inc. A, exc. B.

General Summary				Pressure		Superheat		Vacuum	
Limits of capacity	No. plants	Kw. capacity	% of total capacity	% of capacity	Limits of pressure	% of capacity	Limits of superheat	% of capacity	Limits of vacuum
LIGHT AND POWER PLANTS.									
0 to 1,000	4	2,400	12.5	72.1	150-175	49.1	100-150	87.5	27 to 28
1,000-2,000	4	4,900	29.3	22.4	175-200	33	0	7.1	28+
2,000-4,000	3	9,750	58.2	5.4	125-150	22.4	0 to 100	5.4	26 to 27
					200+		150−		26−
Total	11	16,750							
Average	1	1,523							
POWER PLANTS.									
0 to 1,000	14	7,550	38.2	59.6	150-175	47.8	0	37.6	27 to 28
1,000-2,000	4	5,750	29.0	38.4	125-150	28.7	0 to 100	35.6	28+
2,000-3,000	1	2,000	10.1	2	200+	23.5	100-150	22.7	26−
3,000-5,000	1	4,500	22.7	...	175-200		150-200	4.	26 to 27
Total	20	19,800							
Average	1	990.0							
ELECTRIC RAILWAY PLANTS.									
0 to 1,000	5	3,000	2.8	59.4	150-175	44.8	150-200	38.6	26 to 27
1,000-2,000	2	2,700	2.5	39.8	175-200	42.8	100-150	39.6	27 to 28
2,000-5,000	2	4,000	3.7	0.75	125-150	12.5	0	11.2	28+
5,000-10,000	2	11,000	10.3	.	200+	.	0 to 100	0.75	26−
10,000-25,000	3	46,500	43.4						
25,000-50,000	1	40,000	37.3						
Total	15	107,200							
Average	1	7,150							

Total number of plants 46
Total capacity .... 143,750 Kw.
Average capacity .... 3,125 Kw.

TABLE III.

TEST OF 400 KW. STEAM TURBINE, BUILT FOR ROCKLAND LIGHT AND POWER COMPANY, NYACK, N. Y.

LOW VACUUM, PRESSURE AND NO SUPERHEAT.

Load, B. H. P.	Steam Pressure, lbs.	Vacuum (Referred to 30")	Superheat, F.	Water per Hour	Steam Consumption per B. H. P. Hour.
326	130.6	26.03	None.	5,834	17.89
457	124.9	26.02	"	7,481	16.36
580	125.6	26.10	[illegible]	8,939.5	15.41

defer the "dew point" or beginning of condensation of steam during its expansion, thus eliminating to a large degree the detrimental effects of friction due to entrained moisture at high surface speeds.

But, although essential in some types, it is by no means so in the Parsons turbine as is evidenced by the several installations working under 25 in. and 26 in. vacuum and no superheat, and with excellent economy. The principal reason for the almost universal adoption of these economic expedients is the ease with which the turbine avails itself of these advantages. In a reciprocating engine, an attempt to expand below 5 or 6 lb. (abs.) back pressure might readily result in negative economy, the increased friction and thermal losses overbalancing the small gain in steam consumption. The turbine, however, expands its working steam to within 1 in. of the barometer with as great facility as to atmosphere, and the increase in bulk is scarcely comparable to that which would be unavoidable in a reciprocating engine. Moreover, the heat losses are infinitesimal and there results a clear gain in economy.

GENERAL AVERAGE.

	1st Majority. Basis of % of total No. plants.		1st Majority. Basis of % of total plant capacity.		2d Majority. Basis % capacity.	
Pressure most generally used	150 lbs.	50.	165 lbs.	36.	175 lbs.	32.
Superheat most generally used ...	0	46	100	28.	150°	20.
Vacuum most generally used.......	27"	37	26.5"	35%	27 "	27"
Pressure most generally used (25-lb. range)	150-175	79%	150-175	61%	175-200	32.
Superheat most generally used (50 range)	0-100	54%	100-150	40%	150-200	33
Vacuum most generally used (1" range)	27-28	46%	27-28	45%	26-27	37%

ELECTRIC RAILWAY. *Basis capacity only.*	1st Majority.		2d Majority.	
Pressure most widely used..............	165 lbs.	47%	175 lbs.	40%
Superheat most widely used...........	100°	42%	150°	35%
Vacuum most widely used	26½"	47%	27½"	35%
Pressure most widely used (25-lb. range	150-175	59%	175-200	40%
Superheat most widely used (50° range).	150-200	45%	100-150	43%
Vacuum most widely used (1" range)....	26-27	49%	27-28	40%
LIGHT AND POWER.				
Pressure most widely used..........	150 lbs.	38%	160 lbs.	25%
Superheat most widely used............	0°	37%	100°	32%
Vacuum most widely used	27"	88%	28"	7%
Pressure most widely used (25-lb. range)	150-175	72%	175-200	22%
Superheat most widely used (50° range).	0-100	59%	100-150	40%
Vacuum most widely used (1" range)....	27-28	88%	28+	7%
POWER.				
Pressure most widely used..............	150 lbs.	46%	140 lbs.	23%
Superheat most widely used............	0°	48%	100°	24%
Vacuum most widely used	27"	36%	28"	36%
Pressure most widely used (25-lb. range)	150-175	60%	125-150	38%
Superheat most widely used (50° range).	0-100	87%	100-150	24%
Vacuum most widely used (1" range)....	27-28	38%	28+	36%

The nature of the saving due to vacuum and superheat has been revealed by tests. Figs. 6 and 7 show the effects of vacuum. In the former the test covers vacua from 0 to 26.5 in.; in the latter from 25 in. to 28 in. The drooping of the curve of steam

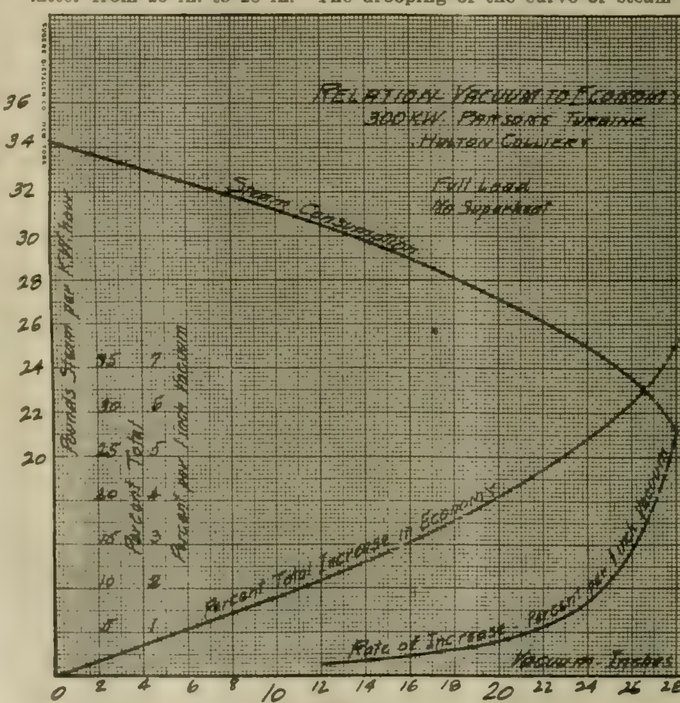


Fig. 6.

consumption at the right. Fig. 6, clearly shows the relative advantages of the last few inches of vacuum. The curve, "Rate of increase per 1 in. of vacuum" shows this still more clearly. With 21 in. vacuum the gain is but 1 per cent. per inch; at 26½ in. it is 3½ per cent.; and at 28 in., 5½ per cent., the last point being, however, estimated.

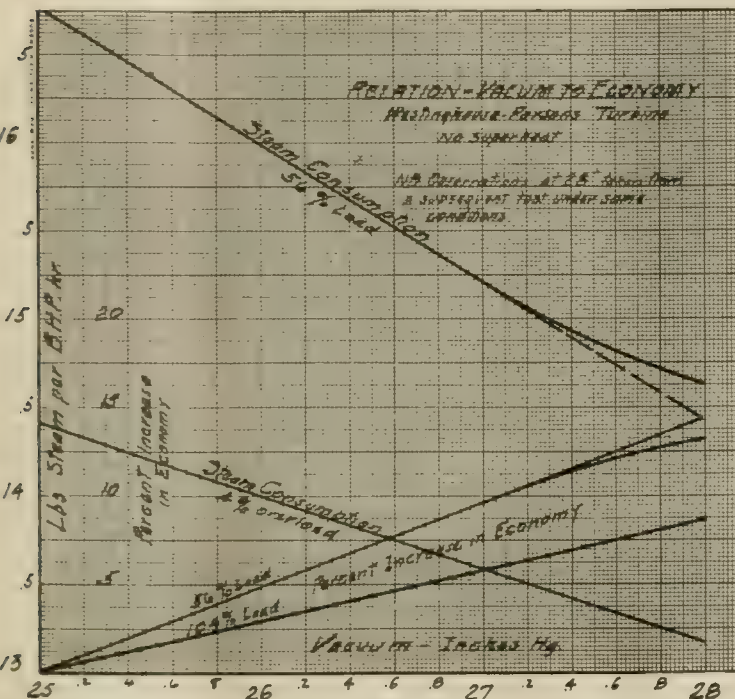


Fig. 7.

A test upon a large Westinghouse-Parsons turbine between 25 in. and 28 in., shown in Fig. 7, indicates somewhat different characteristics, viz: a proportional relation. This, however, might have been the case with the above results if plotted to a larger scale and carried up to the same limits. Here the benefit from vacuum at half load is considerably greater than at a slight over load, viz: 5 per cent per 1 in. in the one case and 3 per cent in the other.

The effect of superheat on economy is as striking as that of vacuum. In Fig. 8 the steam consumption was reduced 23 per cent —from 16.45 to 12.66 pounds per e. h. p. at full load by raising the vacuum 3 in. and superheat 140°.

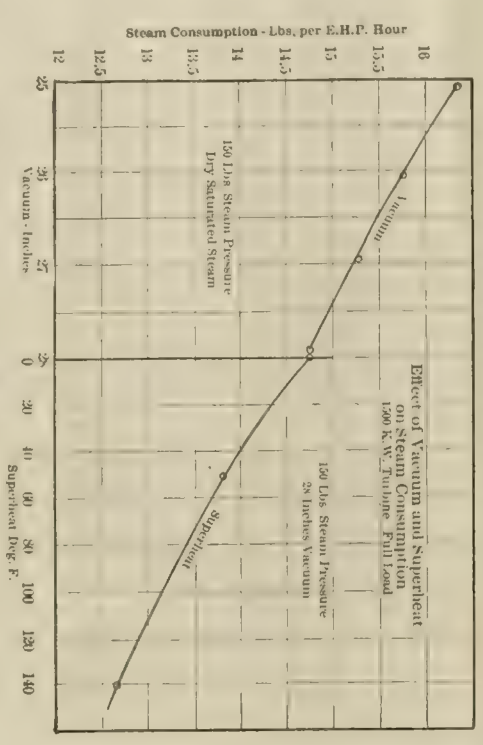


Fig. 8.

The series of tests upon a 400-kw. turbine by Messrs. Dean & Main give curves of slightly different character but of close agreement. The relation is a direct proportion and a uniform gain of 10 to 11 per cent. per 100° superheat is observed, this gain being practically the same at all loads, as the steam consumption lines are parallel. (Fig. 9.)

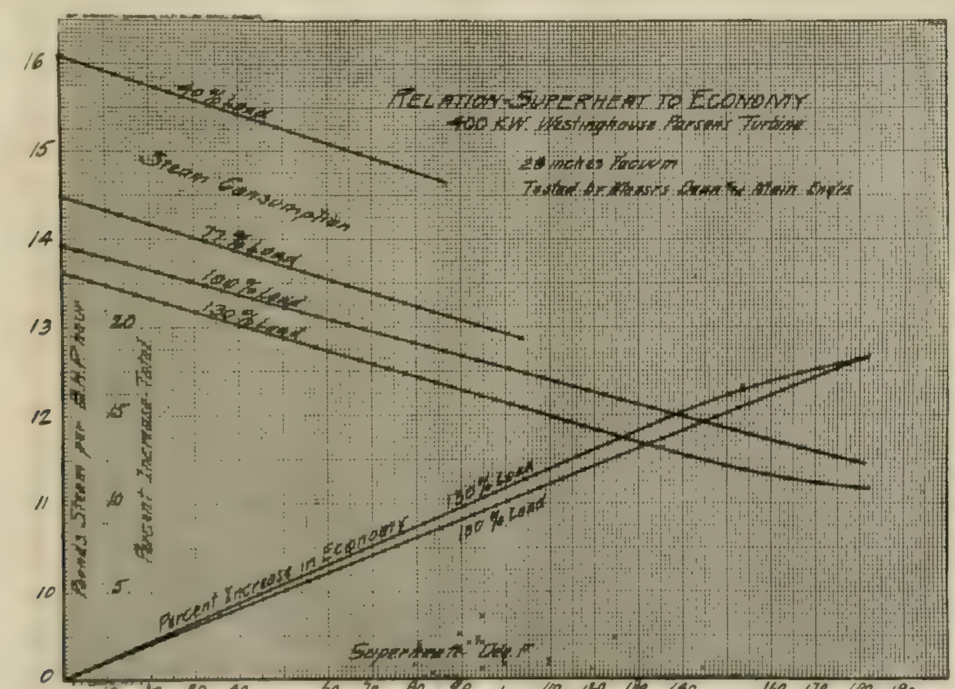


Fig. 9.

From these curves and other data on Westinghouse-Parsons machines it is apparent that, although wide variations exist, in round numbers 100° superheat will insure an increase in economy of about 10 per cent and 1 in. vacuum (between 25 in. and 28 in.) 2½ to 4 per cent depending somewhat upon the load.

Upon this assumption we may estimate the net saving resulting from the use of high vacuum. In Table IV. three cases have been calculated embracing possible or typical conditions of service and cost of fuel. A 2,000-kw. plant has been chosen, containing two 1,000-kw. units. By raising the vacuum 2 in.—from 26 in. to 28 in.—a saving in coal results amounting to 3.5, 2.6 and 1.3 tons per day in the three respective cases. The extra cost of high vacuum condenser equipment will, however, be about $2 per kw. capacity or $4,000. Deducting the interest and depreciation (12½ per cent) on this investment from the fuel savings a net saving is determined which represents an interest rate of 115 per cent, 27 per cent and 3 per cent respectively on the increased investment in high vacuum. The increased power requirements of the new equipment will presumably reduce these percentages by 1 per cent to 5 per cent according to the price at which the power is charged, but the estimates, although largely tentative, certainly point to high vacuum as an excellent investment where high plant economy is imperative.

A diagram (shown at the meeting) embodies these relations graphically, and in addition covers for each case a wide range of fuel cost. With cheap coal there is evidently a point where the high vacuum ceases to be a source of economy. This is shown under the conditions assumed to correspond to coal at 40 cents, 62 cents, and $1.36 per ton respectively. On the other hand, the annual saving in cases 1 and 2 is sufficient to equal the original cost of the improvement with coal at $3.55 and $5.20 respectively.

TABLE IV.

RELATIVE ECONOMY OF HIGH VACUUM.

CASE	I	II	III
Conditions of operation	Good Coal Continuous Service.	Med. Coal Continuous Service.	Poor Coal Day Service.
Capacity plant ... Kw	2,000	2,000	2,000
Daily run ... Hrs.	24	24	10
Yearly run ... Days	365	300	300
Average load ... Kw.	1,500	1,000	1,000
Price coal ... per ton (2,000 lbs.)	$4.00	$2.00	$1.00
Evaporation (actual) ... Lbs.	9½	8	7
Average economy ... lbs. water per kw. hr.	23	22	22
Raise vacuum ... Inches	26 to 28	26 to 28	26 to 28
Water saved per Kw. hour ... Lbs.	1.84	1.76	1.76
Water saved per day ... Lbs.	66,240	42,240	17,600
Coal saved per day ... Tons	3.49	2.64	1.26
Gross saving per day ...	$13.96	$5.28	$1.26
Gross saving per year ...	$5,095.	$1,584.	$378.
Extra cost of condenser ...	$4,000.	$4,000.	$4,000.
Interest 5%, Depreciation 7½% ...	$500.	$500.	$500.
Net saving per year ...	$4,585.	$1,084.	$ 122.
" " " Capitalized at 5%	$91,900.	$21,680.	$ 2,444.
Net saving as interest on increased investment in 2" extra vacuum	114.9%	27.1%	3.05%

With superheated steam the same method of arriving at the net saving may be employed. At the present time the superheat usually specified in turbine plants ranges in the neighborhood of 100° F., which is easily within the limits of various forms of apparatus suited for mounting within the boiler setting in the path of the flue gases. An increase in economy of 10 per cent. is thus effected, and at an investment cost of fully 25 per cent. less than that for the 2 in. extra vacuum. The net saving should therefore be even greater. Superheat cannot, however, be obtained for nothing and the net saving is evidently affected largely by the cost of heat supplied. In the case of the independent superheater this comprises fuel and stoking; in the case of the boiler superheater, the fuel value of heat delivered by the flue gases.

Power Consumption of Auxiliaries.

Granted the beneficial effects of high vacuum, do the auxiliaries require excessive power to render them commercially impracticable? Fortunately, we are able to present results from two plants which throw some light upon this subject. At the Broad St. station of the Citizens' Light, Heat & Power Co., Johnstown, Pa., the condenser auxiliaries are driven from a single steam cylinder—that of the rotative air pump. By indicating this cylinder at normal speeds the total power imput was obtained as given in Table V.

The results are shown graphically in Fig. 11, plotted to station load. Although observed in i. h. p., the results were reduced to a basis of equality with turbine output in order to obtain commensurate percentages. At less than ¼ load, the total power consumption was less than 5 per cent. of the station output, and it progressively decreased to 2½ per cent at full load. From the curves it may be inferred that at a load of 800 kw., which is the

TABLE V.

TEST OF POWER CONSUMPTION OF AUXILIARIES.

CITIZENS' LIGHT, HEAT & POWER COMPANY, JOHNSTOWN, PA.

LOAD		VACUUM	I. H. P. AUXILIARIES			PERCENT TOTAL POWER		
E. H. P.	I. H. P.	Inches Hg.*	Steam I. H. P.	Air I. H. P.	To water, I. H. P.	Steam cyl., %.	Air cyl., %.	To water, %.
97.8	150.8	27.8	7.08	2.45	4.63	4.7	1.63	3.07
167.5	220.5	27.7	7.75	3.00	4.75	3.5	1.36	2.14
185.0	238.0	27.6	7.66	3.02	4.64	3.22	1.27	1.95
207.5	260.5	27.6	8.38	3.16	5.22	3.21	1.21	2.00
238.0	291.0	27.3	8.98	3.46	5.52	3.09	1.19	1.90
241.0	294.0	27.4	8.75	3.21	5.54	2.98	1.09	1.89
404.0	455		12.77	4.35	8.42	2.8	.95	1.85
536.0	589		14.57	5.03	9.54	2.47	.85	1.62

*Reduced to 30 in. barometer.
The turbine indicated horse power based upon [illegible] losses which are assumed approximately constant throughout the test.
Condenser—Weiss 32 inch elevated jet, 800 kw. capacity.
Air pump—Weiss single stage rotative type.
Circulating pump—Bitus rotary type.
Three quarters and full load values estimated from data taken.
Tests conducted and computed by company's consulting engineer.

full rating of the condenser, the power consumption will approximate 2 per cent. of the turbine output. And it must be borne in mind that even this percentage is not entirely chargeable, as all steam auxiliaries exhaust into an open feed water heater in which the heat of the exhaust steam is regained. The upper curve in Fig. 11 expresses the ratio

i. h. p. input to auxiliaries÷e. h. p. output of turbines.

Similar observations casually made on a 2,000-kw. Curtis turbine equipment at the Louisiana Purchase Exposition indicate the same relations, although a higher power consumption. All auxiliaries are driven by constant speed induction motors supplied from the hightension bus bar through step-down transformers. The curves, Fig. 12, are based upon observations varying from half to full load, and the power input is assumed constant for all loads, as this is approximately the case. At full load the auxiliaries required 7 per cent of the total power output, 5 per cent for the circulating pump and 1.6 per cent for the air pump. It is probable that the percentages might be largely reduced were it possible to more closely proportion the speed of auxiliaries to the turbine load, as may be done in the Johnstown plant. The equipment is also laboring under unexpected high temperature of cooling water, frequently 85°, which renders it difficult to obtain the high vacuum which could be held under normal conditions. The most important point is, however,well shown by the curves, viz: that the power consumption of turbine auxiliaries is moderate and constantly decreases with the load.

Condensers.

An important requisite in the maintenance of a high vacuum is the absolute exclusion of entrained air. This air may find its way into the condensing system from many sources—through the feed water and steam—through air leaks in piping, and through packing glands improperly sealed. A minute opening will have a remarkable effect in lowering the vacuum unless the air is removed before reaching the condenser. This is usually accomplished by a single or double stage "dry" air pump. Mr. Charles A. Parsons has made successful use of a small steam ejector which removes entrained air from the condenser casing, discharging into a small auxiliary condenser. By this means he has succeeded in raising the vacuum 2 in. with about 4½ per cent. net gain. On account of this trouble from entrained air entering through the feed water, the surface condenser has found particular favor for turbine work. It, in addition, enables the condensed steam, which is pure distilled water, to be re-

turned to the boilers, thus not only saving water but the cost of purifying it and a considerable proportion of the maintenance cost for cleaning and repairs of the boiler equipment.

It is frequently thought that an air pump requires the maximum power at the highest vacuum. This is found to be not strictly the case, but rather that the maximum occurs when the amount of air to be handled is greatest. Obviously if there are no air leaks to lower the condenser vacuum, the pump vacuum is equal to that of the condenser, and the pump will require no power outside of that to overcome its own friction.

Another effective means of reducing the power requirements of a surface condensing plant is to balance the circulating water columns leading to and from the condenser by sealing both ends beneath the same level of water. A syphon is thus formed, and it is only necessary to move the circulating water against the friction of pipes, valves and condenser tubes.

A limitation to high vacua of course exists in the temperature of cooling water, and unless sufficient difference in temperature exists between water and steam—20° to 30°—the amount of circulating water per pound of steam becomes much greater than that with normal temperature of, for instance, 70° F. This of course entails increased power input to pumps. High water temperature, therefore forms a practical barrier to higher vacua. But with ordinary water temperature and a closed steam cycle and circulating water system, the power requirements may be kept at a low point, as shown in the tests

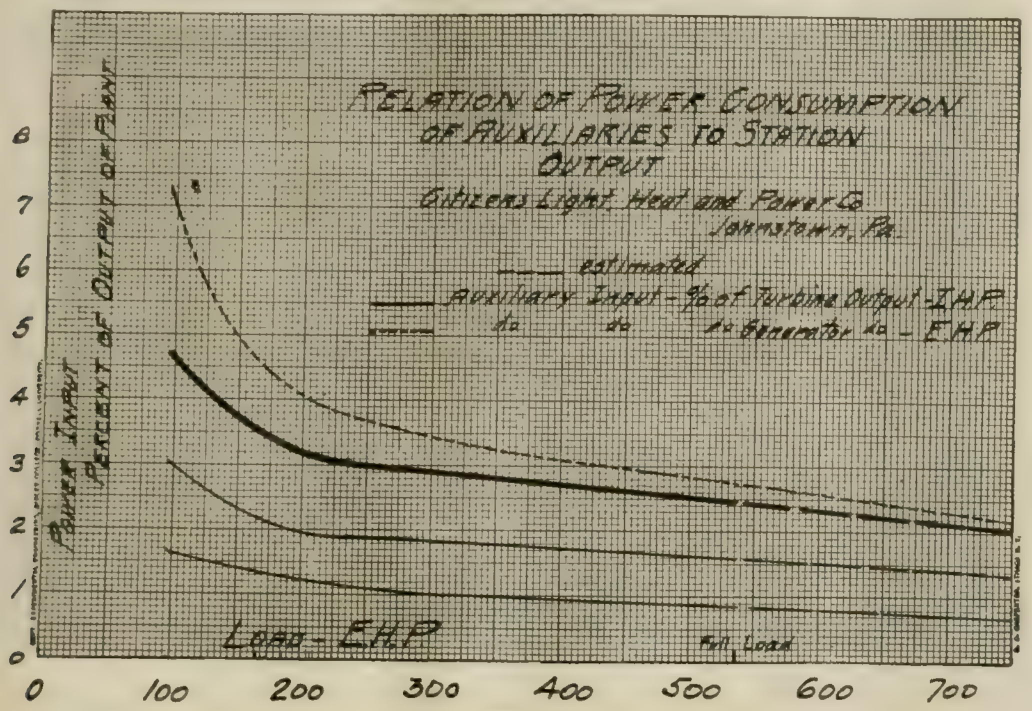


FIG. 11

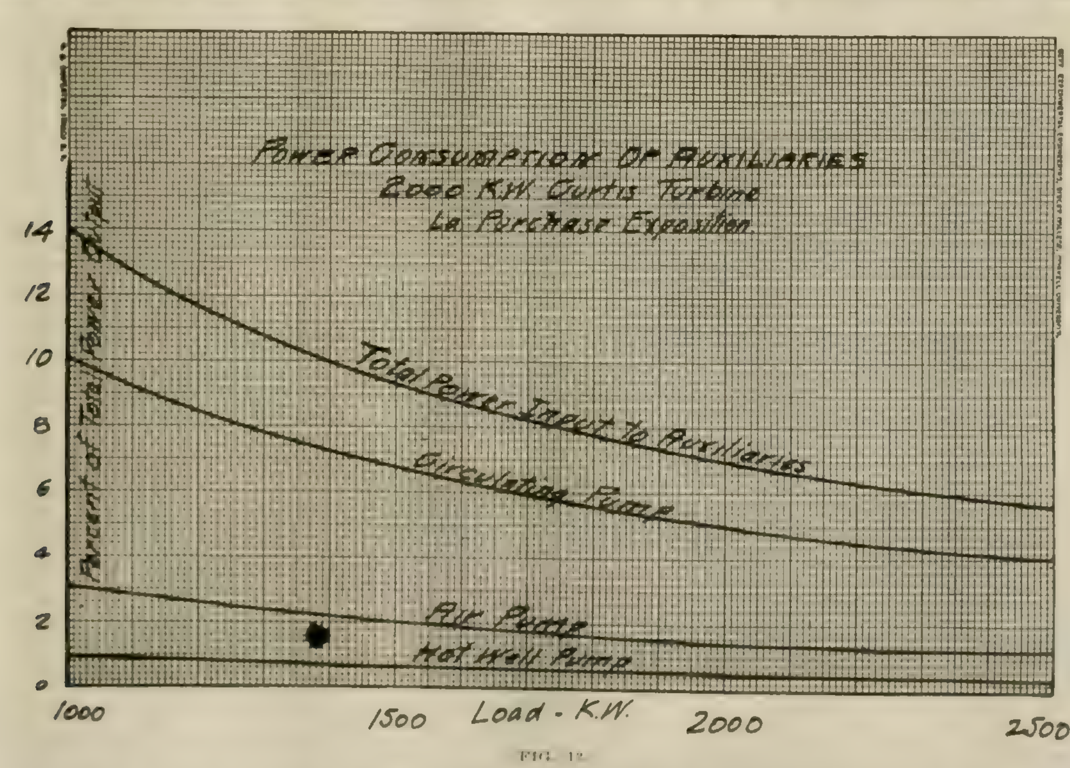


FIG. 12

at Johnstown. In the turbine plant at Elyria, Ohio, where the circulating pumps are motor driven (See Fig. 14), the power input to the motors at $\frac{3}{4}$ load on the turbine and 27 in. vacuum

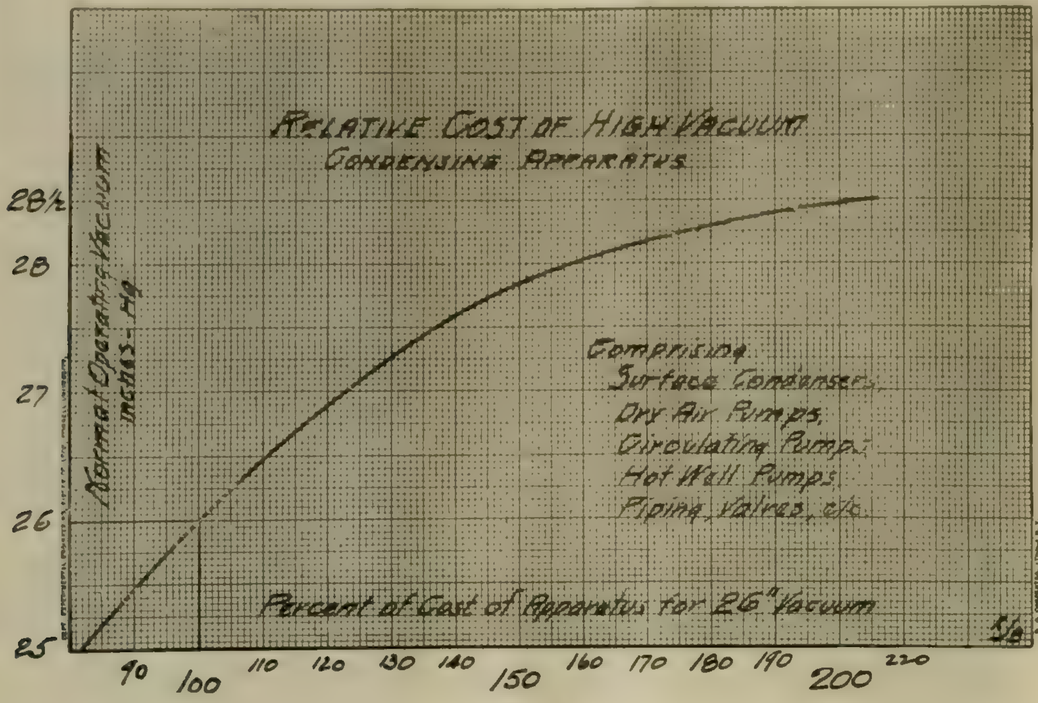


FIG. 13

was found to be but 3.36 per cent, including a 15-ft. lift. As this was introduced for the purpose of making Weir measurements, the power chargeable to the condenser, including the friction in over 550 ft. of cast iron piping, was but 2.33 per cent. of the turbine output.

The cost of high vacuum apparatus is not proportional to

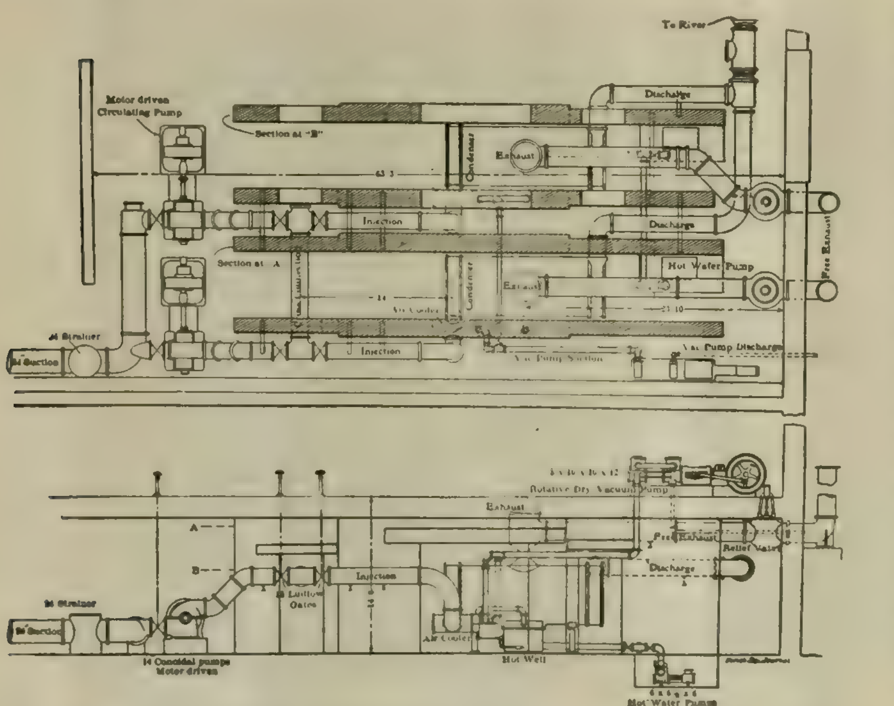


FIG. 14. ARRANGEMENTS OF FOUNDATIONS AND CONDENSING APPARATUS, 2,000 KW. TURBINE PLANT, CLEVELAND & SOUTHWESTERN RY., ELYRIA, OHIO.

the vacuum but increases much more rapidly, as shown in Fig. 13. Increasing the vacuum 1 in. above 26 in. increases the cost about one-fourth, another 1 in. raises it nearly one-third, and $\frac{1}{2}$ in. above 28 in., about one-half of the cost at 26 in. These estimates are of course averages and intended to show relative not specific costs.

Condenser Arrangements.

Another important factor in securing a high working vacuum is the elimination, as far as possible, of friction in the exhaust piping leading from turbine to condenser. As is well known, the volume of steam increases with great rapidity at high vacua, thus requiring extremely large exhaust piping. Considerations of convenience, however, frequently outweigh those of engineering precision, thus tending to decrease the size of exhaust piping, although at the expense of considerable increase of friction and resultant loss of vacuum. An instance where this matter has been given attention is the replacement in the Manhattan station of the former jet condensers by those of the barometric type connected directly to the engine exhausts. Although this arrangement was adopted partly on account of the height of the engine exhaust, it nevertheless is reported to have resulted in higher engine vacuum. In turbine work where 28 in. vacuum is employed the volume of steam is from 50 to 100 per cent. greater than with the usual engine vacuum. This fact emphasizes the necessity of locating the condenser as near as possible to the turbine, and the desired arrangement has been accomplished by placing the condenser immediately beneath the turbine, an arrangement which has never before been possible with any other form of steam engine. As is well known, the absence of vibration or external thrusts permits the employment of any kind of foundation of sufficient strength to sustain the dead weight. In numerous instances steel beams with concrete arches sprung in between them are employed sole for this purpose. The basement may therefore be employed for accommodating the condenser instead of the massive foundations required for reciprocating engines. The turbine exhaust may then be conducted straight downward through

a few feet of exhaust piping which may be proportioned as liberally as desired, as no valuable space is being taken up. This is practically equivalent to the location of the condenser

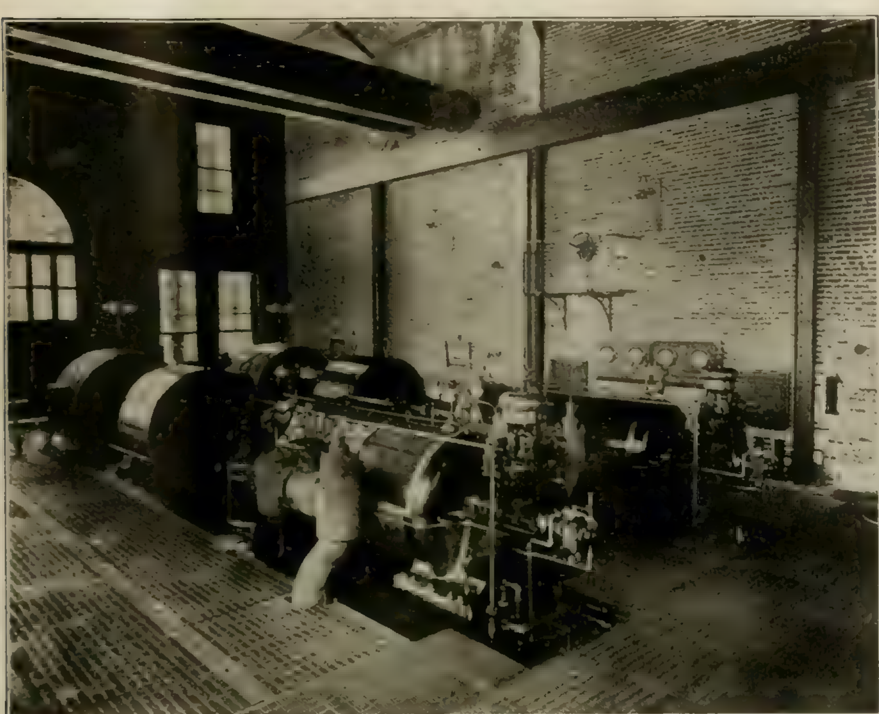


FIG. 14A.—2,000-KW. ELECTRIC RAILWAY TURBINE PLANT. CLEVELAND & SOUTHWESTERN RAILWAY CO., ELYRIA, OHIO. TWO 1,000-KW. WESTINGHOUSE-PARSONS TURBINES. OPERATING INTERURBAN ELECTRIC RAILWAY SYSTEM WITH HIGH TENSION TRANSMISSION.

directly at the turbine exhaust and obviates the undesirable features of mounting the turbine directly on top of the condenser as has been proposed. A good illustration of this arrangement is offered by the turbine plant at Elyria, Ohio, shown in Fig. 14, and accompanying views. The cross-hatched areas represent the sections of the concrete walls constituting the foundation piers. The exhaust extends straight downward into the condenser which, as shown, is located between the piers. This vertical exhaust leg is of sufficient length to accommodate a fluted copper expansion joint, a free exhaust branch to atmosphere, and a gate valve.

Following out the ideas previously mentioned a number of plants with various sized units have been drawn up for the purpose of indicating the possibilities of compactness in arrangement of condenser and auxiliaries. Three sizes of turbine have been chosen for illustration—viz: 400 kw., 1,000 kw. and 5,500 kw.—four units being included in each plant as constituting a typical and desirable arrangement in a modern power station.

In the 400-kw. plant, Fig. 16, a central condenser is employed with rotative 2-stage dry air pump and a centrifugal circulating pump driven by a small high speed steam engine. The sketches illustrate the counter-current type of condenser, which, however, is merely incidental and not essential to this arrangement. A gate valve in each turbine exhaust permits independent control of each unit, and at light loads the circulating water can be readily decreased in proportion by throttling the pump engine. A small reciprocating hot-well pump returns the condensation directly to the boiler feed. The vertical loop in the circulating water outlet pipe serves to keep the condenser full of water and the tubes covered at all times.

In the 1,000-kw. plant, Fig. 17, independent condensers are employed, with, however, practically the same arrangement as in the smaller plant, with the exception that a single air pump serves two units. By cross connecting the air piping the two air pumps may be arranged for relay service. Each condenser is provided with its own circulating water pump. By locating the several condensers alternately at one side or the other of the line of exhaust outlets, sufficient space is available for withdrawing and replacing condenser tubes which would evidently not be the case if all were located upon the same side.

In the 5,500-kw. plant, Fig. 15, concrete piers are employed supporting the bed plate of the turbo-generator unit at points beneath the three journals. As before, the condensers are located directly beneath the turbine, whose outlet in this case, for convenience and compactness, is of approximately rectangular cross section. By placing them at the angle shown space is left for the removal of condenser tubes. In plants of this size concrete lined conduits would presumably be used to convey cooling water to and from the condensers.

In all of these condenser arrangements, an independent atmospheric exhaust outlet with relief valve is provided for each unit, thus in the case of loss of vacuum from any sources the turbines are capable of continuing operation non-condensing. It is also desirable to employ a fluted copper expansion joint in the exhaust riser. The turbine casing is thus relieved of any strain due to expansion and contraction of the riser which is of course firmly supported from beneath by the condenser. This, however, becomes unnecessary in the 5,000-kw. equipments on account of the shorter connection between turbine and condenser.

The following Table (VI.) gives the general data upon these arrangements:

When plotted in graphical form the fact is apparent that, although the greatest relative compactness is found in the large station, the greatest benefit from the arrangements occurs in the smaller stations.

TABLE VI.

COMPARATIVE DATA ON TURBINE PLANT ARRANGEMENTS.

Normal capacity of units..............Kw.	400	1,000	5,500
Number of units......................	4	4	4
Capacity of room......................Kw.	1,600	4,000	22,000
Size of engine room...................Ft.	26 x 35	59 x 36	100 x 61
Length of turbine units (over all).......	18′ 11″	29′ 11″	47′ 3″
Width of turbine units (over all).......	3′ 11″	5′ 3″	14′ 0″
Height of turbine units (over all).......	7′ 6″	8′ 4″	14′ 0″
Center to center distance between units	7′ 10″	13′ 0″	22′ 6″
Width of passage ways.................Ft.	4′ 0″	8′ 6″	8′ 6″
Depth of basement	14′ 6″	18′ 0″	25′ 0″
Vacuum................................In.	28	28	28
Condenser cooling surface ....Ft.	7,000	16,000	80,000
Condenser cooling surface, per unit....Ft.	1,750	4,000	20,000
Condenser cooling surface, per kw.....Ft.	4.37	4.00	3.14
Area of operating room............Sq. Ft.	910	2,124	6,100
Turbine capacity, per sq. ft. of operating room..............................Kw.	1.76	1.88	3.60
Area of engine room, per kw. capacity .	0.57	0.531	0.277
Area of engine room, per E. H. P. capacity	.425	.396	.207

It is of interest to note comparative figures on the five great New York power stations:

	Area—sq. ft. per kw. capacity. Power house.	Operating floor.
New York Edison Co..................	0.96	0.573
Metropolitan Ry.	1.27	0.635
Kingsbridge Station	1.40	0.748
Manhattan Railway	2.06	0.884
Rapid Transit	2.32	1.38

In point of compactness, the New York Edison station, although employing 6,500 h. p. vertical 3-cylinder compound engines with direct connected overhung generators and with condensing equipments located between engine foundations, requires over twice the room necessary for the turbine station employing units of commensurate size.

Results of Practical Operation

The soundness of engineering judgment in taking a step so radical as the adoption of steam turbines is invariably reflected in the entries in the station log and the monthly cost sheet. If opinions were unanimous concerning the several factors comprising the true cost of power and such figures were generally available, it would not be difficult to formulate legitimate conclusions as to the precise commercial standing of the steam turbine. But data relating to investment and other fixed costs are not easily obtainable, and in fact not infrequently neglected altogether in determining the cost of power. Even the various factors constituting the operative costs, such as fuel, wages, supplies and repairs, are not always available in segregated form. In many industrial plants, one boiler equipment furnishes steam for electric power generators in conjunction with steam engines and special processes. These facts render an accurate analysis of power costs an extremely difficult if not impossible matter.

In Great Britain, the practice of making public accurate cost records is much more prevalent than in this country. Results from a few central stations employing steam turbines have been collected in Table IX., taken from "The Electrical Times." The stations are all above 1,000 kw. in capacity; one is non-condens-

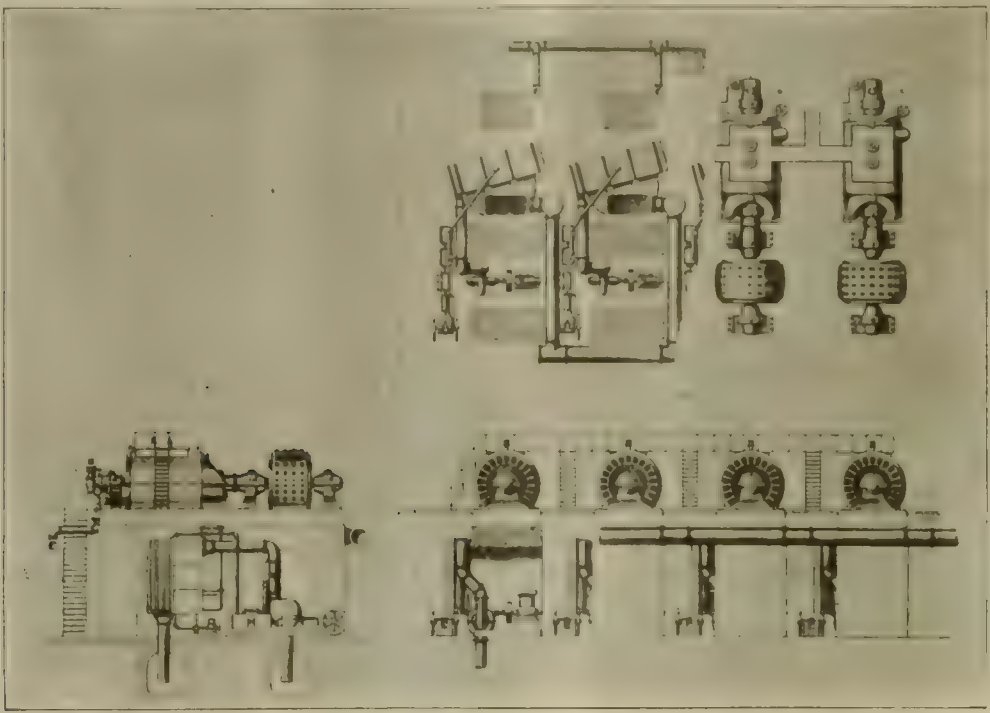


FIG. 15. TYPICAL TURBINE PLANT ARRANGEMENT. FOUR 5,000 K. W. UNITS.

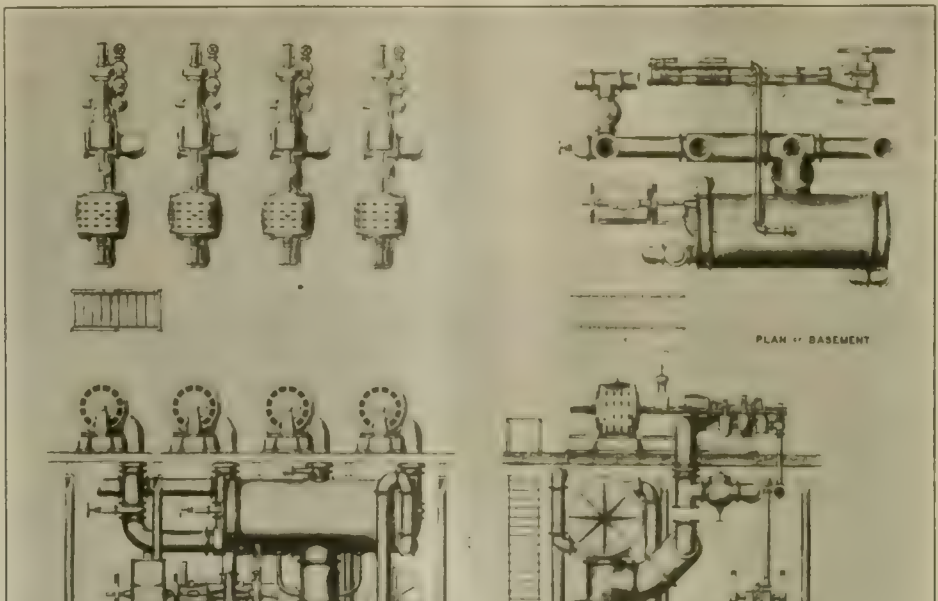


FIG. 16. TYPICAL TURBINE PLANT ARRANGEMENT. FOUR 400 KW. UNITS.

ing, and one part condensing, and the largest—the Newcastle-on-Tyne—contains both engine and turbine capacity in the proportion of 3 to 4. It is reported that within one year after installing turbines, the cost of coal was reduced from .96 to .36 cent per kw. hour, and works costs from 1.96 to .76 cent per kw. hour. The average of the eight plants is as follows:

Capacity.	Load factor.	Cost—cts. per kw. hour. Coal.	Works costs.
2,546 kw	13.4	1.18cts.	2.36cts.

Omitting, however, the non-condensing plant and the two with exceptionally low load factor, the average becomes:

Capacity	Load factor	Coal	Works costs
2,046 kw	14.42	[illegible]	[illegible]

In the above report the cost of coal is not stated and the exact measure of fuel economy cannot therefore be determined. Other sources, however, show the local price of British steam coal to average fully as high if not higher than the American. The figures at least indicate that turbine plants are being operated at a cost quite comparable to that of the best of modern steam plants.

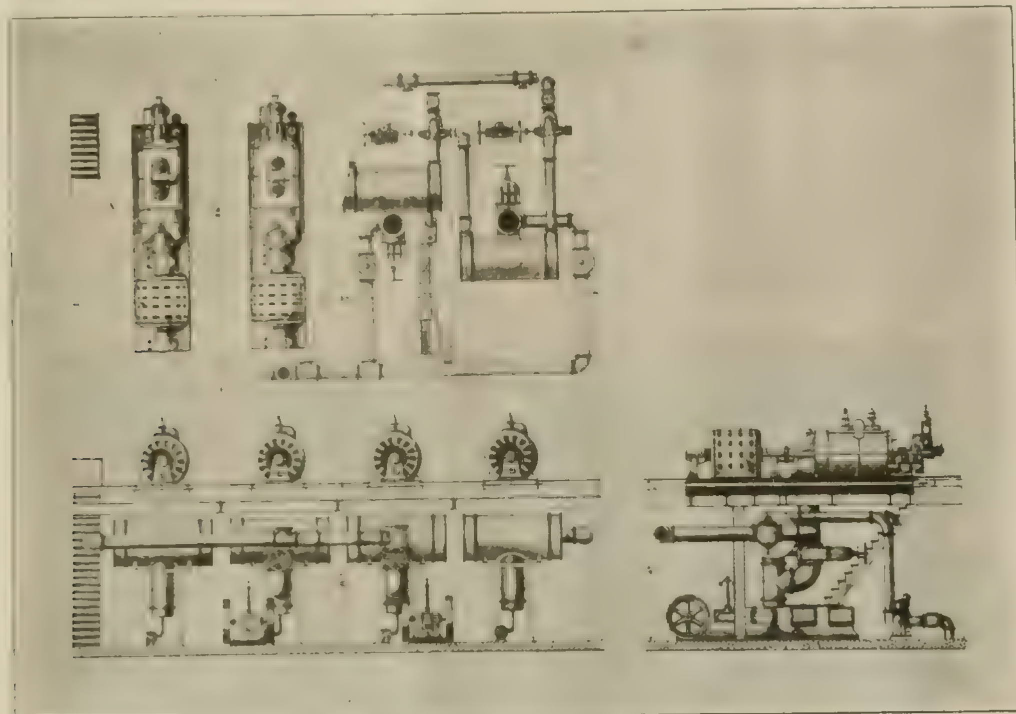


FIG. 17. TYPICAL TURBINE PLANT ARRANGEMENT FOUR 1,000 KW. UNITS.

Much uncertainty is still expressed concerning the reliability of the turbine. The following facts may be of interest as possibly having some bearing on this point:

A—Railway and light plant: A 400-kw. Westinghouse-Parsons turbine ran from April 24th, 1903, to September 11th, 1904—505 days—on 24-hour railway load without being opened for inspection. Another ran nearly as long. Both steam pressure and vacuum were low, and the steam was so wet that at one time seven barrels of water collected in the exhaust main during a 10-hour run, unable to be carried over to the condenser; yet,

TABLE IX.

COST OF POWER IN BRITISH CENTRAL STATIONS EMPLOYING PARSONS STEAM TURBINES.

("The Electrical Times Tables.")

No. Station	Year Ending	Year of Working	Capacity at End Year	Current	Conductor or Non conductor.	No. of Units Sold.	Load Factor	Cost per Unit Sold D. per Kw. Hour: Coal	Oil and Stores	Wages Workmen	Repairs	Works Costs	[illegible] D: Average Price obtained
1. Newcastle-on-Tyne..	Dec., 1902..	13th.	7,250	D.C. & A.C.	Conductor	5,509,340	13.98	.20	.03	.11	.14	.48	1.82
2. Newcastle and district	Dec., 1902.	13th.	3,200	A.C.	Part cond	2,058,804	14.69	.52	.12	.24	.06	.94	2.90
3. Blackpool..	Mar., '02-'03	9th.	3,050	A.C.	Non-cond	2,169,463	14.32	.91	.10	.21	.30	1.52	3.13
4. Cheltenham......	Mar., '02-'03	7th.	1,980	D.C. & A.C.	Conductor	1,287,421	14.31	.55	.10	.32	.27	1.24	2.83
5. Cambridge	Dec., 1903	11th.	1,500	A.C.	Conductor	471,510	9.38	.61	.11	.46	.29	1.47	5.93
6. Harrogate........	Mar., '02-'03	6th.	1,150	A.C.	Conductor	761,136	13.16	.66	.08	.31	.31	1.36	3.75
7. West Bromwich..	Mar., '03-'04	2d	1,150	D.C.	Conductor	1,105,006	15.96	.11	.08	.17	.17	.83	2.02
8. Scarborough..	Dec., 1902..	9th.	[illegible]	A.C.	Conductor	431,777	9.34	.85	.08	.44	.24	1.61	5.36
Average, Nos. 1 to 8 inclusive			2,546				13.4	.59	.087	.28	.22	1.18	3.49
Average, Nos. 1, 2, 4, 6, 7			2,946				14.42	.468	.082	.23	.19	.97	2.66

on a recent inspection, no deterioration is noticeable. It has frequently been slowed down by quantities of water in the steam. This turbine has carried 15 per cent. overload for fifteen consecutive hours, it has operated the entire railway and lighting system for nine hours without vacuum, and has operated successfully in parallel with another turbine and with compensated field alternators belted to high speed automatic engines. During erection it slipped from a temporary staging, fell 6 ft. and landed bottom side up; no injury has ever resulted.

B—Railway and lighting plant: Another 400-kw. turbine system ran 375 days, 24 hours each, with but 3 per cent. shutdown, less than 1 per cent. of which was chargeable to the turbine; the remainder to vacuum pump, steam piping, etc. In this plant the steam has been extremely wet and contained much foreign matter carried over from the boilers.

C—Industrial plant, Stamford, Conn.: After eleven months' continuous operation of a 400-kw. unit, the original shop oilstone marks on the bearings were plainly visible. This turbine ran five consecutive hours at 50 per cent. overload. During the winter it runs non-condensing part of the day, supplying 32,500 sq. ft. of heating surface.

D—Industrial plant, Akron, Ohio: One 400-kw. and one 750-kw. turbine operate in parallel, with the greatest ease, with two 500-kw. and one 150-kw. direct connected corliss engine units upon a widely fluctuating factory load, due to electric motors, many of which are of 100 to 300-h. p. capacity. The turbines exert an important corrective influence over the regulation of the entire plant.

E—Electric light and power plant, Hartford, Conn.: A 1,500-kw. unit has been started cold and load applied in seven minutes. It has carried a load of 2,200 kw. for 30 consecutive hours. It operates regularly in parallel over a high tension transmission line with a water power station 11 miles distant.

F—Railway plant, Elyria, Ohio: A 1,000-kw. unit has carried a load of 1,675 kw., and operates 21 hours daily on a railway load frequently fluctuating from 100 to 3,000 amperes in two or three minutes. It operates in parallel with another unit of the same size, supplies some power for lighting, and has more than halved the cost of coal per kw. hour of the engine station.

G—Electric light and power station, Newcastle-on-Tyne, England: No. 10 turbine installed in the Neptune Bank station made the following record, as shown by the station log: Out of 7,512 hours run—from December, 1901, to December, 1903—the turbine was out of commission 52 hours or 0.7 per cent. of the running time. Repairs comprised the re-lining of the governor throttle valve chest and the renewal of an oil disk.

H—Light and power station, Newcastle-on-Tyne, England: 3,000-kw. capacity—75 to 500-kw. units. After 11 years of service for the greater part of the turbine equipment, the cost of repairs at the Forth Station averaged, up to 1903, .225 cts. per kw. hour output.

These facts would seem to command respect for the turbine as a machine of wide application, rugged and permanent in construction, responsive to excessive and sudden demands, peculiarly suited for parallel operation under the most difficult circumstances, and capable of yielding commercial results under extremely unsuitable conditions. It is not, however, in the makeshift plants that the turbine can do its best work.

Formerly, the turbine has, in many cases, been designed to accommodate existing conditions in the plant. Today the reverse is true. The plant is now being designed for the turbine, and the more universal this practice becomes, the more marked will be the influence of the turbine on present and future power station economics.

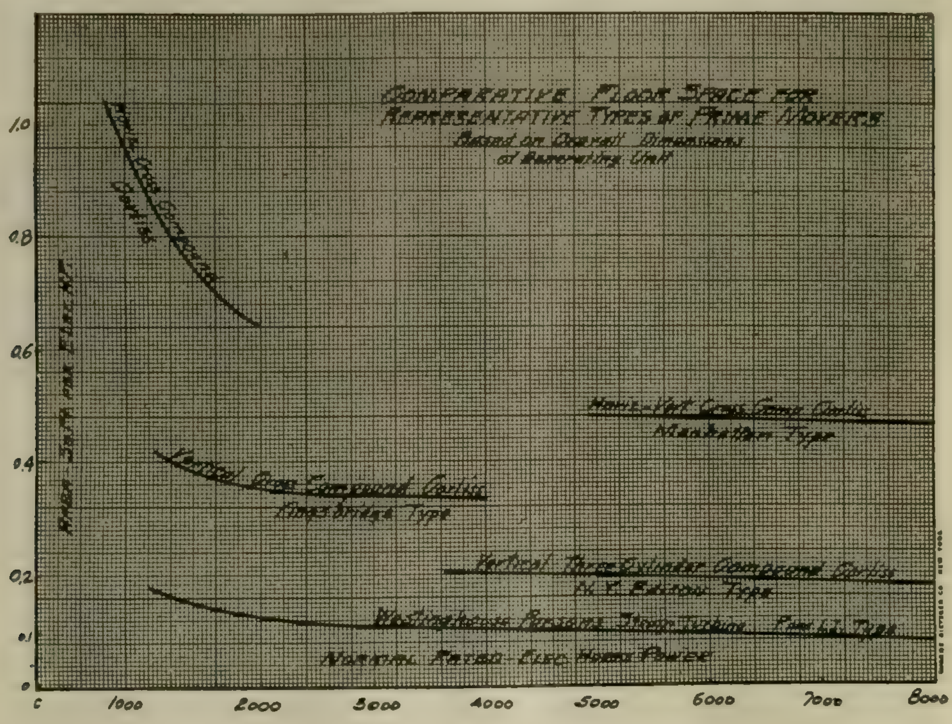


Fig. 18.

Mr. B. F. Stewart, sales manager of the McGuire-Cummings Manufacturing Co., whose friends in the trade are legion, has been in charge of the company's Buffalo office several months and reports a very excellent business in the East. During the convention Mr. Stewart may be found at the company's exhibit in the Transportation Building.

One of the neatest souvenirs seen at the convention thus far is a chain watch guard and charm which Mr. John C. Dolph, manager of the insulating varnish department of the Standard Varnish Works, is presenting to friends.

Mr. G. M. Gest, the subway contractor, whose comprehensive exhibit may be found in the court of the Electricity Building, is assisted in exploiting his products by Mr. W. T. Jackson, of the Cincinnati office.

From all accounts the local entertainment committee made no mistake in choosing the spectacle "Louisiana" at Music Hall as the attraction for the delegates and friends to view last evening. The occasion was unanimously declared an unqualified success.

LIVE STEAM PIPING: WHAT CONSTITUTES GOOD DESIGN AND WHAT SHOULD BE AVOIDED.

BY CHARLES K. STEARNS, BOSTON, MASS.

Without intending to detract from the importance of exhaust steam or drain piping or piping for heating purposes, which must be installed in the modern power station under the general head of steam piping, let us attempt to briefly cover the subject of live steam piping.

A few of the principles underlying good design are:

1. The steam should be carried from the boilers to the engines by the shortest practical route.

2. An ample supply at the engine must be provided.

3. Undue losses in pressure and excessive velocities should be avoided.

4. Provision must be made for expansion and contraction.

5. Suitable supports and anchoring are necessary to avoid vibrations.

6. The system should be thoroughly drained and the condensation returned to the boilers.

7. Proper joints and packing must be used.

8. The valves should be selected and located with care, using all that are required to carry out the intention of the design, but avoiding all unnecessary valves.

9. The whole should be divided into units or the elements of the system duplicated as far as practicable or consistent with the service demanded from the station.

10. Separate headers for the auxiliaries should be used.

11. The piping should be thoroughly covered.

12. The designer should not economize in the "vital" part of the power plant.

13. There should be accurate drawings and carefully worded specifications and these should be followed.

14. The engineer should not be blamed for results when the owner orders apparently unnecessary parts omitted in order to reduce first cost.

Nearly all modern power plants are designed along two general lines. Engines and boilers are placed back to back with fire wall between, or engine room and boiler rooms are side by side. The principle stated in No. 1 favors the former arrangement, where the shortest practical route is from boiler to main header (which is preferably placed in boiler room), and thence rising, or dropping to engine throttle valve.

Locating the main header in the boiler room may avoid serious injury to the engines and electrical apparatus in case of accident to the header, thereby allowing the plant to continue in operation after closing the valves necessary to isolate the damaged portions of the header. The shortest route also means the least amount of condensation and loss in pressure.

The most powerful fire engines are worthless at a serious conflagration unless ample water supply is furnished; the same is true of the best designed modern engines, unless an ample steam supply is at hand as called for by the second requirement and following closely is the third where we wish to avoid loss and excessive velocities. A good piping design will provide ample sizes of pipes from the boiler and establish the proper ratio of volume between the main header and engine cylinders.

The writer knows of a case not many miles from Boston where 16-in. brick walls forming the corner walls of a mill were demolished by a 12-in. steam main passing through in which the expansion had not been properly cared for, and this may be cited to emphasize how necessary it is to provide for expansion and contraction in steam piping. This is usually done by using easy bends in the piping, from boilers to headers or from header to engine, or in both, and the local conditions determine whether they are in horizontal or vertical planes.

Pipes not suitably anchored and supported are as badly designed as those in which no allowance is made for expansion.

The proper anchoring and supporting of large steam mains is worthy of careful thought and many times calls for quite a little engineering to secure the desired results, allowing the system to expand in the proper directions easily, and avoiding at the same time vibrations; provisions for expansion, anchoring and supporting, all are so intermingled that the neglect of one will often ruin the good points of the other.

The system should be thoroughly drained, but what a multitude of sins the drain piping is made to cover; unnecessary water pockets, valves so located that condensation collects at that point, or pipes not properly pitched, all look to the drip system for cure.

Using the shortest route for the steam reduces the condensation, but in the best design there will be some condensation which must be provided for, and the best possible arrangement of drain is none too good, for water carried along by steam under high velocity if allowed to collect has many chances of causing damage, not only to the piping system because of changes in direction through elbows or tees, but may even wreck the engine.

The header section should be drained independently to provide for the cutting out of one or more sections.

The pipes should be pitched so that condensation will tend to flow in the same direction as the steam and never opposite to it, unless excessively large sizes of pipe are used or conditions compel. Connections should always rise from the tops of mains, etc., when possible, to avoid pockets. Sometimes in a long run at different levels, pockets are required, but they must be thoroughly drained.

When possible, as on receivers, large traps, etc., a water glass should be provided to enable the operator to see when excessive amounts of water are collecting, and return all possible to the boilers.

There are many types of joints, flanges and kinds of packing, but there are few good ones. Therefore, one should not economize at the joints, but having decided properly, the best joint, packing, etc., insist upon having the kind ordered. All bolts must be long enough to have full threads in the nuts. Re-drilling of flanges under any conditions should not be allowed.

Only the best of makes of valves are good enough, and no straight way globes should be placed in the main lines. Rising spindles should be on all important valves, so a glance tells whether the valve is open or shut. Large valves, 6-in. or over, should have by-pass. The valves necessary to secure the desired results should be used but the line should not be crowded with valves that "might come in handy."

Sometimes an extra valve will be a saving and more than pay its cost; for example, if the pipes feeding the boiler pump are approximately 1¼-in. to 2-in. a small ⅜-in. pipe with globe valve, by-passed around the throttle valve, will, after starting, be ample to run the pump at the required speed and be better than wire drawing through the large valve only partially open.

There are many opinions for and against the duplicate pipe system, while nearly all believe in sub-dividing into units. If sub-dividing into units is good, why is not a duplicate system also good, when sub-dividing is not possible. It cannot be said that all plants require duplicate mains, neither can it be said all plants should not have a duplicate system. The hours of service whether intermittent or continuous govern this somewhat, but from a general view a modern electric power station should have some method of preventing a "shut down" whether by duplicate main or sub-divided units.

A separate header should be used for auxiliaries, especially in large stations, thus keeping the main header for the engine and insuring a more nearly uniform velocity of steam in the header. The auxiliary header being much smaller is more easily arranged for tapping to condensers, pumps heating system, air piping system, etc.

The losses occurring in unprotected steam piping from condensation are so well determined that any well designed station requires the best grade of covering for live steam piping, valves, etc., but it should not be applied until all joints are proved tight to the entire satisfaction of the engineer. The thickness and details as to plastic parts, valve bodies or bonnets, painting bands, etc., should all be specified.

The competent designing engineer, after examining carefully into the requirements as to continuity of service, future expansion and the hundred and one details that go to make up a first class modern station will not specify unnecessary piping, blanked fittings, valves, etc., but while avoiding costly "special" work, should call for the full and complete design, to operate not only in the routine method but under emergency conditions, and will not economize in first cost in the vital points in question.

To this end accurate drawings should be made, showing the exact location of each part, not only in regard to the one at

tached but to adjoining foundations, walls, floor beams and placing valves where they are accessible and can be operated without interference with other structural portions, also showing drips and traps where their level can be determined, and these plans together with carefully worded specifications should leave nothing for the contractor to guess at, when the installation of the plant begins. Care in locating center lines from a fixed point oftentimes saves much annoyance for two brick walls, say 120 ft in length, forming two sides of a station supposed to be parallel will vary from ¼-in. to 1-in. or more if measured at different points in the length.

A header located from the wall and other piping located from another point might cause serious delays to the contractor by not meeting properly. The best way is to establish two permanent center lines at right angles to each other while the foundations are building, and have all parties work from the established lines; the engine, electrical, piping and other contractors' work will all conform each to the other, assuming, of course, that care is taken in measuring from the reference lines.

The wording of a specification can be such as to cause no end of trouble or it can be such as to be understood alike by all parties. Specifications should be explicit yet simple in their phraseology, showing to the reader what was in the mind of the writer, protecting the owner and fair to the contractor; and while no one invites legal settlement they should be so worded as to be susceptible of legal interpretation. A single example may suffice —the word "guarantee" is very commonly used in specifications, as "The contractor shall guarantee the material to be free from all defects, etc." This should read, "guarantee the material to be free from all defects and covenant to make good any such defects which may arise within" a stated period.

Results are expected from a well designed system of engines, boiler, piping, condensers, pumps, etc., and on the results to be obtained depends the design of the various parts each being a part of the means to the desired end. Therefore, after employing a competent engineer, and having him give careful study to the problems involved, executing drawings and specifications the owner should not omit certain parts which may appear as if they would not affect the working of the system as a whole, and then blame the engineer for a failure to reach maximum economy in operation or keeping the service constant.

The apparently useless part of a well designed steam piping system, may in an emergency arising from accident, be the one part needed to complete the cycle of operations.

The writer has only briefly outlined a few of the more important principles of good steam pipe design, but each division is capable of being sub-divided, and the interdependence of the parts should have careful study. It is believed that no engineer who has designed and erected a first class power station, but will acknowledge that there are parts he would improve in the next design.

ALLIS-CHALMERS- BULLOCK.

The Allis-Chalmers-Bullock interests have large exhibits in the Machinery Building, the Palace of Electricity and the Mines and Metallurgy Building. The largest exhibit is in Machinery Hall, the main feature of the exhibit being a 5,000-h. p. generating unit comprising an Allis-Chalmers combined vertical and horizontal condensing engine direct connected to a Bullock electric generator. This unit supplies current for 120,000 incandescent lamps used for the decorative lighting of the principal Exposition buildings, the Cascades and lagoons, and the grounds.

The engine is the largest of its type ever built and is capable of developing 8,000 h. p. Its dimensions are as follows: Height above floor, 39 ft. 2 in.; diameter of flywheel, 25 ft.; weight of flywheel, 300,000 lb.; diameter of shaft (hollow forged), 37 in.; weight of shaft, 61,000 lb.; weight of crank, 32,000 lb.; weight of revolving parts together, 514,400 lb.; diameter of high pressure cylinder, 44 in.; diameter of low pressure cylinder, 94 in.; diameter of exhaust pipe, 36 in.; main bearings, 34x60 in. B. & S. type; outer bearings, 32x48 in. B., and S. type. The stroke is 60 in.; steam pressure, 150 lb.

The low pressure cylinder is vertical with side pipe construction. The valves are in the heads and double ported, the heads being single ported. The high pressure cylinder is horizontal, the valves being in the cylinder, and valves and cylinder are double ported. The slide has a foot under it which rests on a heavy foundation plate; the slide is bolted at the front or crank end to the bedplate and low pressure frame and the foot is bolted to the foundation plate. The foundation plate is 23 ft. 3¼ in. long, 3 ft. 3½ in. wide and 12 in. deep, extending from under the bedplate, to which it is fastened to the end of the foundation, supporting the high pressure slide and cylinder and the brackets for high pressure carrier arms and regulator.

The valve gears of both cylinders are designed for long range cut-off under control of the regulator. The steam valves of the high and low pressure cylinders are driven from one eccentric and the exhaust valves of both cylinders are driven from one eccentric. The regulator is the Allis-Chalmers extra heavy weighted type, equipped with electric and hand synchronizers, hand lever for adjusting cut-off in low pressure cylinder and belt rider safety stop.

The Bullock generator is rated at 3,500 kw. and generates 6,600 volt, 25-cycle, three-phase current; the speed is 75 r. p. m. The unit carries the full lighting load of 3,500 kw.

On both sides of the big unit the Allis-Chalmers Co. has fitted up a large space for reception purposes, where in addition to comfortable chairs, desks, writing materials, etc., messengers are in waiting to carry out commissions for guests. There is a matron on hand, also, to care for the comfort of lady visitors.

TROLLEY TO BE OBSOLETE.

Some six years ago one of the great Sunday dailies devoted several pages to the popular description of a magnetic railway. July, 1902, the same device again got into the press dispatches in the following language:

Small electro-magnets, imbedded between the rails of the track, are used to pull the cars. The electro magnets form one-half of the motor and are placed in the ground in a line half way between the tracks. The other part, the armature, is attached lengthwise to the bottom of the car. It is a long iron bar, cut up into feet and so attached that the ends ordinarily are within an inch of the top of the magnet boxes. But the primary difference between the new system and the trolley car motor is that the new car is not propelled by the friction of the wheels with the track, but by the invisible force of magnetism.

Each magnet is connected with main feed wires, heavily insulated, and bringing electricity from the power house. But when the car is not running over them the magnets are not magnetic. In other words, they are not in the circuit except when the car comes over them.

Arrangements of the magnets, according to polarity, first a north or positive, and then a south or negative, is the scheme for attracting the car and making it run smoothly. In the car, on the other hand, by the use of a small storage battery, the polarity of the feet of the armature is controlled.

The operator of the car can, with one simple movement of his lever, stop it or reverse the movement instead.

CHEAP AND SPEEDY.

The great saving which the inventor claims is in the amount of electricity required. He says seventy-five amperes will suffice for forty cars, while with the present trolley system seventy-five amperes are required for one car. It is also claimed that the cars can be run faster than trolley cars, because they are always under perfect control.

A 10-ft. model car, accommodating six persons, was manipulated successfully in the trial on a track 180 ft. long.

The Crane Co., of Chicago, has issued an eight-page booklet describing and illustrating its exhibit at the Exposition, and announcing that at rooms 213-15 Frisco Building, corner of Olive and 9th Sts., the company has established a bureau of information and offices for the convenience of customers and friends. The company has also issued a four-page folder, illustrated, treating of Crane renewable seat and disk globe and angle valves, and renewable seat and wedge straight-way valves for high pressure service; also Crane selfpacking radiator valves and selfpacking globe and angle valves.

Mr. F. L. Markham, southern representative of the J. G. Brill Co., is attending the convention.

TWENTY-THIRD ANNUAL MEETING

AMERICAN STREET RAILWAY ASSOCIATION

St. Louis, Mo.—Oct. 12-13, 1904.

THURSDAY, OCT. 13, 1904.

President [illegible] called the meeting to order at 10:20 o'clock, and announced that the first order of business would be the report of the secretary and treasurer.

SECRETARY PENINGTON'S REPORT.

The new members joining between Aug. 24, 1903, and Sept. 20, 1904, were:

Cedar Rapids, Ia.—Cedar Rapids & Iowa City Railway & Light Co.

Ft. Worth, Tex.—Northern Texas Traction Co.

La Salle, Ill.—Illinois Valley Traction Co.

Levis, Canada—Levis County Railway Co.

Louisville, Ky.—Louisville & Eastern Railroad Co.

Newark, N. J.—Public Service Corporation of New Jersey.

Portland, Ore.—Oregon Water Power & Light Co.

San Diego, Cal.—San Diego Electric Railway Co.

Steubenville, Ohio—Steubenville Traction & Light Co.

Aug. 24, 1903, there were 206 member companies; 9 new members have been added and 19 lost by suspension or withdrawal, leaving the membership Sept. 20, 1904, at 196.

The financial statement showed a balance on hand Aug. 22, 1903, of $10,338.69; receipts to Sept. 20, 1904, of $6,867.05; expenses to Sept. 20, 1904, of $9,559.18; and a balance on hand Sept. 20, 1904, of $7,[illegible].

On motion of Mr. Mailloux the report was accepted and ordered to be published in the minutes.

An invitation from the Railway Signaling Club, inviting the members to attend its sessions, was read; also an invitation from the Street Railway Accountants' Association of America, inviting the delegates to inspect the blanks and records which were displayed in the hall, being the collection of exhibits which the Accountants' Association had compiled.

The East St. Louis Suburban Railway Co. of East St. Louis invited the members of the association to use its lines on the bridge and in Illinois, the badge being sufficient identification.

The various invitations above named were accepted, with thanks.

Mr. Bean said that in connection with the postponement of the resolution yesterday—referring to the publication of the proceedings by the press, he wished to offer the following resolution:

"Resolved: That the last paragraph of the resolution in relation to the censorship of the proceedings as recorded on pages 237 and 238 of the Proceedings of the 22d Annual Meeting of the American Street Railway Association be amended by substituting for the word 'proceedings' the words 'verbal reports of [illegible]

Mr. L. E. Myers said that he had discussed the matter with Mr Royse, the editor of the "Street Railway Review," and had read a copy of the "Daily Street Railway Review," published on Thursday morning, and noticed the proposed change in the report of yesterday's proceedings, and believing the resolution offered would give the meeting what was desired, he seconded the resolution of Mr. Bean

Mr. Bean's resolution was carried unanimously.

The [illegible] of the executive committee relating to the [illegible] of the various organizations engaged [illegible] was then read and Mr Bean moved its adoption

Mr. [illegible], of New York, thought it would be wise [illegible] matter so that some idea might [illegible] of them [illegible] regarding the matter as to the manner in which the affiliation of what might be called the subsidiary departments of the organization might be arranged. He thought it wise to give the matter some thought, because he looked with a certain feeling of apprehension at the increasing number of section or auxiliary associations, as eventually there might be but little work left for the parent association to perform. He felt that the framing of the provisions which are to govern the relations between these sections should be done with a great deal of care. His own view of the matter was that he would like to see some system of control by the central body, the American Street Railway Association. If we look closer into the organization of many other societies we will find in many cases that they are organized with a central body and having different sections. It occurred to him that some such arrangement might be made in this case. There might be a sort of holding corporation, which would have the general control. Then there could be sections a, b, c, or 1, 2, 3, having as its subtitles names such as now selected. The American Street Railway Association should have a closer relation to these sections than it seemed to him it was going to have if things continued as they were at present. He could see, he thought, that if the relation between the parent association and the subsidiary associations was not a closer one, and subject to a closer supervision of the central body, the formation of the auxiliary bodies might increase in number to such an extent as to seriously hamper the effectiveness of the parent association. Hence he thought that a system of a central body, in which the other associations would become sections, should be carefully considered by the executive committee. He thought there should be, for instance, some sort of an arrangement whereby a company belonging to the American Street Railway Association should be able to partake, to some extent, even without paying the entire of amount of dues which would have to be paid to become a member of all of them, of the benefits of the others. The very fact that it is proposed to bring as members of the executive committee the officers of the other associations indicates that some privileges are being given them for which some corresponding advantage should be given to the American Association. He believed the matter should be so arranged that it would not appear so much as it appears now that there are three or four, and perhaps will be five or six different organizations. They should all really be a part of a central organization.

Mr. Bean said he believed the executive committee when it came to consider the matter would view it in all its bearings and make the best possible arrangement for the good of all.

The resolution was adopted.

The President stated the next business of the meeting would be the reception of the report of the Committee on Rules. The report was presented by Mr. W. E. Harrington, for the committee.

REPORT OF COMMITTEE ON RULES FOR THE GOVERNMENT OF CONDUCTORS AND MOTORMEN.

The arrangement and numbering of the rules in the standard code does not permit of inserting such special rules, as might be required by the various companies, in their proper places under the different headings. In order to overcome this difficulty, a rearrangement of the standard code has been made and the rules numbered under three separate heads, viz:

General Rules, 1 to [illegible]

Rules for Conductors 101 to 200, inclusive

Rules for Motormen, 201 to 300, inclusive.

Rules, additional to those contained in standard code, can now be numbered and given their place, following the standard rules, under their proper headings. Where local conditions will not permit of the use of certain of the rules in the standard code, they may be omitted, the number thus left vacant should not, however, be used for any other rule but be left blank, thus preserving the integrity of each standard rule under its own number. Such additions to any of the standard rules as may be necessary, can be made by adding sections to the rule, using a suffix letter, as for example: "2a," "2b," etc.

It is intended that the interurban rules shall be used in connection with those contained in the standard code. The numerous accidents occurring of late, in connection with the operation of interurban railways, have suggested to the minds of the committee the necessity for many of the rules contained in this report.

The efforts of this committee were directed toward making the interurban rules conform, as nearly as conditions would permit, with the standards adopted by the American Railway Association, the diagrams, descriptive of hand, flag and lamp signals, being the same as those appearing in the standard code in use by steam railroads. The diagrams of the train signals necessarily vary from their standards to a degree, although the colors are used.

In the rearrangement of the standard code, certain rules were omitted to avoid repetition, and certain other rules, which seemed necessary, were added thereto.

This committee held one meeting jointly with the Standard Rules committee of the New York State Street Railway Association, at which meeting there was a representative of the Board of Railroad Commissioners of the State of New York, who ably assisted the Committee by making suggestions. The rules, as they now appear, were adopted by the Street Railway Association of the State of New York at their annual convention in Utica, September 13th, and they are herewith submitted for your consideration, with the recommendation that the Committee on Rules be continued, and that members of the Association be urged to communicate with the Committee, giving it the benefit of suggestions as to additional rules or changes in the Standard Code as herewith recommended.

E. G. Connette,
W. S. Harrington,
T. E. Mitten,
Robert McCulloch,
John J. Stanley.

(Some editorial comment on these rules will be found in the "Daily Review" for Oct. 11, 1904, at page 703.)

On motion the report of the committee was adopted.

The following resolution was offered by Mr. Vreeland:

Resolved, That the President of this Association be, and he is hereby, authorized and empowered to appoint a special committee to be known as the Membership Committee of the American Street Railway Association, of which the president of the Association shall be chairman, ex-officio. Such committee to consist of nine members, three of whom may be representatives of the technical press, and may or may not be members of this Association. The duty of such committee shall be to endeavor to increase the membership of the Association.

Mr. Mailloux moved the adoption of the resolution.

Mr. Vreeland stated there were at the present time something over 600 street railroad companies operating throughout the territory covered by the Association, independent companies, of which number 196 are members of the Association. The idea in appointing this committee was to have representative committee of the leading railroad men of the country to prepare circulars and enter into general correspondence with railroads which were not members, and to use their personal influence with the managers of street railroads, with whom they were acquainted, to have them become members of the association. He thought this was particularly desirable at this time, as a certain percentage of increase in the membership of the association, with the present dues, would care for the general running expenses of the organization and leave the reserve fund of the association intact, which probably could not be done with the membership standing stationary as at present. The idea of the resolution was to make a concerted and vigorous effort to increase the membership of the association

The resolution was unanimously adopted.

The President announced the next business to be the reading of the papers.

The paper on "Steam Turbines," by Mr. Richard H. Rice, was then presented by Mr. Rice. This will be found on page 790.

In the discussion which followed, Mr. W. H. Abbott, of Cleveland, asked Mr. Rice to give a further description of the high speed commutators, and whether they run in oil or are submerged.

Mr. Rice replied that the commutators run dry, with lubricated brushes, and the commutator bars are well-supported by nickel steel rings shrunk on to the outside over the insulation. The commutator bars of the larger size are turned off in place after the shaft is put in the bearings.

Mr. Abbott inquired if they were carbon brushes, to which Mr. Rice replied they were.

Mr. C. O. Mailloux, of New York, said that he would be glad to give the delegates the results of some observations which he had made in an extended tour in Europe last summer in which the investigation of steam turbines under various conditions was one of the principal objects he had in view. He was under the impression at the outset that steam turbines were not very suitable for use in driving direct current generators, but he was pleased to say he had seen numerous instances of direct current dynamos which are being driven at rather high speeds in Europe. The largest unit he had seen was 250 kw. running at 2,500 turns. He had seen several small sizes running at 3,000 and 4,000 turns. There seemed to be no difficulty, at least no difficulty which is not likely to be overcome, in the operation of such machines. The brushes are generally carbon, although in some cases he had seen metal brushes of the Boudreaux type used with satisfaction. The tendency, however, is to prefer carbon brushes wherever they can be used because the Boudreaux brush requires a much better electrical design that the carbon brush in order to get sparkless and suitable commutation. The general practice is to make the commutator very strong, using nickel steel bands around it, or similar bands of very ample proportions. He had heard of but a few cases where sparking had given trouble and it had been due in nearly every instance to unbalancing; where the armature is not properly balanced there is a slight chattering, which, though not visible to the eye, is yet sufficient to keep the brushes dancing on the commutator and it soon becomes rough and gives trouble. He was glad to see a line of small turbines developed in this country as they have already been developed in Europe. He had ordered two small turbines in Europe for direct current work, of 15 kw. each, because he was not then satisfied he could get in this country direct driven turbines that would answer the purpose. He was glad to see the General Electric Co. developing a line of small turbines that can be driven direct. He meant by that turbines which do not require gears. He had had some experience with small turbines in which the speed is reduced through a gear, but found while they did the work, they are necessarily more delicate and not so satisfactory as one which does away with the gear. One of the uses to which small turbines are being put in Europe is that of driving pumps for boiler feed. He knew of several instances where direct driven centrifugal pumps working under high pressures are being used very successfully indeed as boiler feed pumps. They have great advantages, because they have no reciprocating motion; the feed is absolutely steady. In cases where the exhaust steam is used for feed water heating, it will be realized that the economy of the system is not of great importance, so that while it is in the abstract desirable to have a small turbine unit, which gives as high an economy as possible, yet for many applications, such as for auxiliaries in a power station, in many cases it would be rather desirable to have the auxilliaries consume a great deal of steam than the

reverse, because in many modern power stations today it is becoming a problem to be able to get sufficient feed water without using live steam and without using economizers, which many of us are not inclined to favor.

Mr. Abbott inquired if Mr. Mailloux had found that there was any great danger from water in the steam in using the turbine—water carried with the steam, even if the steam may be superheated.

Mr. Mailloux said he had heard of no cases of such trouble, although he had seen cases where turbines were operated at very low pressure. He visited one installation in a mine where a 250-kw. turbine is operated from the exhaust steam of hoisting engine, which steam was collected in a device called a steam accumulator, so that the work pressure of a few pounds is available, as accumulated at the turbine. The turbine is run condensing, and enough power can be obtained from the exhaust of a 1500 h. p. engine by the low pressure turbine to drive a 250 kw. turbine. The steam is naturally not very dry, and although the plant had been running for some two years, there was no record of any difficulty whatever. He had heard of no trouble being experienced with steam turbines from water. He could hardly understand how water would be present in superheated steam, because the idea of superheat itself would imply that there cannot be any water there, because any water would become saturated steam at the expense of superheat.

Mr. S. M. Hopkins, Columbus, said that in Columbus, Ohio, a 500 kw. turbine was installed and had to be started up temporarily to take steam from a long line. They used superheat, and therefore no provision was made to drain the lines, depending upon superheat to take up such condensation as would occur in the line. The turbine was connected practically on the end of the line, and also a General Electric exciter engine, the turbine spoken of being used principally for lighting work. They would find a large amount of water condensed in the pipe, not being drained properly; in fact, it was almost impossible to start the exciter engine. They never had any trouble after starting the turbine up with a large amount of water going through. They used high pressure, and for that reason feared the result on an air pump, which handled both air and water, and in starting high pressure you can see large gulps of water come out of the exhaust without any apparent injury or jarring of the turbine in running.

The speaker further said that in the last six months he had done some practical work on two 500-kw. turbines, installed in a steam station and taking steam from the steam boilers, and practically under the same conditions were two Green-Wheelock tandem engines, with a cylinder ratio of 6 to 1, connected to two 500-kw. direct connected generators. In order to get at the real comparative commercial value of an engine unit of similar size, working under the same conditions of superheat as the turbine, they made quite exhaustive tests, and went so far, both machines operating under commercial load, as to figure out the thermal efficiency and the B. t. u. per electrical horse power, as that was what was really desired after all. He was much surprised to discover that the Green-Wheelock engine showed a higher efficiency, or used less B. t. u.'s per e. h. p. on the board than did the turbine. These tests were made under one-third load, half-load, full load, and fifty per cent over load, and after comparing the tests, and taking the whole proposition into consideration, he considered that the turbine showed itself to be a superior generating unit. They were directed especially to make these tests, as all guarantees on turbines are based on steam consumption for the turbine alone, and also certain guarantees as to certain degrees of superheat. Recognizing that superheat costs money, the question arose as to applying that superheat to an engine and to the turbine, and whether it would not be of equal value to the engine as to the turbine. They found it even more so, if anything, although, on the other hand they found a great deal of trouble in lubricating the cylinders on the engine. It has been running for some months with an average of 75 degrees to 100 degrees of superheat on the engine, and they still have trouble in lubricating the high pressure cylinders, but the economy of the superheat with the engines is quite as marked as with the steam turbine, and their conclusions were in purchasing apparatus they should not be misled by guarantees as to the additional superheat. The speaker thought that the superheat costs practically as much as can be got in economy in steam coming from the turbine. The tests were made in their own shops, under their own supervision and they were pretty sure of them.

Mr. W. H. Abbott of Cleveland remarked, in reply to Mr. Mailloux in regard to water in superheated steam that they are operating two 1,500-kw. turbines with from 50 degrees to 100 degrees of superheat, and in a number of cases they had water present in the steam; whether it is present always in a small degree he did not know, yet there are times when the water comes there in more or less great quantities, although the thermometer will be registering superheat all the time. Of course, the thermometer is more or less lagging in its readings, but result of their experiments and experiences would indicate that they could have and do have, frequently, water in fairly large quantities present in the steam pipe with a high degree of superheat.

Mr. Hopkins added that the plant he had referred to was originally designed not to have separators on the steam line of the engines, but having experienced the trouble which had been mentioned, they were compelled to add separators on all the engines, although they had 100 degrees of superheat. They find that they get water in the engines almost as badly as with saturated steam.

Mr. Mailloux remarked that explained the difficulty—simply water entrained mechanically—and that the cause of it was a defect in the design of the piping or boilers, or in the operation of both, and that it could be remedied by a receiver placed near the turbine or by the use of separator as the gentleman had stated. With reference to the matter of economy he thought the gentlemen present would be interested to know what is not a secret, but a matter which has been very well ventilated elsewhere, namely, that the turbine makers themselves did not claim that the steam turbine has the highest economy under all conditions. In fact, the turbine makers recognized that the steam turbine is more efficient in the lower stages of pressure than in the higher stages. This was so well known that a very prominent English engineer has proposed to use the reciprocating engine for the higher pressure stages, say from 200 lb., expanding the steam down to 10 or 15 lbs. above the atmospheric pressure, and using the lower pressure turbine with condensation. Under these circumstances it would be found that a few pounds of pressure, plus the condensation, would enable the turbine to develop as much power as the steam engine with the higher form of pressure. That is why things which are intelligible from a thermo-dynamic consideration are not a mystery. As the gentleman from Columbus had pointed out, there are other things which enter into the case. They were not concerned alone in the cost of fuel in the operation of a plant, as the cost of fuel is a small proportion, after all, of the total cost per kw. hour. What they wanted was the total cost reduced and in that equation there entered many things, like space maintenance, repairs, etc.; and the bulk of evidence up to the present time indicated that the turbine will make up in other things for a slight discrepancy against it in steam consumption, There was a steam engine in Berlin built by one of the most distinguished firms in Switzerland, a triple expansion, four cylinder compound engine, 5,000 h. p. unit, which, running at very nearly full load has developed a horse power hour for something less than nine pounds of water per indicated h. p. hour with superheat up to 600 degrees F. or more. That was perhaps the world's record up to the present time, but that engine had sixteen valves, complicated mechanism, and a great deal of lubrication was required. It has been stated that doubtless the cost of maintenance and the cost of the extra lubrication of the cylinder, lubrication of the valve motion, etc., and all the expenses connected with the operation of that unit make it less economical when you come to consider the total cost per annum of producing the kw. year. So it was an important thing to bear in mind that one of the reasons why the steam turbine appeals to us is that it simplifies the operation and reduces the maintenance of the plant in other respects than that of economy of coal. The steam turbine had only begun its development, and the more it was developed the more it would approximate the results obtained by the steam engine.

Mr. Robert McCulloch, of St. Louis, inquired where Mr. Mail-

[illegible] thought it was an insignificant matter as the price of [illegible] power, which with most roads it is larger than all the other items put together.

Mr. Mailloux answered that it was a pertinent question. He referred the engineer to the transactions of last year, where that question was discussed and covered. In his capacity of consulting engineer he had to deal with problems where fuel varied from $1.50 per ton to $15 per ton and he had stated quite definitely in the discussions referred to that there is a certain critical price for coal at which the steam turbine is not preferable to the reciprocating engine, and that there was a price slightly higher at which the steam engine fell short in comparison with the gas engine, and at a little higher price it laid between the gas engine and the Diesel engine, so that it was a pertinent question. It was the first duty of a consulting engineer when called upon to advise his client to investigate the cost of fuel.

Mr. Thomas Hawken, of Dover, N. H., said that he believed that it is the duty of every man here who has a turbine working satisfactorily to testify regarding it for the benefit of others. He has charge of a station of the United Gas and Electric Co., in which are installed two 500-kw. machines, and since they had started up about three months ago they had been working very satisfactorily. They have had no trouble whatever with the lubrication of the turbines, and they had a 21-hour test made and got the results on light loads, quarter, half and full loads and fifty per cent overload, and he considered the results as good as any secured with a first class reciprocating engine. The output for the day was 4,100 kw. and they run machine motor circuits, railroad circuits, and lighting circuits, and the regulation was very fine on the machine. The coal consumption was 4 lbs. per kw. hour. As to the lubrication, he wished to state for the benefit of those present that he was told it was necessary to have the oil cooled, but he found that after a couple of months that the water would get into the oil and the oil became saponified and looked very much like lard; but he found he could separate it by putting a steam pipe into the oil. The people who sold them the oil then advised them it was not necessary to cool the oil. They claimed the oil would give perfect results up to 400 degrees. He was doubtful, but tested the matter and found they had no bad results whatever, and the temperature is 140 to 160 degrees. They have a perfect return-water system for their plant. They pay a price of 25 cts. per thousand gallons of water, but with this return system they find that it does not require over 5¾ lbs. per kw. so that their water bill is not very high.

Mr. W. H. Abbott, of Cleveland, said that the experience related by Mr. Hawken as to the deposits in the oil was interesting to him. In one of the plants for which his firm was consulting engineer it had a similar experience. The deposit Mr. Hawken referred to was said to be like lard; the deposit which they had was something like vaseline, a dark yellowish red deposit. He did not think it was due to water in the cooler, because as far as they knew there was no leak in the pipe, no collection of water which would indicate a leak, and yet in using different kinds of engine oil the best that the builders could recommend, they always had this deposit in rather large quantities, which was rather a serious matter, since they occasionally had to stop a turbine and clean out all the oil chambers.

Mr. Hopkins remarked that the turbines at Columbus are different from those at St. Joseph, Mo., with which he was familiar. There the pipe for the oil and the pipe for the steam leaving the step bearing are so arranged as to practically produce a balance between the oil and steam and at that point they are having no trouble with water in the oil. He was not familiar with the detail of the method of piping as it is a recent installation, but as he understood it it is the method of piping which the General Electric Co. expects to adopt. The installation at St. Joseph is a 1,500-kw. turbine, and they have no trouble with sediment in the oil, or with water in the oil. With the 500-kw. turbine at Columbus they had the trouble the gentleman mentioned and they found that they had to change the oil.

President Ely announced that the next business would be the paper on steam turbine power plants by Mr. J. R. Bibbins. This paper will be found on page [illegible].

Mr. A. S. Kibbe, of Philadelphia, asked Mr. Bibbins whether the relative economy of the high vacua, as deduced in his paper would not apply as well to reciprocating engines as to turbines?

Mr. Bibbins thought that he was not far from the truth in stating that an engine with a cylinder ratio of 1 to 4 did not usually expand below 5 lb. condenser pressure. It would, of course, become more and more economical as the vacuum was decreased, but the proportion of the rate of increase, as you might call it, is decidedly less than in the turbine, because the turbine does expand down to condenser pressure. That had been shown time and time again by taking the temperature of the exhaust end of the turbine. If a condenser can be run with 28 in. vacuum the turbine can be designed so as to reach any condenser pressure. It was a fact that the turbine, without being made extra large or bulky, can take advantage of a high vacuum, where the engine cannot directly.

Mr. W. H. Abbott, of Cleveland, stated that he had noticed Mr. Bibbins called attention to the large amount of air which is brought into the water by small leaks, and he wished to ask whether, reasoning from that standpoint, Mr. Bibbins would say he should not use open feed-water heaters but rather use closed feed-water heaters, so as to exclude the air. Mr. Bibbins answered that he did not know that he could answer the question from his personal experience, but the fact was apparent, however, that the more you can exclude air from the steam cycle the easier it will be to attain the higher vacuum. He thought that fact was brought out in almost every turbine plant. Of course, the air pump is built to remove the air, but every cubic inch of air that gets into the circulating system has to be taken out by the air pump, and that means power consumption.

Mr. Mailloux inquired if Mr. Bibbins found any practical difference in the power required when the air pump pumps air that is cool—when there is a cooler for the dry vacuum pump.

Mr. Bibbins answered that he could not reply to the question definitely from the fact that he had never seen any tests made to determine that particular point.

Mr. R. H. Rice said that in regard to the question of air, it seemed to him the open heater would contain less air than the closed heater, as the open heater would give an opportunity for the air to escape while the water was circulating, which the closed heater would not do.

Mr. Hopkins, of Columbus, remarked that he knew of two turbine installations, in one of which an open heater was used and in the other a closed heater was used, both using the same form of air pump, and there was practically no difference which could be observed as to the quantity of air which was in the water.

President Ely announced that the next business would be the reading of a paper on "The American Diesel Engine," by Mr. E. D. Meier. Mr. Meier's paper in printed on page 792.

Mr. Mailloux said that he thought he ought to open the discussion on the paper by returning to Mr. Meier a hearty vote of thanks for the extremely clear exposition he had given concerning the Diesel Engine. He had been studying this engine for some years, because he considerd it one of the most interesting things before the profession. He wanted to ask one or two questions—what is the largest size in horsepower or kilowatt capacity of the Diesel engines that are now made, and what are the prospects of larger sizes being made. He also desired, if possible, a statement as to what we may expect the cost to be per h. p. hour or per kw. hour. He considered the engine was more interesting on account of the promises it holds forth for the future than on account of the practical results realized at the present time for large power stations. As he understood, the large size machines have not been commercial and have not been used in practice. It would be possible, he imagined, to get a plant of 1,000 kw. in one unit; but, of course it would be out of the question to have two units of 5,000 or 10,000 h. p., but he thought the time would come when engineers would be as enthusiastic about engines of the Diesel type as they are at present in regard to the steam turbine, as a step forward in the general evolution of prime movers.

Mr. Meier replied that at present they were building nothing

[illegible] The largest being 500 h. p. engines. They [illegible] of that size at Elkhart Lake to [illegible] Sheboygan & Elkhart Lake Ry. That will be running in about six weeks or two months.

Mr. [illegible] how many cylinders the engine contained.

Mr. [illegible] contained six cylinders; it is composed [illegible] coupled together with a dynamo between. The German firm had already built four engines of 400 h. p. [illegible] 100 h. p. to a cylinder, which they have been erecting for the street railway and light plant in Kiew, Russia. They expected to get to larger sizes in the course of the next year and would probably get to a 1,000 h. p. engine before long; no difficulty had been experienced so far. The difficulty in regard to large gas engines had been on account of the explosive action and the uncertainty of ignition, which has been largely overcome, and on account of the high temperature. The temperature in the Diesel engine is considerably less than in the gas engine and they had experienced no difficulty in the larger sizes. They naturally began with the small ones, on account of experimental work, but they are now designing larger machines and expect to have engines as large as 1,000 h. p. by next year. As to the cost, that was at present pretty high, but that will come down in the course of time; you could not buy a corliss engine 15 years ago for the price that you can buy it now, and the cost of a Diesel engine varies from $60 to $70 per h. p. for the plant. Mr. Meier called the attention of the members to the fact that when they compare that price with a steam engine or a steam turbine plant they must remember that they have no boilers to consider, no smoke stack, no coal handling machinery, and no ashes to get rid of. All the engine requires is an underground tank. Run the oil into that, and the engine will do the rest. There was no fuel to take care of. The exhaust was clear as air. In some cases lately they had admitted a little water into the exhaust chamber of each cylinder and that water cooled the gases, and there was a small vapor of steam coming from that, which was especially designed to kill the noise, as the noise had been very objectionable.

Mr. Hopkins inquired upon what mean effective pressure the engine was rated.

Mr. Meier could not tell, it was so long since he took any indicator cards. They began by taking indicator cards on every engine, and after they started they found the brake test was all they required. As long as they got the economy and power by the brake test they were satisfied.

Mr. Hopkins inquired how the initial pressure and indicated efficiency compared with the ordinary gas engine, using in both cases ten thousand heat units.

Mr. Meier answered they had about 520 lb. pressure at the [illegible] out at about 30 or 40 pounds. The expansion was immense.

President Ely [illegible] that the very valuable papers which had just been read, whose preparation had evolved so much care and effort, were a source of congratulation to the meeting, and that some recognition would undoubtedly be taken of them by the convention.

President Ely announced that the last paper before the meeting [illegible] "Transfers: Their Uses and Abuses," by Mr. Leon Jewell, of the Chicago City Railway Co. This will [illegible]

A [illegible] interesting discussion on the subject of transfers then ensued, in which President Ely, Mr. John I Beggs, Mr. Robert McCulloch, Mr. L. E. Myers and Mr. H. H. Vreeland [illegible]

Mr. Vreeland offered the following resolution:

[illegible] committee be and hereby is, [illegible], to employ such clerical or expert assistance as it may deem desirable, and to fix the compensation [illegible]

Mr. [illegible] reason for offering the resolution [illegible] of the Association largely [illegible] At the annual meetings [illegible] given to the consideration [illegible] the delegates assemble the practical and technical questions connected with the business. It was, therefore, necessary for the executive committee to do the real work of the organization and have it ready to report to the open convention in annual session. An organization of which he was the president, the New York Railroad Club, a steam railroad club with over 1,200 members, empowered its executive committee over two years ago to take similar action, so that it has been possible for the club to do a great amount of work in the sessions of the executive committee during the year, which is invaluable to the work of the organization. There are many questions which come before the executive committee of the American Street Railway Association which it can more intelligently handle than the open convention, and by giving it such technical and clerical assistance as it may require, and allowing it to be the judge of what it shall be, when to be used, and what the compensation shall be, he thought that the members of the Association would be well repaid for any expenditure envolved.

The motion was seconded and duly carried.

Mr. G. Tracy Rogers, of Binghamton, offered the following resolution:

Resolved, that the thanks of the Association be extended to the officers and members of the Manufacturer's Committee for the very excellent arrangements provided by the committee for the entertainment of the delegates at this convention, and the very satisfactory manner in which they are being carried out.

Resolved, further, that the members of the Association take this opportunity of expressing their appreciation particularly of the music furnished by the band engaged by the committee. Carried.

The President called for the report of the committee relative to prices on girder and standard T-rails, and Mr. John I. Beggs, chairman of the committee stated that the committee had no report to make at that time.

Mr. John Grant, chairman of the committee on compensation for carrying United States mails, submitted the report for his committee. It was a report of progress, coupled with an expression on the part of the committee that it believed the conditions would soon be favorable for having the matter considered by the government.

On motion of Mr. J. C. Hutchins, of Detroit, the present committee was continued.

The President called for the report of the Committee on Nominations which was as follows:

Your committee appointed to nominate officers and select a place and time of meeting for the next annual convention of the association respectfully begs leave to submit the following report:

Recognizing the necessity for and looking to an administration of the work of the Association along more comprehensive lines, a general plan of which was tentatively set forth in the admirable address of the president which we heartily endorse, and to enable him to elaborate and perfect the plan so well outlined, we recommend the retention in office for another year of the president and first vice-president.

We also recommend that during the ensuing year arangements be made and negotiations entered into to the end that at our next annual convention the duties of the secretary shall be enlarged so as to require him to give his entire time to the work of the association and that he shall be qualified by training and experience to collect and preserve information on technical subjects and other matters of general interest to the members of the association and that his office may constitute a bureau of information on subjects of importance to our work and interests.

We recommend the following as officers for the ensuing year:

For president, W. Carl Ely, president International Ry. Co., Buffalo, N. Y.

First vice-president, Elwin C. Foster, president New Orleans Railways Co., New Orleans, La.

Second vice-president, John I. Beggs, president and general manager The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

Third vice-president, Richard McCulloch, assistant general

[Continued on page 787.]

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SAVE THE "DAILY REVIEW."

SOME COMMENTS ON THE CONVENTION.

The 23rd annual meeting of the American Street Railway Association was a very gratifying surprise in several respects. When St. Louis was chosen as the meeting place grave doubts were entertained as to whether it would be possible to prevent the Fair and the various entertainment features from interfering with the technical work of the association. These doubts were increased to some extent when it became known that but two sessions of three hours each were to be held.

While the time available for the discussion of the technical papers that were presented was entirely too short, being confined to the second day, on which was also considered practically all of the routine business of the association, the discussion was unusually interesting and instructive.

The first day was devoted to the preliminary addresses; these addresses were by far the best that it has been our privilege to hear. Although every one in attendance had undoubtedly read much concerning the Louisiana Purchase Exposition, it is safe to say that the address of Governor Francis was a revelation because there were extremely few among his auditors, who, like President Ely, knew by experience some measure of the work involved.

The address of Professor Goldsborough was a most interesting resume of the striking electrical features of the Exposition, and it is a source of regret that the delegates could not have had the advantage of hearing Professor Goldsborough speak on the first day of convention week.

Mayor Wells, in his brief address, departed from the time-honored methods of extending a welcome to the city and took occasion to introduce some substance into his remarks. The reason for this, of course, is that Mr. Wells is an old street railway man and felt at home among his colleagues, knowing that they would not misunderstand him.

Undoubtedly the most important work transacted at this meeting was the consideration of plans for the betterment of the American Street Railway Association. President Ely devoted a considerable portion of his address to a presentation of various plans which had been suggested and discussed by the Executive Committee and other leading members of the association. The allied associations demonstrated that they are also deeply interested in the reorganization and there can be no question but that within the next year the A. S. R. A. will be entirely rehabilitated. The excellent work done by President Ely in putting new life into the association was most properly recognized by the unprecedented action of re-electing him as president for the succeeding year. The convention of 1905 will be the third at which Mr. Ely will have served as presiding officer, he having been called to the chair at the Saratoga convention by reason of the absence abroad of President Hutchins.

The well-deserved compliment of re-election was also paid Vice President Foster and Secretary Penington.

In the course of his remarks from the chair at Saratoga Mr. Ely commented upon the facts which were apparent to all: that the association was devoting too much time to play and too little time to work and that the supplymen were not receiving fair treatment in that too little attention was given to their exhibits by delegates to the convention.

A most striking feature of the St. Louis convention was that the meeting hall was crowded during the whole of both sessions, something unheard of in former years. This is in itself a sufficient testimonial as to the ability of the present management of the association and fully justifies the departure from precedent in re-electing Mr. Ely.

That in the limited business sessions of the association it turned out more discussion and of far better quality than at any of the recent conventions is also indicative of the ability of Mr. Ely as a presiding officer.

Also there was quiet.

The organization of the Manufacturers' Association has been successfully accomplished and its work at St. Louis has been in nearly every respect most admirable. Special praise is due because of the excellence of the entertainments provided. The band concerts were particularly enjoyable and the theater parties and receptions provided interesting and diverse recreation for the evenings. The Manufacturers' Association has also recognized the effective work of its executive committee by re-electing all of the members who were willing to serve. The new committee in turn re-elected Mr. Brady, to whose efforts the successful organization of the association was so largely due.

We believe that the only adverse criticism that can be passed on the work of the Manufacturers' Association at this convention relates to the matter of the registration and the publication of the list of those in attendance. The confusion in the matter of registration doubtless arose from failure on the part of the Manufacturers' committee to consider that the registration would be conducted by the secretaries of the three railway associations and also to the fact that the red badges were distributed at the Southern Hotel only, during the first two days of the convention. Failure to provide a registration booth for supplymen at the Fair Grounds caused many considerable annoyance, and it perhaps is not too much to say imposed a hardship upon many members of the Manufacturers' Association. Inasmuch as the Mechanical & Electrical Association registered its members at the Transportation Building on Monday and Tuesday the names of none of the members of this association were registered in the first bulletin issued by the committee having charge of registrations. This list was issued about 30 hours later than was intended.

The Mechanical & Electrical Association can regard with satisfaction the work that has been done by its retiring president, Mr. E. W. Olds, of Milwaukee. No one has been more earnest in promoting the welfare of the body nor is any member more competent than he to direct the affairs of such a technical association.

In his annual address, President Smith of the Accountants' Association showed his keen appreciation of the needs of this important branch of railway work.

One important theme in his address is the need of a world-wide standard in electric railway accounting, and he emphasized the fact that America, which, in this connection, means the Street Railway Accountants' Association, has taken the lead in the matter of standardizing street railway accounts and by virtue of this priority is today the dominant factor in such matters.

Another point made by President Smith was the spirit of co-operation between the Accountants and the Master Mechanics shown in the arrangements for the joint session to be held today. This is in hearty accord with the moving spirit of the St. Louis conventions, which can perhaps be best described in the two words Harmony and Co-operation.

"THE DAILY STREET RAILWAY REVIEW" AND THE A. S. R. A.

At the closing session of the American Street Railway Association the resolution rescinding the action taken at the Saratoga convention in requesting that the technical press do not publish daily reports of the proceedings came up for discussion. The action taken was to promptly pass a substitute for the resolution introduced Wednesday by Mr. J. C. Hutchins, which substitute resolution embodied the change desired by Mr. Hutchins.

The complete history of this matter was given at pages 739 to 741 of the "Daily Review" for Oct. 13, 1904, and it is sufficient to say here that the record has been amended to show that the Association now thoroughly approves of the publication of the "Daily Street Railway Review," asking only that verbatim reports of the discussions be not published until opportunity be had to eliminate those slips of the tongue and other errata that so often find their way into the records during a heated debate.

While regretting that the discussion as to the amendment of the censorship resolution trespassed upon the total time of the Association to the extent of nearly one-seventh thereof, we nevertheless feel that as a matter of justice to ourselves the membership of the association should know the merits of this question. As this resolution now stands it embodies all that we have ever asked.

The association and the "Review" proved to be in entire accord in this matter as soon as a mutual understanding was had.

In conclusion we wish to express our heartiest thanks to Messrs. J. C. Hutchins, C. O. Mailloux, and John I. Beggs, the censorship committee appointed on Wednesday, for their courtesy in so promptly releasing yesterday's discussions that we were able to include it in today's issue of the paper and still close our forms several hours earlier than we expected.

AN EXPRESSION OF APPRECIATION.

Although a knowledge of the modus operandi of newspaper publishing has been widely diffused, so that it is no longer a "mysterious" calling to the layman, yet it is conceded to be no light task, even when all the departments and operatives of a newspaper office have been trained to work together. Consequently it may be imagined that the publication in a strange garret far from home, of a daily technical magazine like the "Daily Street Railway Review" is no mean undertaking, especially when it is remembered that the mechanical features of the work have to be carried on by operators who are more or less unfamiliar with electric railway technicalities, and with no previous preparation other than a general knowledge of the printing business. Hence the publishers of the "Review" feel that it is but just to take this opportunity to express their gratitude to those who have helped to make the St. Louis "Daily" a success. We wish to thank the St. Louis Chronicle Co. and the manager of its linotype department, Mr. T. M. Jenkins, together with the J. P. Richarz Press-room Co. and the employes of these companies, who inconvenienced themselves and put forth every effort in order that the delegates and other readers of the "Review" might not be disappointed. And we think every reader of this year's "Daily Review" will join us in commending these gentlemen upon the result of their co-operation with the publishers.

The "Daily Review" is very greatly indebted to Mr. T. E. Crossman and his assistants for their efficient work in reporting the proceedings of the conventions. Mr. Crossman has long been identified with the associations as their official stenographer, and they are very fortunate in obtaining the services of so competent a reporter.

PRESIDENT BAKER.

In the election of Mr. C. F. Baker to the position of president of the American Railway Mechanical & Electrical Association this body has again shown its wisdom and good judgment in its choice of its officers. Mr. Baker is superintendent of motive power and machinery for the Boston Elevated Railway Co., and has long been recognized as an authority in this field, having devoted a great deal of study and investigation in this line of work. Mr. Baker has been an earnest worker in the association and was one of the founders. At Saratoga he presented the paper on "Car Bodies." In discussing those perplexing problems which face a master mechanic and are presented before the conventions he has always done his full share. It is certainly pleasing to note this recognition of his efficiency and we all know that the progress and success that has been attained by the association will be continued by its newly elected officers.

SECRETARY MOWER.

The Mechanical & Electric Association has re-elected to the position of secretary Mr. S. W. Mower. We wish to extend to Mr. Mower our hearty congratulations and we would say to the association that their choice in this matter is certainly a very good one. Mr. Mower is known to all of us not only as an earnest and efficient servant of the association, but as a congenial and obliging gentleman, always having the interests of the association at heart and at all times willing to lend his assistance to those seeking information in regard to the matters before the association. His ability and integrity have been recognized by the members of the association and a more fitting appreciation of them could not have been shown than in his re-election to the position of secretary of the American Railway Mechanical and Electrical Association.

Mr. H. F. A. Kleinschmidt, superintendent of the track welding department of the Lorain Steel Co., arrived at the convention Monday. His headquarters are at the Southern.

When you meet Mr. Cadwallader Evans, Jr., of the Macon-Evans Varnish Co., of Pittsburg, ask him for one of the miniature dice outfits he is giving away as souvenirs. They are said to be very efficacious whether shaking for fun or marbles.

The familiar countenance of Mr. Ernst Woltmann, of the Albert & J. M. Anderson Manufacturing Co., is met with frequently in the corridors and at convention headquarters. Brother Woltmann is very generous with souvenirs, too, and without asking he will hand out a very attractive match box.

Mr. William Ward Hincher, of the Chicago sales department of the Albert & J. M. Anderson Manufacturing Co., is putting in some telling work for his company at the convention. He says the company is rushed with orders.

Among the representatives of the National Electric Co. who have been active this week is Mr. J. J. Riley, of the Cleveland office.

The Barbour-Stockwell Co. of Cambridgeport, Mass., manufacturers of street railway special work, is represented at the convention by its president, Mr. Henry R. Luther.

Mr. H. A. Dorner, the electric railway equipment man, of Chicago, has headquarters at the Southern Hotel, where he may be found when he is not at the convention.

The Taylor Electric Truck Co. of Troy, N. Y., is represented at the convention by Mr. Franklyn M. Nicholl, its western agent.

[Continued from page 779.]

manager St. Louis Transit Co., St. Louis, Mo.

Secretary and treasurer, Thomas C. Pennington, treasurer Chicago City Railway Co., Chicago, Ill.

Executive Committee: president, vice-presidents and

John J. Stanley, general manager Cleveland Electric Ry. Co., Cleveland, O.

Howard F. Grant, manager Seattle Electric Co., Seattle, Wash.

C. G. Goodrich, vice-president Twin City Rapid Transit Co., Minneapolis, Minn.

Frank G. Jones, vice-president and general manager Memphis Street Railway Co., Memphis, Tenn.

W. E. Harrington, general superintendent Public Service Corporation of N. J., Camden, N. J.

We recommend that the selection of a time and place for the next annual convention of the association be left to the incoming officers and executive committee.

Mr. W. Worth Bean moved that the secretary be authorized to cast the ballot of the convention for the officers nominated. The secretary cast the ballot, and the gentlemen were declared elected.

President Ely: I cannot but feel greatly complimented and highly honored by this mark of your appreciation of the work of the past year. I had firmly resolved upon this subject, it having been broached to me, and had communicated that resolve to a number of gentlemen, some of whom were upon this nominating committee, that it would be impossible for me to yield to any sense of duty in this matter along the line indicated. However, I suppose that this association is bigger than anybody in it, and that its call is unmistakable; that it constitutes a call of duty. It has not been my practice to shirk duties and I accept this high mark of your appreciation.

I would say that during the past year the members of your executive committee have worked very hard and very earnestly and have always been perfectly willing to go long distances to meetings, and to spend all the time necessary to satisfactorily and properly do the things that were to be done. However, the executive committee and your officers will be powerless to effect good along the lines indicated or to do much that will be found to be beneficial unless there is the heartiest co-operation and assistance afforded by the members of the body of this association. It seems to me that we have all been guilty of a feeling of neglect, that is a feeling that has manifested itself in a neglectful way. We have laid the affairs of the Association down at the end of a convention to be taken up only at the assembling of another convention a year thereafter. Now, if this work is beneficial, if this is not boy's play, but man's work, it should be continuously prosecuted in an earnest way, and the members of the association after getting home should feel that the duty was still upon them to manifest their interest by holding up the arms of the executive committee and the officials of the association. That can be manifested in different ways. We are all pretty well familiar today with the things that are contemplated, and I should be glad, and I know that the incoming officers would be glad, to see discussions in the technical press, that is, suggestions offered from highly intelligent sources concerning the nature of the work and the nature of the reformation of the lines of work that suggest themselves to the different members of the Association.

It does seem to me that it is an important thing that every president, every manager, of a street railway company, who feels that out of co-operative and united work may come good to the great body of the street railway fraternity, should do everything in his power to increase the membership of this association. Out of the large number of street railways in the country, something more than 700, we have less than 200 members. If there is approval of our work, certainly it should take the form of increased membership, and if we should double our present membership, and secure 400 members, we would still only have about 50 per cent of the companies eligible to membership. The dues from 400 members would give us a fund of $10,000 a year which would be sufficient to carry on this work in a most intelligent manner so that the American Street Railway Association will come to be recognized as a body of authority and power representing and [illegible] the street railway interests of this country, so that as the result of this increase in our membership and in the usefulness of the Association you will find that it will take a place among the well recognized and highly respected bodies and associations in the world, and that to be connected with it either as a member or an officer will be a matter of credit to all. There is already an international railway association, international between the different countries of Europe, which I think is holding a convention in Vienna at just about this time.

It seems to me that the tremendous amount of money, between two and three billions of dollars, that is represented in our business in the United States should call for a more vigorous support of this association; and if it should come about that we secure as members 75 per cent of the companies of the United States and Canada, the Association will become a great and progressive organization that will give a tremendous uplift to our business and all engaged in it, manifesting itself in every direction that is beneficial.

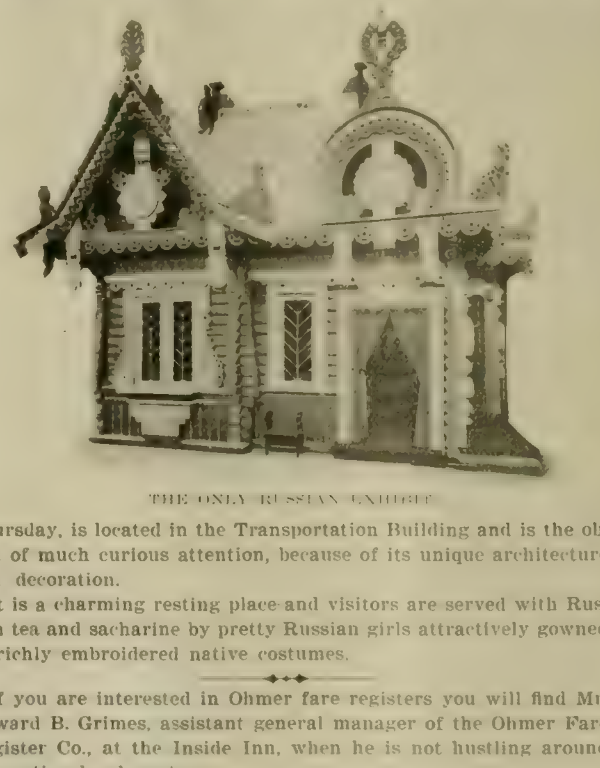
Without your co-operation the labors of the incoming officers will result in nothing. With your co-operation along the lines suggested, the lines that naturally occur to you, I believe that much can be done in the present year. So far as I am concerned, I am a very busy man. I have enough to do to keep me busy, and have sufficient sacrifices of my time to make in other directions, without the work entailed by this position to which you again elected me. But I accept it, with all that it means, and with your co-operation will endeavor to perform satisfactory work.

The meeting then adjourned.

WESTINGHOUSE RUSSIAN BUILDING.

The accompanying illustration shows the front of the only Russian building at the Exposition, which was erected by the Westinghouse Co., Ltd., of St. Petersburg, as a feature of the Westinghouse brake exhibits.

This pavilion, which was described in the "Daily Review" for



THE ONLY RUSSIAN EXHIBIT.

Thursday, is located in the Transportation Building and is the object of much curious attention, because of its unique architecture and decoration.

It is a charming resting place and visitors are served with Russian tea and sacharine by pretty Russian girls attractively gowned in richly embroidered native costumes.

If you are interested in Ohmer fare registers you will find Mr. Edward B. Grimes, assistant general manager of the Ohmer Fare Register Co., at the Inside Inn, when he is not hustling around convention headquarters.

Mr. Arthur S. Partridge, the ever popular street railway supplyman, of St. Louis, as secretary of the local entertainment committee, is certainly trying to help all the visitors to have a good time. You will find him hustling around at every entertainment function.

EIGHTH REGULAR ANNUAL MEETING

STREET RAILWAY ACCOUNTANTS' ASSOCIATION

St. Louis, Mo.—Oct. 13-15, 1904.

THURSDAY, OCT. 13, 1904.

The meeting was called to order at 3:40 p. m. by the President, F. E. Smith, of Chicago, in the Convention Hall of the Transportation Building.

Secretary Brockway then called the roll of member companies.

The minutes of the last meeting were on motion approved as printed.

The President then read his annual address, which will be found on page 759 of this issue.

Mr. Brockway then presented the annual

REPORT OF THE SECRETARY-TREASURER.

In submitting my annual report as secretary and treasurer for the year just closed, I have to tell you that we have gained 28 new members; we have lost 16, making a net gain of 12, and now has 148 members in good standing, which is not a very bad showing in view of the fact that mergers are still continuing. The association has suffered considerably from the merger fever in the last five or six years, and it is some comfort to me, and I am sure to the executive committee, to advise you that we have made a gain. As a list of reasons for resignations I want to read to you that on account of merger we have lost five out of 16; on account of "receivers appointed," 2; on account of "cannot afford," 1; on account of "practically all steam railroad," 1; three apparently from the records which I have and from their actions in the matter, joined, got their reports and immediately resigned; two gave as their reason that they were outside of control, and two are so far unenlightened that they cannot see any use in the Accountants' Association.

In regard to delinquencies, I have reason to believe that three will be paid.

The companies joining the Association in 1903-4 were:

Fonda, Johnstown & Gloversville Ry., Gloversville, N. Y.
Rochester & Eastern Rapid Ry., Canandaigua, N. Y.
Public Works Co., Bangor, Me.
Pueblo & Suburban Traction & Lighting Co., Pueblo, Col.
Elgin, Aurora & Southern Traction Co., Aurora, Ill.
Coeur d'Alene & Spokane Ry. Co., Spokane, Wash.
Youngstown & Southern Ry. Co., Youngstown, Ohio.
Cleveland, Painesville & Eastern R. R., Willoughby, Ohio.
Niagara, St. Catherines & Toronto Ry., St. Catherines, Ont.
Northern Texas Traction Co., Fort Worth, Texas.
Knoxville Traction Co., Knoxville, Tenn.
Lima Electric Ry. & Light Co., Lima, Ohio.
Cleveland, Painesville & Ashtabula R. R., Cleveland, Ohio.
Indiana Northern Traction Co., Marion, Ind.
Boise Traction Co., Boise, Idaho.
New Jersey & Hudson River Railway & Ferry Co., New York.
Pennsylvania & Mahoning Valley Ry. Co., New Castle, Pa.
Cincinnati, Lawrenceburg & Aurora Electric Street R. R., Cincinnati.
Norfolk Railway & Light Co., Norfolk, Va.
Scioto Valley Traction Co., Columbus, Ohio.
Los Angeles & Redondo Railway Co., Redondo, Cal.
Montgomery Traction Co., Montgomery, Ala.
Coal Belt Electric Ry., Marion, Ill.
City & Suburban Ry., Portland, Oregon.
Indianapolis & Cincinnati Traction Co., Indianapolis, Ind.
Camden & Trenton Ry., Riverside, N. J.
Public Service Corporation of New Jersey, Newark, N. J.
Interborough Rapid Transit Co., New York, N. Y.

While anticipating the report of the executive committee I desire to add that the committee has examined the books of the Secretary-Treasurer and certified them as correct.

Sept. 3, 1903, the balance on hand was $2,399.49; receipts during the year were $2,839.10 and expenses $3,343.63, leaving a cash balance on hand of $1,894.96.

On motion the report was unanimously adopted.

Mr. Elmer M. White, of Hartford, Conn., then presented his report on Blanks and Forms.

REPORT OF THE DEPARTMENT OF BLANKS AND FORMS.

BY ELMER M. WHITE.

Blanks and Forms have always been of interest to members of this association, as the records will show. When the meeting to organize this association in Cleveland, Ohio, March, 1897, was called it included the following: "Delegates are urged to bring complete sets of forms and blanks for exchange and inspection."

At the Boston meeting in 1898 some of you will remember the large collection that was brought for inspection and the great interest shown by the members present; so great was the interest that at that meeting Secretary Brockway was appointed Custodian of Blanks. The thought as expressed at this meeting was that the collection should be put in a permanent form so that members could have access to it and that new blanks should be added from time to time and so kept up to date.

At the Chicago meeting in 1899 the Department of Blanks became a permanent feature of the association. Secretary Brockway had arranged the Boston collection, to which had been added many thousands of new blanks, in 14 large books, 13 books 20x30 inches and one book 30x30. The collection now was in permanent shape, and the arrangement had been so carefully made and indexed that one could readily find the kind of blank he desired, or if the blanks of a certain company were wanted, they also were soon located. It is believed that this collection of blanks from about 80 representative companies of the country has been of great benefit to the association, not alone to the smaller and younger companies, but to the larger and older ones. The collection was shown at the meetings at Kansas City, in 1900, New York, 1901, and Saratoga, 1903 (at Detroit in 1902 owing to a delay on the road the blanks did not arrive until after the meeting adjourned).

While the collection has been of great help to the members that have been able to attend the meetings, the members that have not been so fortunate have been able to get such blanks as they desired from the duplicate set, and in that way have been kept informed as to what is latest and best in any line they may be working.

At the Saratoga meeting the Executive Committee recommended " . . . the appointment of a committee of one to make a new collection of blanks and forms, as the present collection is over four years old; it has been very valuable and would be still more useful if it were up to date." Mr. Ross moved that the President appoint a committee of one as recommended and President Davies appointed the undersigned

On November 2, 1903, a request was sent to the 143 members of the association. This was followed by a second appeal on December 2, 1903 Early in January, 1904, members had sent in about 13,000 blanks, so that the committee decided to issue no further calls However, two or three large sets came in during the next two months, so that the total number of blanks reached nearly 20,000, divided among 80 companies. This does not mean that there were that many different blanks, but it does mean 20,000 separate pieces of paper, which cover the duplicate set and the duplicate and triplicate showing of forms.

Our first work on receipt of a package of blanks was to count them, stamp the date filed, and see if a duplicate set had been sent. The duplicate set was often not considered by the sender when the blank was printed on both sides. I should say that about 20 per cent of the returns were short one or more such duplicate blanks to make their collection complete. Letters had to be written to get the missing blanks. Among the directions that were in the original letter was: "Send all blanks flat. Do not fold anything to a smaller size than 14x17," and "If blanks do not have name of company printed, write name in ink or stamp with rubber stamp." I think there were at least 20 packages that came rolled, some of them so tight that it was almost impossible to straighten out and get into good shape the heavy ledger paper and cards which were sent in this way. Many of the companies neglected to put their names on the blanks. This was important, for they were to be indexed.

After the blanks had been counted, stamped with date, and names of companies written on, came the distribution to the proper subdivision in the various books. We soon found that it was necessary to write out a brief description of what was to be included in these various subdivisions, both for our own guidance in distributing and also for the member who wished to find a blank covering a certain subject. Here was one point where I cried, Help! but had to go it alone and do the best I could. I am sure you will not all agree with me in all my subdivisions and the explanation of them, and I shall not blame you or feel badly if you do not. We do not all look from the same point of view or have the same experience to guide. The explanation of what is in these subdivisions will be found at the end of this report. It will be of much assistance to members desiring to find a certain kind of blank in the collection here on exhibition, or to the member who wishes to have a certain blank sent to him. In the past it has not always been easy for a member to make clear just what was wanted; we trust that we have made the task easier.

The present collection is in 16 loose leaf books, with 152 subdivisions. The decimal idea was followed in the numbering of the subdivisions. Former book 1 we call 100, and each subdivision goes by steps of 5 from 105. This gives an opportunity to put in new subdivisions without using half numbers or letters. Each subdivision in the books of blanks has its own page numbers; each begins at one.

Instead of following the scheme of indexing for companies that was used in the old collection, we have made a separate loose leaf index, using a page for a company, arranged alphabetically by cities. Mr. Brockway has found that that system was preferable. Numbers only are used in this index; for example, a black number 570 indicates "Material Supplied," a red number 5 indicates the fifth page of 570. Of course to know the meaning of the black numbers one must consult the second section of this report showing the subdivisions. A list of books printed on an orange-colored card shows the class of blanks in each book, and a label shows the number of the book. The list shows that Book 500 is "Material," and the label on cover is 500, and the blue number on every page is from 505 to 580.

The class of blanks in the various books has not been changed from the original collection except that "Gas and Water" has been added to Book 1400, "Electric Lighting." Book 1500 has been used for "Freight and Express," which will be found of interest to many, and "Glasgow Corporation Tramways" has been put in Book 1600. This book is also worthy of your attention, for there is much that we can learn from our brothers across the water.

The work has progressed slowly, owing partly to lack of room for handling such a number of pieces of paper, and also the limited time at my command for doing the work that I could not detail to others. My daughter has done all the work, counting, stamping, distributing, pasting, indexing; the scheme of classification numbers and indexing is hers. I examined every blank when it came in, wrote the description of the subdivisions and checked the blanks after they had been distributed. The work of distributing was very perplexing at times, for the information on some of the blanks covered so many subjects that they could be put almost anywhere and be right. Other blanks I have not yet been able to find out what they were made for, so they will not be found in the collection. I had some thoughts of making a separate book for them, but did not. This work has given me great pleasure, and I think has done me good, and I hope I know more about blanks than I did a year ago.

I found many excellent blanks, and I am sure the collection shows that much more thought is given to the matter of blanks than there was when the previous collection was arranged, more thought as to size and quality of paper, arrangement of type, etc. I am sure that the suggestions made by Mr. Brockway at the Chicago meeting have been followed in many cases. There are, however, one or two points that will bear repeating: 1. Always put a form number on every blank. There is no better way of identifying it than this. Use whatever scheme you wish, either consecutively as the blanks are made, or give each class of blanks its own hundred numbers; for example, the writer gives all blanks relating to "Injuries and Damages" same number in the 1000 class, and "Maintenance" in the 600 class. The quantity, month and year are usually added to the form number and are of much assistance in keeping track of the number of sheets used in a given time. 2. The name of the company is still the prominent line on many of the blanks in this collection. It is all right, of course, to make a good display of your name when the sheet is to go to the outside world, but of what benefit is it to have a coal report from the Power Station with the name of the company in large, bold type, and the words "Coal Report" or the word that tells what the sheet is so small that it is hard to find or possibly not on at all.

The loose leaf, I find, is being used for many different purposes, from ledger, cash book, voucher record, away down the line. The advantages of it are many, and its use will probably extend into new fields. The loose leaf has had a tendency on the one hand to reduce the size of many forms to a more convenient shape, and on the other hand to increase the size of some, for I find records that were put on a 3x5 card now kept in better shape on a 9x11 sheet. The Card System is most excellent for many things, but it cannot be used to advantage for everything. I think there is no doubt that the card system and the "loose leaf" have both come to stay, but let us look carefully at their respective merits before we decide which we adopt for a new form.

I think there is one good thing the "loose leaf" has done, and that is to reduce the size of our "reports." I mean the 20x30 sheet that was covered on both sides with all the different kinds of information we could think of, and submitted to the management every month. This sheet was usually folded, backed and put in a pigeonhole. We now have a sheet about 9x11 or 10x12. One company will use two of these sheets, while another will use a dozen or even more, depending on how much information they tabulate each month. Of course, a company that has electric lighting, gas and water departments keeps them on different sheets. But no matter how many or how few sheets, they will be found in a loose leaf cover, where are added the sheets month by month, so that we may readily have the reports for, say, five years in as convenient form as if the same were in a bound book. You will find in this collection quite a number of different exhibits, and the member who still uses the "blanket" I will ask to stop and look over book 1200.

The collection is so good that none of us can afford to let the opportunity of a careful examination go by. I will not ask you to look at every one of the 1405 pages, but do give the book or books you are most interested in a little time and see

if someone else has not worked out some blank a little better than you have.

This was followed by an index of 14 books each of which contained a number of subdivisions, under which are listed the kinds of blanks to be found in each section.

Discussion was deferred to give opportunity to inspect the very elaborate exhibit of forms made by Mr. White.

The President then named as the Committee on Nominations the following:

C. N. Duffy, Chicago City Ry., Chairman.
P. L. Young, Public Service Corporation.
H. C. Mackay, Milwaukee Electric Railway & Light Co.
A. L. Linn, Jr., Utica & Mohawk Valley Ry.
J. W. Lester, Worcester Consolidated Ry.

And as the Committee on Resolutions:

W. J. Kehl, Norfolk Railway & Light Co.
W. J. Thorp, Little Rock Railway & Electric Co.
W. J. Lynch, Quebec Railway & Light Co.
P. A. Conolly, Lima Railway & Electric Co.
F. J. Duffy, Beaumont Traction Co.

Mr. Duffy: Mr. President, I offer the following resolutions and move their adoption:

"Whereas, The American Street Railway Association at its meeting held this day adopted the report of its executive committee, which contained the following resolution:

"'Whereas, During the past year many suggestions have emanated from different sources concerning the desirability of rearranging the lines and methods of work of the American Street Railway Association and its existing auxiliary organizations, the Street Railway Accountants' Association of America and the American Railway Mechanical & Electrical Association, to the end that through the medium either of these existing organizations, or such other and additional organizations as may be deemed desirable, the work which was originally embraced within the scope of the objects of the parent organization, the American Street Railway Association, may be so enlarged and so prosecuted as to bring about results of greatest value to the street railway corporations of America, and at the same time that whatever organizations may be deemed most desirable to conduct such work shall be brought more closely together along systematic and correlated lines of work and procedure, and

"'Whereas, At this convention the matters above mentioned have taken such form that representatives of the different organizations have met in an official way and have made some progress in the consideration of the matter; now, therefore, be it

"'Resolved, That it is the sense of the Executive Committee of the American Street Railway Association, in formal meeting assembled, that it is desirable that a closer working arrangement should be effected between the different organizations conducting street railway work, and to that end be it further

"'Resolved, That the Executive Committee of the American Street Railway Association hereby recommends to its convention, about to be assembled, such amendments to its by-laws as may be necessary to provide for increase in the size of its Executive Committee, sufficient to accommodate as members thereof, by virtue of their office, the presidents of such auxiliary organizations engaged in street railway work as may be approved and fostered by the American Street Railway Association; and, be it further

"'Resolved, That the American Street Railway Association be requested to commit all matters and things concerned in bringing about the above named objects to its executive committee with power to act.'"

"And whereas, By the provisions of the foregoing resolution this Association is to be represented by its president on the executive committee of that Association; therefore, it is now

"Resolved, That the thanks of this Association be expressed to the American Street Railway Association for the signal honor thus conferred upon us and, that, as a representative of this Association, the president is directed to take such action in the meetings of the committee of the American Street Railway Association as in his judgment will conserve the best interests of this Association and the companies we represent in all matters pertaining to the forming of such an association or an amalgamation of the associations so formed."

Mr. Wilson seconded the motion to adopt the resolutions as read. Carried.

The convention then adjourned until 10 o'clock Friday morning.

ACCOUNTANTS' REGISTRATION TO THURSDAY NOON.

Akron, O.—Charles W. Lohr, Northern Ohio Traction & Light Co. (Inside Inn).

Augusta, Ga.—R. E. Hunt, general manager; Charles L. Furbay, superintendent Augusta Railway Co.

Alton, Ill.—J. F. Porter, president; H. E. Weeks, assistant secretary and auditor Alton Light & Traction Co.

Asbury Park, N. J.—G. B. Cade, auditor Atlantic Coast Electric Railroad Co. (Southern).

Anderson, Ind.—Isaac McQuilkin, comptroller Indiana Union Traction Co. (Inside Inn).

Baltimore, Md.—H. H. Adams, master mechanic United Railways and Electric Co.

Birmingham, Ala.—C. O. Simpson, auditor Birmingham Railway, Light & Power Co. (5216 Minerva Ave.).

Buffalo, N. Y.—H. M. Pease, International Railway Co. (357 Whittier St.).

Chicago, Ill.—F. E. Smith, assistant secretary and auditor Chicago Consolidated Traction Co., and auditor Chicago Union Traction Co. (Inside Inn).

Columbus, O.—P. V. Burington, secretary and auditor Columbus Railway & Light Co. (Inside Inn).

Camden, N. J.—John W. Glendening, assistant to auditor Camden & Suburban Railway Co. (Inside Inn).

Cleveland, O.—John Ehrhardt, assistant treasurer; W. G. McDole, auditor Cleveland Electric Railway Co. (Inside Inn).

Canton, O.—E. B. Kidson, auditor Canton-Akron Railway Co. (3057 Thomas St.).

Detroit, Mich.—Irwin Fullerton, general auditor Detroit United Ry.

Duluth, Minn.—Herbert Warren, general manager Duluth-Superior Traction Co. (Inside Inn).

Elmira, N. Y.—H. M. Beardsley, auditor; Donald P. Beardsley, Elmira Water, Light & Railroad Co.

Gloversville, N. Y.—E. H. Stichel, assistant auditor Fonda, Johnstown & Gloversville Ry.

Hartford, Conn.—Elmer E. White, cashier Hartford Street Railway Co. (Inside Inn).

Indianapolis, Ind.—P. A. Hinds, purchasing agent Indianapolis Traction & Terminal Co. (5175 Fairmont Ave.).

Jersey City, N. J.—P. S. Young, comptroller (Inside Inn); M. R. Boylan (Southern), general auditor Public Service Corporation.

Knoxville, Tenn.—C. H. Harvey, president (Southern); H. T. Bunn, treasurer and auditor (Inside Inn); W. G. Woolfalk, superintendent (Forest Park Hotel), Knoxville Traction Co.

Leavenworth, Kan.—Charles O. Evarts, secretary and treasurer Kansas City & Leavenworth Railway Co. (Inside Inn).

Louisville, Ky.—Samuel G. Boyle, secretary and treasurer Louisville Railway Co.

Milwaukee, Wis.—H. C. Mackey, comptroller and auditor Milwaukee Electric Railway & Light Co. (Inside Inn).

Montreal, Can.—T. W. Casey, purchasing agent (Inside Inn); Patrick Dubee, secretary (4350 Maryland Ave.) Montreal Street Railway Co.

Nashville, Tenn.—C. A. Genning, auditor Nashville Railway & Light Co. (McDaniel Hotel).

Norfolk, Va.—W. J. Kehl, Norfolk Railway & Light Co. (Inside Inn).

Philadelphia, Pa.—C. L. Tingley, 2nd vice-president American Railways Co. (Hamilton Hotel).

Quebec, Can.—W. J. Lynch, accountant Quebec Railway, Light & Power Co. (5218 Delmar Blvd.).

St. Louis, Mo.—Frank R. Henry, auditor; James Adkins, secretary and treasurer; Frank L. Betts, superintendent of time; W. H. Burroughs, auditing clerk; R. J. Richardson, assistant bookkeeper; Harry Cohen, statistician; Robert E. McKenzie, bookkeeper; James J. Roche, general storekeeper; Frank J. Suda, auditing clerk; Z. E. Watson, private secretary to auditor; C. P. Gregory, manager oil department; J. E. Evans, clerk; T. W. Messick, clerk St. Louis Transit Co.

Savannah, Ga.—Leon F. Bowers, assistant treasurer Savannah Electric Co.

Utica, N. Y.—A. L. Linn, Jr., assistant secretary and treasurer Utica & Mohawk Valley Railway Co. (N. Y. State Bldg.)

Worcester, Mass.—J. W. Lester, treasurer Worcester Consolidated Street Railway Co. (Hamilton Hotel).

Washington, D. C.—David S. Cade, H. D. Crampton, Capital Traction Co. (Southern).

Youngstown, O.—S. C. Rogers, Youngstown-Sharon Railway & Light Co.

THURSDAY AFTERNOON REGISTRATION.

Allentown, Pa.—C. M. Walther, assistant secretary and treasurer Lehigh Valley Traction Co. (5923 Clemens).

Austin, Tex.—Frank E. Scovill, secretary and superintendent Austin Electric Railway Co. (4357A Maryland Ave.).

Boston, Mass.—H. L. Wilson, auditor Boston Elevated Railway Co.

Beaumont, Tex.—Frank J. Duffy, secretary and treasurer Beaumont Traction Co.

Chicago, Ill.—C. N. Duffy, secretary Chicago City Railway Co.

Jackson, Miss.—John Lorenz, general manager Jackson Electric Street Railway & Power Co.

Little Rock, Ark.—W. J. Thorp, auditor Little Rock Railway & Electric Co.

Lima, O.—P. A. Conolly, auditor Lima Electric Railway & Light Co.

Richmond, Va.—G. B. Williams, assistant general auditor Virginia Passenger & Power Co.

Riverside, N. J.—W. E. Harrington, director Camden & Trenton Ry.

LADIES.

Mrs. Charles W. Lohr, Akron, O.
Mrs. C. O. Simpson, Birmingham, Ala.
Mrs. Sarah Bishop, Birmingham, Ala.
Jane R. Adams, Buffalo, N. Y.
Mrs. P. V. Burington, Columbus, O.
Mrs. John Ehrhardt, Cleveland, O.
Mrs. W. G. McDole, Cleveland, O.
Nettie L. Kidson, Canton, O.
Mrs. Irwin Fullerton, Detroit, Mich.
Mrs. Herbert Warren, Duluth, Minn.
Mrs. E. H. Stichel, Gloversville, N. Y.
Miss Florence White, Hartford, Conn.
Mrs. P. A. Hinds, Indianapolis, Ind.
Mrs. H. T. Bunn, Knoxville, Tenn.
Mrs. C. O. Evarts, Leavenworth, Kan.
Mrs. T. W. Casey, Montreal, Can.
Mrs. W. J. Kehl, Norfolk, Va.
Mrs. C. L. Tingley, Philadelphia, Pa.
Miss E. Mann, Quebec, Can.
Mrs. Frank R. Henry.
Mrs. G. O. Bacon.
Mrs. H. H. Burroughs.
Miss Florence Bixler.
Mrs. Harry Cohen.
Mrs. R. E. McKenzie.
Mrs. F. J. Suda.
Miss Laura J. Suda.
Mrs. Z. E. Watson.
Mrs. Belle Gregory.
Mrs. A. L. Linn, jr., Utica, N. Y.
Mrs. J. M. Walther, Allentown, Pa.
Mrs. F. E. Scovill, Austin, Tex.
Mrs. J. D. Leeper, Austin, Tex.
Mrs. W. J. Thorp, Little Rock, Ark.
Mrs. W. E. Harrington, Riverside, N. J.

In connection with the exhibit of the Buda Foundry & Manufacturing Co., in the Transportation Building, the Paige Iron Works, of Chicago, is showing frogs and switches for electric and steam railway work.

THE MILLOY TROLLEY BASE.

The accompanying illustration shows the Milloy trolley base which is made by the International Trolley Controller Co., of Buffalo, N. Y., and which is believed to be the lowest trolley base ever made, it being only five inches high. The Milloy base has a double roller bearing and centers itself on the taper roller bearings. it has no center post and no fulcrum. it is also dustproof and waterproof.

This base is designed to produce the same tension at every location of the wire, and because of this uniform tension and its active movement on curves, it reduces the wear of trolley wheels

MILLOY TROLLEY BASE.

and saves fields, commutators and brush holders by giving a practically regular contact. The cable connection can be made without the use of tape, as it is under cover and not exposed to water or weather.

The Milloy trolley base has been adopted as standard by several large electric railway companies.

J. G. BRILL CO'S. EXHIBIT.

The exhibit of the J. G. Brill Co., of Philadelphia, is located on aisle D, Transportation Building, and extends 300 ft. in one direction, ending on aisle 4. The principal features of the exhibit are a suburban type semi-convertible car, a double-truck convertible car, a 13-bench "Narragansett" car, three sizes of the high-speed truck No. 27-E, and one size each of the single truck No. 21-E, the "Eureka" maximum traction truck and the suburban truck No. 27-G.

The semi-convertible car principal dimensions are: . Length over end panels, 30 ft. 8 in.; platforms, 5 ft. 6 in. each; width over sills, 8 ft. ½ in.; over posts at belt, 8 ft. 4 in. This car has the company's patented roof storage window system, semi-accelerator end doors, vestibuled Detroit platforms enclosed at one side and walk-over seats, except those at the ends, which have stationary backs. The car is mounted on Brill No. 27-G-E-1 trucks. Attention is directed to the curved glass windows between the double corner posts which enable the conductor to watch from any point of the car passengers mounting or alighting from the steps.

The principal dimensions of the convertible car are: Length over end panels, 25 ft. 9 in.; platforms, 4 ft. 8½ in.; width over sills, 7 ft. 6¼ in.; over posts at belt, 8 ft. 1 in. It is vestibuled; the double sash windows and flexible metal-sheet panels raise into roof pockets; instead of grab-handles on the side posts, brackets between the ends of the seats and the posts serve the purpose. This car is mounted on Brill "Eureka" maximum traction trucks.

The "Narragansett" car is 36 ft. 8⅝ in. long over the crown pieces. This is a long open car arranged with double steps while being within the width of the standard single-step double-truck car. The upper steps are upon the middle web of Z-bar sills. It is especially adapted for summer excursion service, ingress and egress being rapid and safe by pairs of easy steps on either side. The car is mounted on Brill No. 27-G-E 1 trucks.

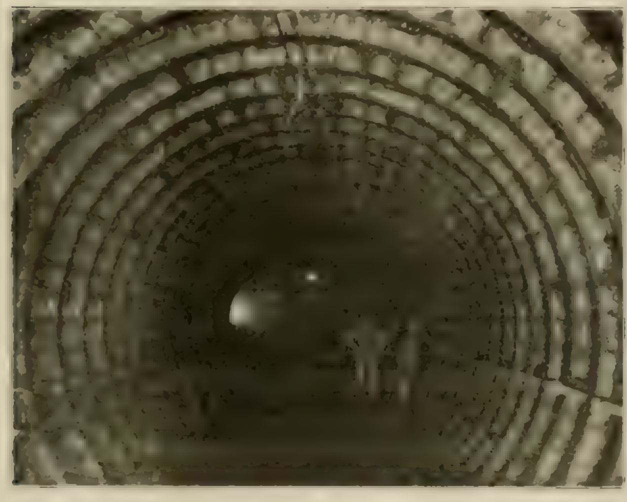
These three patented types of cars have come into large use in the last few years. They are the inventions of Mr. John A. Brill, vice-president of the J. G. Brill Co.

These cars are equipped with Brill angle-iron bumpers, radial draw-bars, ratchet brake handles, "Dedenda" gongs, conductors' gongs, folding gates, round-corner seat-end panels, track scrapers and "Dumpit" sand boxes.

All the trucks shown have side frames solid forged in a single piece—a method of construction peculiar to the J. G. Brill Co.

COMPLETED TUNNEL UNDER THE HUDSON RIVER.

The first of the projected tunnels under the Hudson River, connecting New York City with the New Jersey river front, is now completed. The new tunnel runs from 15th St., Hoboken, to a point near Christopher St., Manhattan, and it will be used ultimately for bringing the electric cars of the Public Service Corporation into direct connection with the cars of the Metropolitan system in New York. It is the intention to extend the tunnel



TUNNEL UNDER HUDSON RIVER.

north on the Manhattan side to a point near 33rd St. and Sixth Ave., where connection will also be made with the New York Subway, and with the tunnel of the Pennsylvania R. R.

The importance of this new tunnel under the Hudson River can hardly be overestimated. Within a radius of 25 miles from the Jersey terminal there is a resident population of more than a million and a half of people, to all of whom New York is the busi-

EAST SIDE OF TWIN LOCK IN NORTH TUNNEL.

ness and social Mecca. More than 200,000 people cross the Hudson River daily in ferry boats. The new tunnel will permit through electric railway service from Newark, Montclair, the Oranges, Hackensack, Englewood, Paterson, Passaic, Bayonne, Jersey City and Hoboken, directly into Manhattan without change of cars. It is believed the carrying capacity of this new means of communication will be taxed to its utmost from the day it is opened for regular traffic.

The tunnel just completed is one of two that are being built by the New York & New Jersey Railroad Co., for the purpose of creating physical connections between the network of electric railway lines in New Jersey, and the surface and subway lines of Manhattan. The tunnel now completed is the northerly one. The south tunnel parallels this a short distance to the south. About 2,000 ft. of the south tunnel is now completed and work is progressing at the rate of 42 ft. per day of 24 hours—a speed, it is stated, that has never been equalled in similar tunnel building.

The north tunnel is 18 ft. inside diameter, and the south tunnel 15 ft. 3 in. Both are circular in section, and have been built by the driving method. The actual cutting is done by means of a huge steel shield which is driven forward by hydraulic jacks. Behind the shield are compressed air chambers in which the men work, the air being kept at high pressure and serving to resist all inflow of water or excavated material. As the shield is pushed forward circular steel plates united together are placed in position back of it, and these constitute the main walls of the tunnel. A single line of tracks will be laid in each tunnel with overhead trolley wires. The north tunnel will carry the eastbound traffic, and the south tunnel the westbound. The ride from the terminal in Hoboken, through the tunnel to the terminal near Christopher St. will be just under two miles in length. The section is 5,700 ft.

The tunnels will not be in actual use until some time next year, owing to the delay in securing desired terminal facilities on the New Jersey side. The matter is now in the courts, but a speedy compromise settlement is foreshadowed. Power for operating electric cars through these tunnels will be taken from the new turbine generating station of the Public Service Corporation, now in course of construction at Marion, N. J.

AN EXHIBIT WORTHY OF ATTENTION.

Among the exhibits in the Transportation Building is the Western car heater, manufactured by the Franklin Railway Supply Co., of Franklin, Pa., at post 52, aisle D, opposite the American Car Co's. exhibit. The Franklin company is represented at the convention by Kenneth D. Hequembourg, manager; Paul Weiler, of the Franklin office; William H. Davis, and Edward Mason, of Porter & Berg, western agent.

A heater is shown piped for single circulation as equipped in an interurban passenger car. Attention is called to the small amount of space occupied by the heater; to the coal magazine, which when filled with anthracite will operate the equipment for 10 hours without refilling; to the increased efficiency because of the water-jacket; to the improved draught regulating device, and to the general appearance of strength and durability. The Franklin Railway Supply Co. stands ready to guarantee that this equipment will heat the largest interurban cars in the coldest climate. Over 200 of these heaters have been installed on various roads during the past few months.

PROSPERITY AT KALAMAZOO.

While, generally speaking, business with manufacturers of railway material has not been as active this season as formerly, it is interesting to observe that this is not the rule. In 1903 the Kalamazoo Railway Supply Co., of Kalamazoo, Mich., moved into its new plant, which at the time of construction was considered large enough for some years to come, but the business has grown so rapidly the past year as to demand increased facilities. Preparations are at present being made for erection of additional buildings and installation of much new machinery, and next year will see the company with a plant of still greater capacity and as completely equipped as any in the country.

The "Kalamazoo" line of construction and maintenance equipment includes hand, push, rail-laying and tower cars, velocipedes, gasoline motor cars, track and car jacks, cattle guards, tanks and water supply machinery, rail benders, levels, gages and many minor tools.

If you cut yourself drop in at the exhibit of the St. Louis Branch of the National Lead Co., post 52, aisle D, Transportation Building, and secure a real nice vest pocket edition of court plaster.

CONSOLIDATED ENGINE STOP CO.S' EXHIBIT.

The Consolidated Engine Stop Co., of 100 Broadway, New York City, has an interesting exhibit in block 44, Machinery Building where are shown the "Monarch" engine stop in both its horizontal and vertical application to the throttle of an engine, and also two new stops, the "electric motor stop" and the

EXHIBIT OF CONSOLIDATED ENGINE STOP CO

"quick-closing balanced valve stop." Five "Monarch" speed limits are belted from a line shaft which is run by a motor; one speed limit being connected electrically to each of four stops, while the fifth operates a small circuit breaker in the motor circuit.

The "Monarch" engine stop is connected to the throttle by a chain and in opening the throttle valve a cable is wound round a drum on the stop, on the end of which is a weight sufficient to close the valve in from 3 to 10 seconds. This drum is fast on a shaft on the other end of which is a dash pot in which air is compressed as the valve is closed, preventing the valve from becoming jammed.

The "Monarch" speed limit is belted to the shaft of the engine beside the flywheel, this speed limit being an application of

VIEW OF MONARCH ENGINE STOP

a centrifugal ball governor. When the limit of speed is reached contact is made with two fingers and a circuit completed which operates a magnet in the stop, releasing the weight, which closes the valve.

The electric motor stop is operated by a ½-h. p. motor and this stop both opens and closes the valve. It is designed for large units and to be connected to the main steam valve near the boiler, or to the throttle. The stop is connected to the valve by a chain similar to the "Monarch" stop.

The quick-closing balanced valve stop is directly connected to a Schutte balanced valve by a connecting rod which closes the valve instantaneously. In applying the stop to a condensing engine an automatic breaker is connected to the exhaust and operated by a set of magnets which are in series with those in the stop. When engines are running generators which are working in multiple an automatic circuit breaker trip is connected to the circuit breaker to cut out the generator of the engine that is shut down by the stop.

The "Monarch" engine stop and speed limit system is installed on the following engines of the Exposition power plant: Four Westinghouse 3,500 h. p.; one Hamilton-Corliss 3,500 h. p.; one Harrisburg 600 h. p.; one Greenwald 600 h. p.; four in Philippine power plant, 1,500 h. p.

The accompanying illustrations show the company's exhibit and a Westinghouse engine which has been equipped with one of the company's engine stops.

The "Monarch" engine stop and speed limit system bears the same relation to an engine that a safety valve does to a boiler. A complete description of this apparatus can be found in the company's catalogue, which will be sent upon request.

THE DEMONSTRATING CARS.

Visitors to the convention have had some difficulty in locating the demonstrating cars which are in constant operation throughout the day on the tracks immediately to the north of the Transportation Building, adjoining the tracks of the Intramural Ry. There are three cars in all—that of the Cincinnati Car Co., equipped with the Westinghouse unit switch system of multiple control and the straight air brake apparatus of the Westinghouse Traction Brake Co.; the Scioto Valley car, equipped with the General Electric Co's. multiple control and the combined automatic and straight air Westinghouse brake, and a car built by the St. Louis Car Co., equipped with the Westinghouse combined magnetic brake and heater.

The Westinghouse multiple control is in charge of Mr. R. C. Thurston, and the magnetic brake car, to which attention is especially called, is in charge of Mr. B. M. Hartsock and Mr. G. Baron. Mr. C. W. Townsend, in general charge of the Westinghouse transportation exhibits, has operated the Westinghouse cars for many of his friends in the past few days.

HANCOCK LUBRICATOR FOR MOTOR BEARINGS.

The Axle Lubricator Co., of Savannah, Ga., makes the Hancock patent lubricator, which is especially adapted for motor bearings. This lubricator is said to possess all the advantages of a ring oiler and in certain respects to surpass it. For instance, the Hancock lubricator can be taken out and replaced on the present bearings by removing the lower half of the bearing without disturbing the armature; also, the flow of oil to the bearing is governed by the size of the oil inlet in the case containing the roller, which runs in oil. This lubricator oils only while in motion, and it is possible to use the same oil repeatedly, as the oil drains back into the cellar, or oil well, in which the roller runs. There is no waste of oil, therefore, no wicks are used and there can be no freezing of the oil.

It is stated that by using the Hancock lubricator and the Axle company's oil the bearing will last twice as long as by using grease.

On G. E. 54 and 57 motors the company has found by actual test that by making the oil hole 1-16 in. in diameter it will take only ¼ gill of oil per day of 18 hours for each bearing, and on

six months' test motors are actually using 1-32 gallon of 16 cent oil per day, which is equivalent to $1.82½ per year for armature bearings per motor.

The Axle Lubricator Co. is represented at the convention by Mr. E. W. Hancock, whose headquarters are at the Southern, and who will be glad to further explain the features of this lubricator to all who may be interested in saving of babbitt and time.

A NEW INSERT BRAKE SHOE.

Herewith is shown a new insert brake shoe of novel design which has been placed on the market by the Central Union Brass Co., of St. Louis. The inserts consist of round steel punchings ¾ in. in diameter and of the same depth. The inserts are scattered uniformly over the wearing surface of the shoe, so that the surface is composed of nearly equal proportions of soft steel and gray cast iron. It is claimed that the short distance between adjacent inserts does not allow them to project beyond the surface of the shoe and consequently there can be no scraping or cutting action on the tread of the wheel. Wherever this shoe has been adopted, it is stated, the wheel mileage has been increased appreciably.

The Central Union Brass Co. has also recently introduced into the electric railway field a new trolley splice for which several advantages are claimed. It consists of a heavy drawn brass tubing with a ratchet dog suspended on a pin at each end. The ends of the wire to be spliced are pushed into the tube and engaged by the dogs. Increased tension on the trolley wire causes the dogs to be pulled down tighter and the wire is gripped with greater firmness. To remove the splice all that is necessary is to release the tension on the trolley wire. A broken trolley wire may be repaired with this device with great facility.

INDIANAPOLIS SWITCH & FROG CO.

The Indianapolis Switch & Frog Co. has an exhibit at the corner of aisles H and 2 in the Transportation Building, which will interest electric railway men. Here are shown several of the company's specialties, among which may be mentioned the following: An 80-lb. A. S. C. E. steam and street railroad crossing, with heavy "Q" section corner iron; spring frog; stiff frog; split switch, 85-lb. A. S. C. E., Pensylvania R. R. standard specification for 1904; extra heavy tongue switch and mate, large radius; main line and yard stands of all descriptions; switches and frogs of light T-rail for industrial tracks. The exhibit is showy, one of the large frogs being gilded and another being painted silver color.

The exhibit is in charge of Mr. W. H. Thomas, chief engineer of the company, who presents a pocket mirror to every caller.

RAILWAY JOURNAL LUBRICATING CO.

In connection with the exhibit of the National Electric Co., in the Electricity Building, the Railway Journal Lubricating Co., of Milwaukee and Chicago, is showing its "Economy" journal lubricators and dust guards, which have been described and illustrated in the Review, and which have become well and favorably known to electric railway managers, master mechanics and shop superintendents during the past year or two. The company has such unbounded confidence that its devices will do all that is claimed for them that it offers a very liberal guarantee, and agrees to equip a reasonable number of cars for competitive test without expense to the railway company. A large number of testimonials have been received from officials of many of the leading companies which adopted these lubricators and dust guards, and among the strongest of these testimonials is one from Capt. Robert McCulloch, general manager of the St. Louis Transit Co.

PEACOCK BRAKE MEETS WITH FAVOR.

The Peacock brake, which is manufactured by the National Brake Co., of Buffalo, N. Y., has met with general approval by many who have seen it. In this device the ratio between the smaller and larger gear, and between the larger gear and the smaller part of the drum, is such as to give great power at the instant power is required, while the slack is taken up very quickly by means of an eccentrically-geared cam when power is not required.

The original cost and expense of installation of the Peacock brake is very low and the cost of maintenance is inconsiderable, as the frame is cast in one piece, secured to the car platform with three bolts. It takes up very little room, and any chain, in either straight or twisted links in any size up to 5 8 in., may be used.

The frame and gears are made of malleable iron. The larger gear works on a roller bearing, which makes the brake easy to operate and free to release. On this account it is a great favorite with motormen.

The National Brake Co. is represented at the convention by its president, G. S. Ackley, and its secretary, W. A. Brewster. The company has salesmen all over the United States, who report an excellent business.

Tag your grip with one of the very attractive tags that are being distributed at aisle D, post 52, Transportation Building, by the National Lead Co. This is one of the souvenirs that are really worth while.

Representing the W. R. Garton Co. at the convention are Messrs. Ray P. Lee, the secretary, and F. S. Hill.

Mr. E. H. Chapin, sales agent of the National Car Wheel Co., is to be seen at the convention daily.

Mr. F. A. Barbey, the New England sales agent of the Lackawanna Steel Co., advises us that the company is in the market for electric railway contracts for T-rails, bridge work, etc., this being something of a new departure. Mr. Barbey, who is attending the convention, makes his headquarters at 185 Summer St., Boston.

Mr. Charles S. Clark, of Boston, Mass., represents the Pennsylvania Steel Co. at the convention. Mr. Clark has attended these meetings for the past 18 years.

The Weber Railway Joint Manufacturing Co.'s interests at the convention are well conserved by J. C. Barr, of New York; Arthur T. Herr, of Denver; Guy M. Lindsay, of St. Louis, and F. A. Poor and H. C. Holloway, of Chicago.

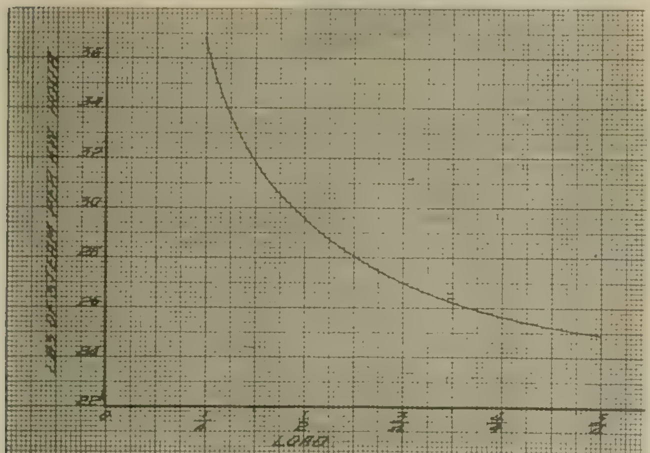
The Continuous Rail Joint Co. of America is represented at the convention by Messrs. L. F. Braine, E. J. Condit, C. E. Irwin, J. G. Miller, J. M. Atkinson, V. C. Armstrong and B. M. Barr.

STEAM TURBINES.

[illegible]

The field of usefulness for the steam turbine as a prime mover is not confined to large units. The first turbines of Parsons and of Curtis were small but on account of the improvement in economies to be effected by the mere increase in capacity, development rapidly proceeded in this direction. The small units have not been neglected, however, and various sizes of small units directly connected to generators have been produced and placed in commercial operation. The problems of design which have to be solved in the small units are of a somewhat different character from those inherent in the large sizes. In order to keep the dimensions and cost of apparatus at a proportionate figure the diameters of bucket wheels must be kept small, and this leads to a comparatively high speed. These speeds must be chosen with reference to the possibilities of generator design in order that the units may be direct-connected. Therefore a proper balance must be struck between the requirements of the turbine and those of the generator. The speed necessary in the small units (from 1,800 to 5,000 r. p. m.) give rise to a set of conditions not met with in large units and certain differences in design have arisen from this fact.

The Curtis principle is useful in keeping speeds of rotation down, and all the Curtis turbines are made without gearing for connection to generators. The accompanying table gives the sizes developed below 500 kw. rated capacity with the principal particulars of the design. A number of these small units are in commercial operation and giving good satisfaction and a still greater number are in course of manufacture.

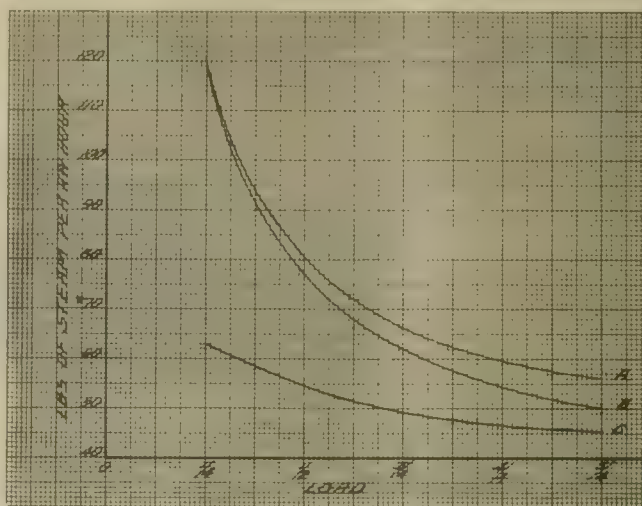


ECONOMY CURVE OF [illegible] KW. CONDENSING TURBINE
Dry Saturated Steam. [illegible] Vacuum. [illegible] lb. Gage Pressure.

It will be noted that attention has been devoted to the development of both non-condensing and condensing types, the three smaller sizes being for non-condensing service solely.

Some of the special problems which require solution on these sizes are balance, construction and lubrication of bearings, flexible couplings between turbine and generator for sizes of 75 kw. and above, and the commutator construction on direct current apparatus. It is possible to balance the turbine parts statically with success, to operate at the speeds given, since the wheels may be balanced individually and collectively and the metal of each wheel is disposed in the form of a flat plate. With the generator, however, this condition is not present, and furthermore we have the liability of the generator or winding undergoing some change after being put into service, due to heating and other causes. For this reason it is necessary to balance the generator parts by rotating them in a vertical position and suspended by a flexible shaft. The rotating parts in this system of balancing take up rotation about the center of gyration of the system and by the addition of balancing weights at various points this center is made coincident with the center of rotation of the shaft. Two balancings of generator parts are usually necessary; one before, the other after the generator has been subjected to a heat-run and a high speed run, the latter being made at a speed which is somewhat higher than the normal running speed of the unit. Due to the symmetrical shape of the Curtis buckets a very small amount of end thrust has to be taken care of; whatever thrust exists being due to accidental variations in bucket or nozzle shapes on each end of one of the bearings. No balancing pistons are necessary.

The question of bearings is of course a very important one and has been made the subject of a great deal of investigation. The bearings now in use are supported on spheres, so that the bearings are self-aligning. The linings are made in two parts and lubrication is effected by forced feed from a pump which is geared to the main shaft of the turbine and supplies oil at a pressure of from three to six lb. per sq. in. The circulation of the oil is constant, passing from the pump to the bearing, thence to a reservoir in the pump chamber, from which it again goes to the pump. It has not been found necessary to provide any cooling arrangement for the oil and a very small amount of make-up oil is necessary.



ECONOMY CURVES OF NON-CONDENSING TURBINE
Dry Saturated Steam. Atmospheric Back Pressure. All Pressures Gage.
A [illegible] kw. [illegible] lb. steam. B [illegible] kw. 150 lb. steam.
C [illegible] kw. [illegible] lb. steam.

The 15 kw. set was first used for train lighting service and a number are now in use for this purpose. Some are placed on the buffer beam of the locomotive and others are installed in the baggage car. The latest forms are also so equipped as to be capable of being put on top of the boiler just in front of the steam dome when desired. The conditions of service are widely different on the locomotive and in the baggage car. In the former case the turbine is supplied with steam at 175 to 200 lb. pressure and exposed to great variations of temperature. Some trouble was experienced last winter with the sets mounted on the buffer beams, due to congealing of the oil circulation, but this was overcome by the use of a special oil. It is not expected that this trouble will be met with in the sets which are mounted on top of the boiler. Dust and cinders are very troublesome on the locomotive and the machine is enclosed as much as possible, to prevent their access to the vital parts. It is, however, necessary to take in a large quantity of air for the purpose of cooling the generator and this air necessarily carries with it a certain proportion of fine dust, which, however, does not prevent satisfactory operation.

In the baggage car the turbine is normally supplied with steam at 80 lb. pressure, but for various reasons the pressure actually realized varies from this figure down to 40 lb. While the turbine can be kept cleaner and is less exposed to temperature changes it must be cared for by entirely unskilled attendants. The most of the train lighting sets now installed are placed in this manner and the fact that their operation is satisfactory is good evidence of the small amount of care needed.

Some of the 25 kw. sets are also used for train lighting in the baggage car and both these sets are well adapted for the excitation of the fields of large generators, as well as for general purposes. The floor space required is small, the regulation is equal to that of reciprocating engines, and the sets are automatically lubricated

and require little attention.

The $1\frac{1}{2}$, 15 and 25 kw. turbines are governed by throttle valves, these being of the piston type, moved directly by a very sensitive and powerful centrifugal governor with spring. The nozzles are therefore supplied with steam at pressures varying with the load. The governor joints are supplied with knife edges and do not require lubrication. All of these machines are of the single-stage type, having a single group of nozzles with single sets of buckets, consisting of three rows of moving buckets with corresponding rows of stationary buckets.

The large sizes are multi-stage and have only two rows of moving buckets per stage. The method of governor control on these larger sizes is somewhat different from that just described. One or more nozzle groups are supplied with steam from a single poppet valve and a sufficient number of poppet valves is supplied to furnish the total number of nozzles necessary for developing the capacity of the turbine. Each poppet valve is therefore the means of controlling the admission of steam to one or more nozzles and the governor, by means of an intermediate mechanism, opens or closes a succession of poppet valves as the demands of the load require.

Two types of intermediate mechanism for operating these poppet valves have been developed and constructed. The 75 kw. turbine is supplied with one of these types, consisting of a hydraulic cylinder the controlling valve of which is directly actuated by the governor. A movement of the controlling valve caused by a change in the speed admits oil to one side or the other of the piston of this cylinder and a movement of the cylinder results, through the intermediate mechanism, in the opening or closing of corresponding poppet valves. While the governor remains in any given position the hydraulic cylinder is also stationary and is locked in its position by confining the oil in both ends of the cylinder. A movement of the governor produces a corresponding movement of the hydraulic piston, and when this movement has taken place the parts come to rest. There is sufficient lost motion and spring in the parts to ensure that the valve, when opening or closing, will be moved suddenly a sufficient amount to prevent too much throttling at the valve, and the nozzle works therefore at high efficiency at all times.

The 150 kw. turbine is supplied with a mechanical valve gear, the valves being actuated by gearing which derives its motion from the main shaft. The governor control operates a mechanical device which produces the same effect on the poppet valves as that above described.

It will be noted from the table that nearly all these machines are constructed with direct current generators with a comparatively small number of alternating current sizes. Other sizes of alternating current sets will be constructed in due course. The operation of direct current commutators at the speeds in question has necessitated the development of various special features in the commutator. Carbon brushes are used throughout, the best form of brush being one which has been treated with a lubricant, and with this form of brush commutation is very satisfactory. On account of the high speed and great length of the commutator bars they are provided with nickel steel shrink rings at the ends and middle of their lengths to prevent deflection. These rings are shrunk on over insulation and provide a very effective means of supporting the commutator bars and also have the advantage of giving a greater wearing depth of copper than the usual construction. The steam consumption curves of these small turbines differ somewhat in characteristics from those of large turbines of the same type, in having a comparatively high steam consumption at light loads. This is because the fixed losses, such as bearing friction and windage of the wheels are a greater proportion of the total output.

All of these turbines are of the horizontal type, the vertical type commencing with the 500 kw. and proceeding upward. The three smaller sizes given in the table have two bearings. The turbine wheels are overhung on the end of the shaft and the shaft is in one piece, with the turbine and armature both mounted on it. Beginning with the 75 kw. size and upward the shafts are in two pieces and the sets have four bearings.

In the smaller sizes where the wheels are overhung the front end of the case can be taken off to obtain access to the wheels and [illegible] and in the larger sizes where four bearings are provided the upper half of the casing is removable for the same purpose.

In the four-bearing sets the generator and turbine shafts are united by flexible coupling which permits some little inaccuracy in the alignment of the two shafts without affecting the operation of the set. After extended experience with various forms of these couplings a construction involving the use of metal parts only has been found to be the most satisfactory. This coupling is a modification of the Oldham coupling, the necessary flexibility being secured by the use of links turning on pins.

Some progress has been made in the application of turbines to driving other forms of apparatus than electric generators. This problem involves the finding of satisfactory methods of speed reduction to fit the turbine for coupling to slow-moving apparatus. Some of our small turbines are in operation with a belt drive with a fair amount of satisfaction. Other forms of gearing are under construction and experiment, and it is safe to predict that we shall soon be able to couple the smaller sizes at least of our turbines to slow-moving apparatus with satisfaction.

TABLE.

Rated Capacity K. W.	Speed of Shaft. R. P. M.	Conductor or Non-conductor.	No. of Stages.	Current.	Poles.	Voltage.
$1\frac{1}{2}$	5,000	Non cond.	1	Dir. Cur.	2	60
15	4,000-4,500	" "	1	" "	2	80-125
25	3,600	" "	1	" "	2	125-250
75	2,400	N-c. & Cond.	2	" "	4	125-250
100	3,600	Cond.	3	Alt. Cur.	2	2,300
150	2,000	N-c. & Cond.	3 & 4	Dir. Cur.	4	125-250
300	1,800	N-c. & Cond.	3 & 4	D. C. & A. C.	4	250, 500 & 2,300

The demand for small units is large and in cases where electricity is to be generated the steam turbine, judging from experience with the turbines described, seems to fill the requirements better than any form of reciprocating engine in general use. While these machines are by no means perfected, they are practical and satisfactory machines and will carry any character of load, variable or steady, with good regulation and economy.

Under variable loads these turbines undergo no deterioration in economy. The steam consumption for average load falls upon the curve obtained by testing with steady loads, while it is well-known that reciprocating engines fall off in economy under these conditions. The steam consumption of reciprocating engines has reached about its lowest point, while that of the turbines is constantly being improved. The performances given in this paper must be regarded simply as starting points from which improvements already in sight will proceed in the direction of better efficiency.

Mr. Frank Hedley, has been appointed general manager of the Interborough Rapid Transit Co. He will have charge not only of the operation and maintenance of the Manhattan Elevated Road, but the Subway as well.

Mr. F. H. Stubbs, of Lincoln, Ga., has been elected a director of the Macon Railway Electric Light Co.

The members and delegates to the American Street Railway Association, the Street Railway Accountants' Association and the American Railway Mechanical & Electrical Association conventions are cordially invited to visit the offices and plant of the Columbia Incandescent Lamp Co., at 2115 Locust St.

The F. Bissell Co., 226 Huron St., Toledo, Ohio, has just issued its Bulletin No. 20, covering a description and price list of security panel boards manufactured by this company.

The handsome private car which the St. Louis Car Co. built for Mr. John I. Beggs includes in its equipment one of the Peter Smith Heating Co.'s well known heaters.

The Consolidted Car Heating Co. is supplying consolidated electric heaters for 15 cars on the East St. Louis & Suburban line.

THE AMERICAN DIESEL ENGINE.

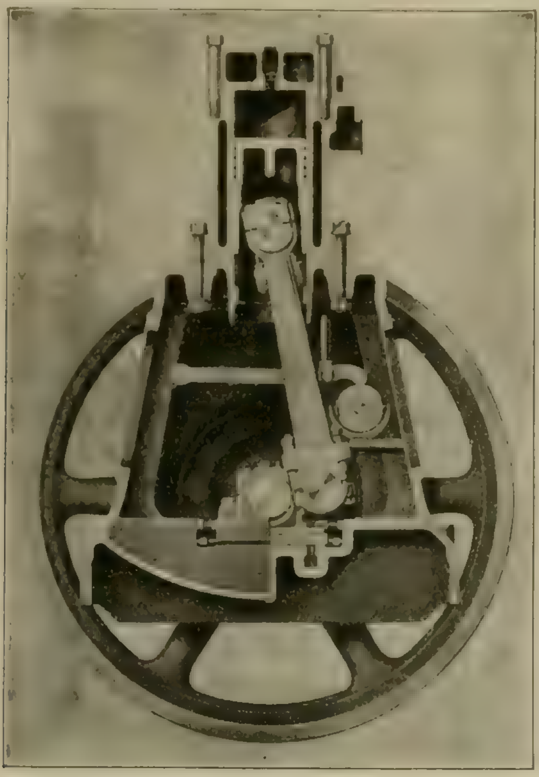
[illegible] THE AMERICAN STREET RAILWAY ASSOCIATION [illegible] BY L. D. MEIER.

Many of your members will remember certain papers published some years ago in regard to the merits of a new invention in prime movers, called the Diesel motor.

The claims set forth as to the economy of this device were so large and far-reaching that most practical men received them with a shrug of the shoulders. They were, nevertheless, not only true but somewhat under-stated. From the small Diesel motor of twenty h. p., which gave these remarkable results, has grown by a natural process of evolution the American Diesel Engine of today, at present built in sizes from 75 h. p. to 450 h. p.

A short explanation of the working of this engine may be permissible as many, no doubt, have forgotten the former explanation while to others the matter may be entirely new.

The Diesel engine is essentially an oil engine, and not a gas engine. Gas engines and previous oil engines which acted on the gas engine principle have all in common the explosion of a



SECTIONAL VIEW

charge. This charge is a mixture of a given quantity of gas, or of a given quantity of oil vaporized so as to act as a gas during the process, combined with a quantity of air varying from seven to eleven times the volume of the gas or vapor. It was well known that some previous compression would add to the economic results of the explosion which, from the moment of ignition, was beyond control of the operator or of the governing mechanism of the engine. This fact limited the efficiency of all governing devices which could be applied, and troubles with the ignitor caused other irregularities, so that even where local conditions made the gas engine (or vaporized oil engine) the worthy competitor of the steam engine, uncertainties of its operation threw doubt on the wisdom of the substitution.

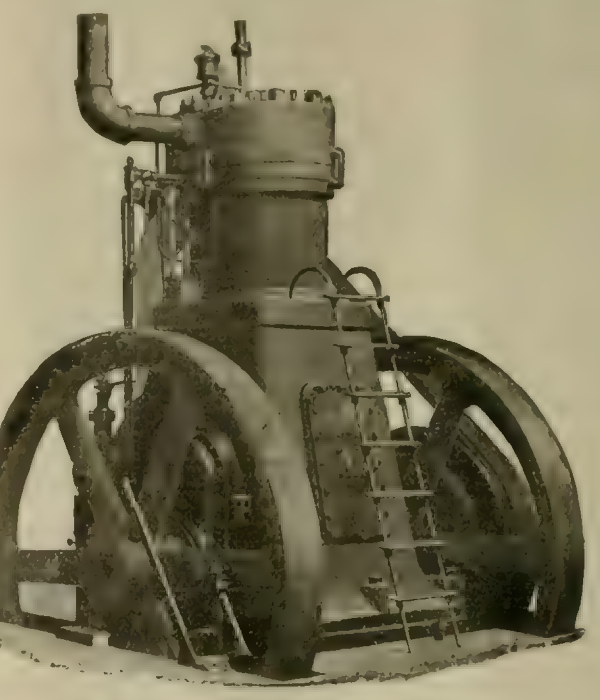
Furthermore, a cheap gas, necessitating the installation of a large and cumbersome producer plant, was the only escape from such costly fuels as gasoline or kerosene.

The Diesel engine made the use of the cheapest liquid fuel, such as crude oil, fuel oil, and distillates possible. To these recent experiment developments promise to add the waste product from gas works, known as light water gas tar.

The Diesel engine works on an entirely new principle. First of all, it dispenses with the so-called charge or mixture, which in all explosive engines must vary only between the limits of one gas to seven air and one gas to eleven air. Its cycle is the same as the gas engine, the well known Otto cycle. There its similarity with the gas engine ends absolutely; in everything else it follows the precedent of the steam engine.

Its first stroke is a suction stroke, drawing in a cylinder full of pure clean air; on the second stroke it compresses this to a tension and consequent temperature sufficient to ignite any fuel which may be injected into it; at the beginning of the third stroke a small quantity of fuel oil is injected into this red-hot air as a spray by a jet of highly compressed air, and thus in a completely pulverized state the fuel meets and mixes with the hot compressed air in the cylinder, burning completely and during a period of time exactly regulated by the governing mechanism of the engine, generally through one-tenth part of the stroke, subsequent to which the stroke is finished by the expansion of the burnt products; the fourth stroke discharges these products of combustion and leaves the cylinder empty and ready for another suction stroke.

It is evident that the work expended in compressing the cylinder volume of pure air is given off again to the shaft of the engine during the combustion or motor stroke, so that the loss is simply the frictional loss during the compression stroke.



75 H. P. SINGLE-CYLINDER DIESEL ENGINES

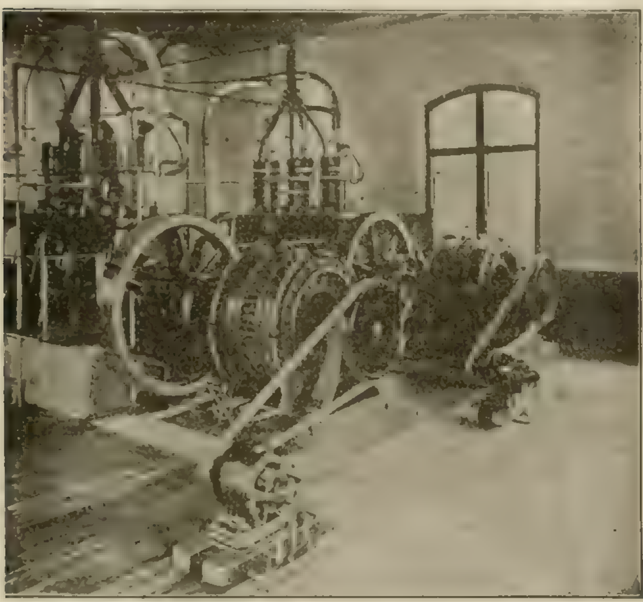
This simple process, absolutely new and original with Diesel, has enabled him to accomplish with one-half pint of common crude or fuel oil as much as the explosive engine does with a full pint of the much more expensive gasoline.

A recent comparison of results extending over a period of regular daily service of six weeks has shown the consequent economy of the Diesel engine over a first-class gasoline engine, which it displaced, of 600 per cent.

The modest statement set forth some years ago by the promoters of the Diesel engine, and covered by absolute and binding guarantees, are that one hundred horse power hours measured at the crank shaft of the engine will require not exceeding eight and one-half gallons of crude oil or fuel oil when the engine is running at or near its greatest capacity nor more than nine and one-half when it is running at or near half-load. The Diesel engines which are furnishing all the electric light and nearly all the power for the German Tyrolean Alps at the World's Fair, St. Louis, furnish 100 h. p. hours on the switchboard while running at loads varying during the day from one-quarter to full load with a consumption of only seven and one-half gallons of common fuel oil from Whiting, Indiana. At three cents per gallon this means 100 h. p. per hour at two and one-quarter cents or 100 kw. per hour at three and

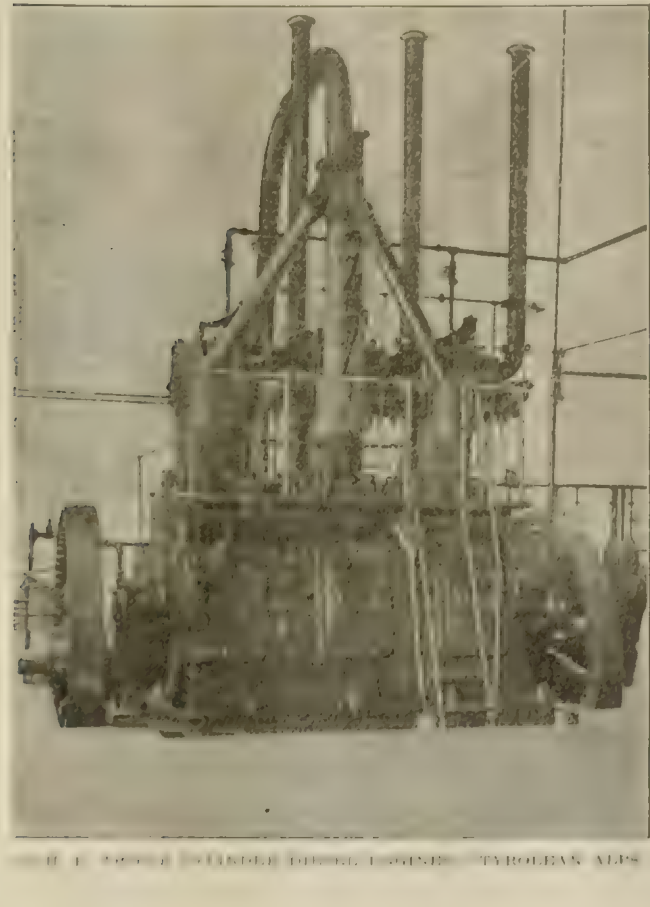
fifteen hundredths cents. While in some localities such fuel oil or crude oil, delivered in carload lots, may cost as high as four cents per gallon, it is readily furnished in many localities contiguous to oil fields at three cents and even two cents per gallon.

The regulation in the Diesel engine is not dependent on hit or miss, but can be followed up or down the scale as closely as in a



TWO [illegible] H. P. DIESEL ENGINES, MANSFIELD, O.

steam engine. In the latter it is a question of cutting off more or less from a pretty large volume of steam at each stroke; in the Diesel engine it is the finer one of cutting off a more or less minute quantity of oil from the small volume delivered by the fuel pump



[illegible] H. P. [illegible] CYLINDER DIESEL ENGINE—TYROLEAN ALPS.

at each stroke. It is accomplished by direct action of the governor on the suction valve of the fuel pump, which is held open during a greater or less portion of the pressure stroke, and thus the pump delivers the exact quantity of oil required during each motor stroke of the engine. While the mechanism is necessarily smaller, and more delicate than in the steam engine, it also requires less power and its effect is more immediate.

In a compound steam engine the volume of steam left in the high pressure cylinder at the point of cutoff must be used in the next stroke of the low pressure cylinder whether at the time more or less would be the proper quantity for that stroke. In the Diesel engine the regulation acts on each cylinder just at the time and in the exact quantity then required.

There remains only the drawback, common to all four cycle engines, that there is but one motor stroke for every two revolutions. For electric light work triple cylinder engines and heavier fly wheels successfully overcome this, while for electric railway work resort is had to still larger fly wheels and six cylinders by coupling two triple cylinder engines at the two ends of the same dynamo shaft.

As for the accessibility, reliability and durability of the engine, three years of experimental work have placed these fully on a par with the best steam engine practice, and since then two years and in some cases nearly three years of continuous service by a number of Diesel engines of the New American type give sufficient examples of the success in this work.

Three engines of 225 h. p. direct coupled to Bullock direct current generators can be seen in daily service in the engine room of the German Tyrolean Alps at the World's Fair, where many practical questions beyond the scope of this article will find ready and complete answers.

GEORGE W. KNOX.

Mr. George W. Knox, of Chicago, president of the Knox Construction Co., which recently built an interurban line between Green Bay and Kaukauna, Wis., on September 1st became general manager of the Green Bay Traction Co., which is to take over and operate the Fox River Electric Railway & Power Co's. property, consisting of 22 miles of city lines in Green Bay and the new interurban line. Mr. Knox will continue, also, as the president of the Knox Engineering Co., with headquarters in Chicago, and it is inferred that hereafter, in addition to building electric lines, the Knox Engineering Co. will enter the operating field. Mr. Knox is one of the best known consulting and constructing engineers in the middle West. He is also well equipped to operate a road. He has been in electric railway work practically since its beginning in 1887 and was employed by the old Sprague, Thomson-Houston and Edison companies. For some time previous to 1900 Mr. Knox was electrical engineer for the Chicago City Railway Co. Associated with Mr. Knox at Green Bay is Mr. R. N Heskett, resident engineer during the construction of the new interurban line. Mr. Heskett was superintendent of the McCartney Electric Ry., of West Green Bay, before it was purchased by the present company. Afterward he completed his education at Armour Institute of Technology, graduating in 1902. Mr. Knox has appointed as superintendent at Green Bay Mr. M. J. Kinch, formerly of the Grand Rapids, Holland & Lake Michigan Railway Co., and of the Rockford, Beloit & Janesville Railroad Co.

Mr. Henry W. French, of the Consolidated Engine Stop Co., New York City, is in St. Louis circulating among his friends and extending hearty invitations to visit the company's exhibit at Block 41, Machinery Building.

Mr Samuel Lowy, of the H. W Johns-Manville Co., is visiting among the delegates and exploiting the efficiency and durability of the company's products

Mr Graham Smith is in charge of the Westinghouse publicity department in Machinery Hall

The large and interesting exhibit of the E. W Bliss Co., of Brooklyn, in Machinery Hall is in charge of Messrs. W. S Smith, E. S. Porter and J. Matthews.

TRANSFERS—THEIR USES AND ABUSES.

READ BEFORE THE AMERICAN STREET RAILWAY ASSOCIATION, OCT. 13 1904.

BY LEON JEWELL.

It is the constant endeavor of street railway companies to provide the best service and all transportation facilities possible, under the conditions met with in the operation of their roads, as well as to offer every inducement to the people to ride on the cars, in order to create and develop the traffic to the mutual advantage and benefit of the companies, as well as their patrons.

Primarily, this is the first and all important "Use" of the transfer. Its purpose is not to lengthen the ride, but to obviate the necessity of making trips on different routes by direct through lines, so that passengers may be carried directly and quickly to their objective points for one fare.

A few years ago, when the electric cars were first being introduced, the people were inclined to take the longest ride possible for one fare, but the novelty soon wore off, and the tendency changed to taking the shortest possible route to their destinations.

The issuing of a transfer does not, in all cases, necessarily mean that the rate of fare has been cut in two, but that there has been created, between certain sections, a traffic which did not formerly exist, prior to the introduction of a transfer system. Without transfers, each line practically serves only its immediate neighborhood, as the people upon whom street railway companies depend for patronage cannot afford to pay more than a single fare in going to or from their various destinations.

By the use of transfers the necessity of direct lines of cars for different destinations is eliminated; travel in opposite directions is established which does not require an increase of car mileage; the traveling public is offered an attraction in the way of cheap transportation for short distances over zig-zag routes not covered by direct lines of cars; the habit of street car riding is acquired from carrying passengers, for one fare, around two sides of a section, when such journeys were formerly left out, or walked, on account of the required two, three, and even four fares, which were considered too great an outlay for the distance covered.

"Abuses" in the operation of a transfer system will constantly arise. Different methods, remedies, safeguards, restrictions, etc., for the correction of these abuses, have been adopted in different cities, by which some degree of protection has been secured in a majority of cases.

The principal and most odious abuses of a transfer system are the exchange, brokerage and transferring of transfers. These abuses can be fairly well controlled and kept within due bounds at ordinary transfer points, but at downtown common centers, the brokerage in transfers becomes a different proposition and a menace to the company.

The damage claims that may arise from the transferring of passengers constitute one of the disadvantages of a transfer system and a strong argument against an extension of transfer privileges.

The abuses perpetrated by employes have been reduced, to a great extent, by removing from the transfers their cash value to the conductor. Employes, as a general rule, are very timid, or conscientious, in regard to giving away transfers, or otherwise disposing of them, illegitimately. Of course, there are employes of another nature, but they do not consider the returns of sufficient value to warrant the risk of losing their positions. They are also restrained through fear of the necessary confederates.

The abuses by employes, in improperly punching, issuing and honoring transfers, demand and require the closest surveillance and the strongest safeguards. The correction of these abuses is often neglected, and, as a consequence, the public is not only encouraged in its abuse of the use of transfers, but is led to believe that the unwarranted privileges permitted by employes are just, and eventually claim them as a right.

My experience with transfers dates back to the fall of 1880. At that time the transfer system of our company was in its infancy and was confined to one transfer point until 1884. During that period the transfers were issued by agents who were stationed at the transfer point. At hours when business was heavy, the agent could not possibly avoid being imposed upon by people who mingled with the passengers and demanded transfers.

At first a small card punched so as to indicate the number of transfer passengers, was passed from the agent to the conductor. Under this system it was impossible to tell who were entitled to ride on the transfer and who should pay cash fare.

Next in order came the small individual transfer slips which were dated but unlimited as to time and direction. These transfers were issued by agents and were honored and registered by the conductors the same as cash fares. The company lost heavily from the frauds of its conductors under the registration of transfers as cash fares. In order to stop these frauds we stopped the "ringing up" of the transfers.

In 1884, upon the opening of an additional cross-town line, the agent system was abolished and the one hour time limit transfers were introduced and placed in the hands of conductors for distribution. From all information that I could gather the time limit transfers were, at that time, used only in San Francisco, Cal.

The transfer system was confined to a limited section of the territory covered by our lines until July 5, 1888, at which time we voluntarily established the transfer system over our whole territory. The following extract is from a notice given the public at that time:

"* * * * By this arrangement residents in all portions of the South Division of the City, Town of Lake, and Hyde Park carried by the lines of this Company, will be enabled to reach Washington and Jackson Parks, or the center of the city, for one fare * * * *, and is attempted by the management in the hope that the territory will be rapidly developed, and the volume of travel be sufficiently increased to warrant this experiment being made permanent, and that many of the lines not now paying operating expenses be rendered self-sustaining * * * *"

The experiment was made permanent and the lines self-sustaining. New lines were established and extensions made into additional territory. The increase of traffic over the normal increase, was principally for short distances, which were formerly walked, as well as from the fact that the people were not backward in appreciating the one fare system and in locating their homes accordingly.

Previous to July 5, 1888, we collected as high as four cash fares from a passenger for one continuous ride for which we now receive only one cash fare. At that time our territory extended into three different townships, but at the present time, is all within one township, brought about by annexation.

Our transfer system from 1888 to 1902 allowed a passenger to transfer from the trunk lines upon a cash fare or transfer, but from the cross-town lines a passenger would be transferred only upon payment of a cash fare.

On December 7, 1902, we inaugurated our present transfer system, under which a passenger, on the payment of one cash fare, may ride in any one general direction as far as the cars of our company will carry him. For instance, a passenger on a southbound car, will, upon request at time of paying cash fare, receive a transfer, good, within a limited time, to any intersecting east, west, or south line. If the passenger takes a west-bound car, whereby he establishes his general direction of travel, the conductor will honor and issue in exchange for this transfer, one entitling the passenger to ride south, or west, and the passenger may then exchange that transfer for one good on south or west-bound cars, to the extreme southern or western limits, reached by the lines of this company. This enables our patrons to travel from one to any other side of a section, reached by our lines, on payment of one cash fare. It would be impracticable, without the use of our transfer system, to do this.

The following data of the Chicago City Railway Co., with respect to the operation of its transfer system, as representing the growth and development of the use of transfers over a period of twenty years, 1884 to 1904, may be of interest:

	1884.	1904
Number of distinct lines of cars operated....	7	20
Number of distinct routes operated..........	19	182
Number of transfer points....................	2	94
Maximum possible number of transfers issued for one continuous ride in one general direction	1	19
Average number of transfer passengers carried daily	4,000	207,728

Percentage of transfer passengers to fare passengers	4.6	50.7
Percentage of transfer passengers to fare and transfer passengers	4.4	37.0
Average fare per passenger (fare and transfer passengers)	$0.0478	$0.0315
Length of longest line miles	4.59	9.78
Average length of all lines, miles	3.38	5.37
Longest transfer route possible miles	4.39	15.74

From what has been said in this paper it would appear that the "Uses" and "Abuses" of transfers could be summarized briefly, as follows:

Uses.

(a) To increase the transportation facilities, whereby passengers can be carried in different directions, by shorter and more direct routes.

(b) To offer additional inducements to ride, thereby creating and developing increased traffic.

(c) To better serve the traffic of each individual line. To reduce the number of direct through lines and decrease car mileage.

Abuses.

(a) The improper and fraudulent acts of conductors in connection with the handling of transfers.

(b) The brokerage or trafficking in transfers, especially by newsboys.

(c) The improper transferring and exchanging of transfers by passengers.

(d) The possible increase of damage claims, arising from the operation of a transfer system.

As to whether the advantages of the "uses" of transfers, outweigh the disadvantages of the "abuses," or vice versa, depends on the specific conditions that each company operates under.

RAILWAYS PROTECTIVE ASSOCIATION.

Street railway men will doubtless remember the daring scheme and carefully prepared plot to swindle the Memphis Street Railway Co. out of $25,000, which was concocted and carried out by two persons giving the names of William Webb and wife, July 15th, 1897. Mrs. Webb and a friend boarded a car and as the car started while she was yet in the aisle, she fell heavily backward to the floor as if thrown from her feet. She was removed to her home, a physician was called and examination showed that her spine was injured. The officers of the Memphis road had heard of the plot and as soon as the suit for damages was filed and heard the Webbs were arrested, pleaded guilty and were fined $100 and sentenced to imprisonment for 11 months and 29 days, this being the maximum sentence allowed. About a year later the Staten Island Midland Railroad Co. had a similar experience with one August Krause, alias John Cramer, alias John Miller, alias John Schaeffer, who claimed that in alighting from one of the cars the grip handle pulled off, and was the cause of his falling off the car with such force as to result in severe injury. He was identified as an old grab-handle man but before police arrived he made his escape. A great many accident fakirs are going around the country today, making their livings at this trade.

Realizing the necessity of an organization to afford protection to the railways against these accident frauds, Mr. L. E. Drummond, of Drummond's Detective Agency, Park Row & Ann St., New York City, has organized the Railways Protective Association. This association has on file a record of many fraudulent claims that have been made in the past against street railways, the record being enlarged each month by the reports received from the different railways that belong to the association. Every month a bulletin is issued which contains all the fake accident claims that were registered during the previous month, together with a detailed statement of how these impositions were operated and how they were detected; an important feature of the service being a description of the witnesses who work with the actual perpetrator of the fraud. As soon as an accident happens on a road which belongs to the association full information concerning all similar cases is furnished immediately upon receipt of the claim. The protection afforded by this service is practically invaluable and such an organization enables all the roads throughout the country to cooperate with one another in detecting and suppressing one of the most trying evils they have to contend with.

SCARRITT CAR SEAT EXHIBIT.

The Scarritt-Comstock Furniture Co., of St. Louis, maker of the well-known Scarritt car seat, is exhibiting in aisles F, G and 2, fronting the central doorway on the east, Transportation Building. Here are shown the various types of car seats made by this company, arranged for effective display and in front of a very attractive pavilion. In the rear of the pavilion is the Pullman Exposition train; the Scarritt seats are used in this train and form part of the Pullman exhibit. Adjacent to the Pullman train is the exhibition train of the Missouri Pacific R. R., two coaches of which are equipped with the Scarritt high back car seat and the chair car with the Scarritt twin reclining car. Visiting street railway men are invited to visit the Scarritt Car Seat Works at 1800 N. Main St., and the offices of the company at Broadway and Locust Sts. Incidentally, it is stated that there are more than 20,000 Scarritt car seats in use on the electric cars in St. Louis and vicinity.

EXHIBIT OF GEO. P. NICHOLS & BRO.

The exhibit of Geo. P. Nichols & Brother, of Chicago, comprises a group of photographs showing electric transfer tables which this company has installed in various parts of the country and which have been favorably spoken of wherever used. This company also makes electric drawbridge machinery, electric traveling cranes and electric turntables.

M'GUIRE-CUMMINGS MANUFACTURING CO.

The McGuire-Cummings Manufacturing Co., of Chicago, the well-known builder of trucks, sweepers, sprinklers, etc., has an extensive exhibit on track 14, aisle D, Transportation Building. One sample each of the company's principal specialties are displayed, as follows:

No. 35 double truck for extra heavy duty and high speed service, known as the company's "Electric Locomotive Truck." The main features of this truck are a solid steel frame, supported at each journal box by four coil springs, and an M. C. B. swinging bolster.

No. 39-A high speed interurban truck, with solid steel frame and swinging bolster. Although the wheel base is short, the brakes are inside hung.

"Solid Steel Columbian" truck, the company's well-known single truck, of which more than 7,000 are in use under city cars.

"Royal Flush" fender, the type which was adopted by the Chicago Union Traction Co., to meet the requirements of the city ordinances, and which has been widely used on other roads, also.

The McGuire "Heavy" snow sweeper, designated "heavy" because of the ease with which it disposes of heavy snow. This sweeper is equipped with brooms at each end which cover a space 18 in. greater than the width of the track, and also with steel wings for leveling the snow outside of the sweep of the brooms.

A four thousand gallon double truck pneumatic sprinkling car. This car has a steel tank with an air reservoir, motor-compressor, four adjustable sprinkling heads, track nozzles, fire extinguishing appliances and hose for car cleaning.

Champion switch stand, one of the company's well-known products.

The McGuire-Cummings "Clinch" grain door for steam railroad use.

In this connection is is announced that the McGuire-Cummings Manufacturing Co. has just received an order by cable for a snow sweeper for the new electric road in Amsterdam, Holland. The company has also equipped the electric road at Callao, Peru, with McGuire-Cummings trucks.

Mr. Frank A. Estep, president and treasurer of the R. D. Nuttall Co., came on from Pittsburg to personally superintend the company's exhibit in the Westinghouse space in the Electricity Building.

ILLINOIS CENTRAL R. R. EXHIBIT.

As part of its contribution to the exhibits at the Exposition, the Illinois Central R. R. has issued for general distribution a 62-page illustrated folder entitled, "Facts and Figures about the Illinois Central Railroad and Description of its Steel-Frame Side-Door Suburban Passenger Car." Starting with the tangible beginning of the road in 1855-56, the text of the folder gives a most interesting, though brief, history of the road and shows the geographical, physical and financial importance of the "Central Mississippi Valley Route." It also embodies an outline sketch of the country through which the road passes, showing, among other things, why New Orleans, its southern terminus, is a port of commanding maritime position.

Some of the more pertinent "facts and figures" given in the folder follow: The road's original 706 miles were completed in the years mentioned and opened between Dunleith, what is now East Dubuque, Ill., and Centralia and Cairo, Ill., and from Chicago to Centralia. The charter of the Illinois Central R. R. reserves to the state of Illinois, in lieu of taxes, 7 per cent of the gross receipts of this original 706 miles of road, and the sum so paid for the year ending June 30, 1903, was $1,026,650.84, the largest ever turned into the state treasury. The lines of the Illinois Central extend from the great northern lakes west to the Missouri River and south to the Gulf of Mexico. At the close of its last fiscal year its total mileage had grown to 4,301.10 miles, while the associated road, the Yazoo & Mississippi Valley, has an additional mileage of 1,162.34 miles, making a total for both of 5,463.44 miles. The gross receipts for the year ending June 30, 1903, were $45,186,076.86 for the Illinois Central and $7,330,085.27 for the Yazoo & Mississippi Valley, or $52,516,162.13 for both roads. For the Illinois Central the freight receipts for the year were $30,592,094.32 and the passenger receipts, $8,977,228.09, while the freight receipts for the "Valley Road" were $5,275,-672.18; passenger receipts, $1,540,655.90. The total equipment of the Illinois Central on June 30, 1903, was 1,003 locomotives, 753 passenger, mail and express cars, 51,911 freight cars and 645 work cars. The road is exceptionally well constructed and equipped, with the best block signals and other safety devices. Its passenger train service is widely known for its excellence.

The folder quotes government statistics showing that New Orleans is a close second to New York in the export of wheat, corn and oats, while it is a good third in the value of all principal breadstuffs; that it is first in cotton exportation, and in the total exports of all classes of merchandise it is second only to New York. In addition, it is the chief rice market in the United States and as a sugar market takes rank among the largest sugar centers.

The steel-frame side-door passenger cars treated of in the folder are those now employed in the road's suburban service at Chicago. This suburban service is conceded by travelers to be the finest in the world. The new cars contain 100 seats each and standing room in an emergency for 200 people, making the emergency capacity of each car 300. The car is furnished with bench-form seats arranged transversely in sections, each section seating eight passengers. There is a sliding door in each side of the car opposite each section. The doors are closed automatically after the passengers have alighted or entered. There is an aisle on each side of the car extending the whole length and the cars are vestibuled. The interior finish is very handsome and the cars are equipped with every modern convenience for lighting, heating, ventilation, etc.

These cars differ from all others, having been built from designs evolved in the office of the company.

The illustrations in the folder are half-tone views which in themselves tell an instructive story and the text of the folder is further explained by comprehensive maps and diagrams.

Mr. F. C. Robbins is present at the convention representing the Niles Car & Manufacturing Co.

The National Brake Co's. interests are conserved at the convention by Mr. W. D. Brewster, secretary of the company, whose headquarters are at the Southern.

STREET RAILWAY REVIEW

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Freight and Express Business of the Interurban Railway & Terminal Co.

In the "Street Railway Review" for Nov. 20, 1903, appeared a complete description of the properties of the Interurban Railway & Terminal Co., of Cincinnati, O. It will be remembered that this system comprises three divisions, known as the Rapid Ry. division, extending from Cincinnati in a general northerly direction to Lebanon; the Suburban Traction division running nearly in an easterly direction between Cincinnati and Bethel, and the Cincinnati and Eastern division running in a southeasterly direction paralleling the Ohio River and extending from Cincinnati to New Richmond. The terminal station built by this company on Sycamore St. between Fourth and Fifth Sts., Cincinnati, is 60 x 160 ft. in area and at the time of its erection was considered of ample size to take care of the passenger, freight and express business of the company for some time to come. At that time, however, the freight and express business had but just been started and its future developments could hardly be estimated. It is interesting to note, however, that within a year the volume of express and freight business has increased so materially that the terminal station which a year ago looked so large has for some time been entirely inadequate to the increased demands made upon it. To meet the present exigencies a plot of ground 50 ft. wide, extending entirely through the block from Sycamore to Lawson Sts., has been purchased by the company and upon this plot, which lies immediately adjacent to the terminal station, has been erected a depot which will be devoted entirely to the freight and express business. For the present the new building will be one story in height but foundations for this addition are being put in sufficiently heavy to eventually add other stories as the business may demand. A plan of the entire terminal property is shown in the accompanying illustration, Fig. 5. The new addition, which corresponds in architecture to the older part of the building, is shown in the upper part of the illustration, and a single track extends through the center of this addition for its entire length. In one corner of this addition adjacent to the old building is an office for the use of the freight agent and clerks, and behind this office a platform extends almost the entire length of the building. This platform will be used for receiving and loading freight and its height is on a level with the floors of the express cars. At the rear of the platform is a court where wagons may back up to the platform to load and unload in case the track happens to be occupied with cars, although during the time which freight is received no cars are generally in the station and the whole length of the platform may be occupied by wagons. The opposite side of the station from the platform is given over entirely for wagon space, and the entire floor is covered with asphalt. A wagon scale is installed in this side of the building. Both the front and rear ends of this addition are provided with rolling steel doors which when raised leave the ends of the building entirely open. This permits the wagons to pass in at the front of the building, to load or unload at the platform and to pass out at the rear into Law-

FIG. 1—INTERIOR OF NEW INTERURBAN FREIGHT STATION, CINCINNATI.

son St., making a continuous passage through the building, which obviates any crowding or congestion of the wagons. An opening from the platform into the express room of the old station is provided and a passageway also extends between the addition and the old part of the station just back of the express room. These passages between the old and new parts of the station will permit the loading and unloading of freight on either side of the general waiting

FIG. 2—COMBINATION PASSENGER AND EXPRESS CAR

room although except in case of overcrowding the new station will be generally used. A 2-ton hoist is also installed for lifting heavy shipments into the car. These provisions are expected to supply ample accommodations for some time to come.

The express business of this company was inaugurated during February, 1903, and the freight business was started some time later. For the first few months the increase of the business was due more to the demands of shippers for this service than to any effort on the part of the company. By October, however, the express and freight business had assumed such importance that the receipts from this source began to be an appreciable part of the company's income, and at this time Mr. S. S. Morris was engaged as general

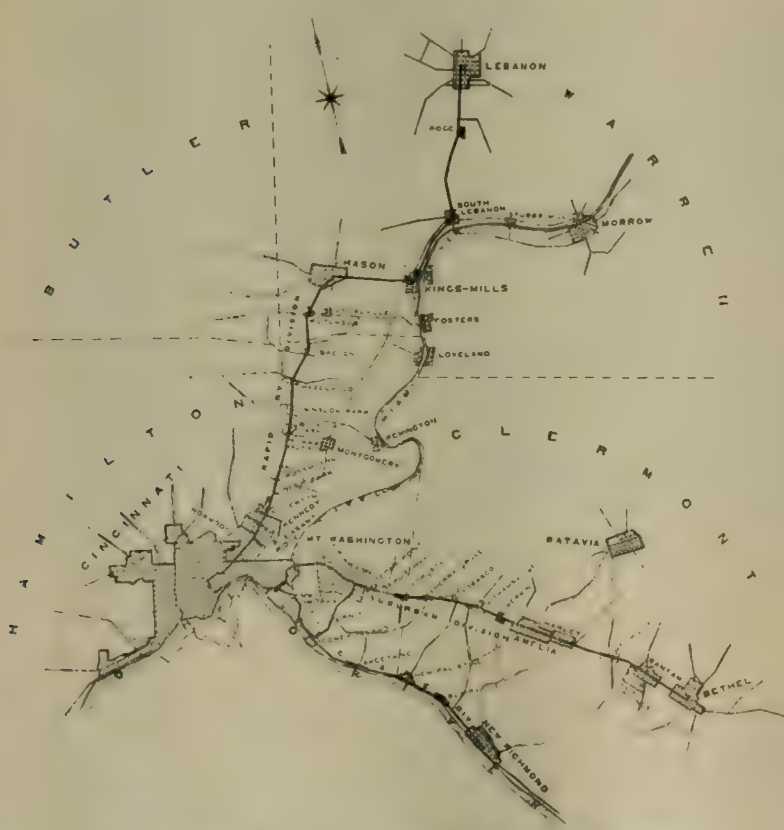


FIG. 3—MAP OF INTERURBAN RAILWAY & TERMINAL CO. LINES

freight agent, and the freight and express business was pursued more aggressively.

It will be understood from the location of the company's lines that the system is a suburban rather than an interurban one. The city of Cincinnati is the center of supply for all the towns and villages touched by this system, and for this reason the freight and express business of the company consists chiefly in distributing general merchandise of all descriptions to the surrounding towns and bringing farm, market and dairy produce from the country into Cincinnati. As the gage of all the street car tracks in Cincinnati

FIG. 4—ELEVATION OF EXPRESS STATION.

is 5 ft. 2½ in. the Interurban Railway & Terminal Co. was obliged to make use of the same gage, as it enters the city over the tracks of the Cincinnati Traction Co., and this departure from standard gage naturally prevents the company from handling freight in carload lots over any of its connecting steam lines.

In developing the freight and express business of this company the management has made a special study of conducting it in the most economical method, the aim being to keep the operating expenses as low as possible and to maintain the net profits at a maximum rather than to reach after a class of business which, while yielding large gross profits, would incur operating expenses which would seriously cut down the net profits. One important item in this connection which has been carefully considered by the management was the use of delivery wagons within the city of Cincinnati and in the different towns through which the road runs. It was decided that such a delivery system would add very materially to the operating expenses of the freight and express department and would not materially increase the gross income for the reason that most of the company's express and freight business is received either from merchants in the city or in country towns or from the farmers along the route, all of whom own their own horses and wagons. The company comes into competition with several regular express companies and as it does not deliver goods beyond its own stations, except in the case of houses or stores on the streets through which its cars run, its express rates are therefore made somewhat lower than those of the regular express companies. The receipts, however, from the express business are practically clear profit as express packages are carried on the regular passenger cars and handled by the regular crews, the only charge against this part of the business being the commission or portion of the salary paid to the agents at different points who also sell tickets and handle the freight business. The freight business is naturally less profitable than express, as the rates are considerably lower and it requires the employment of a number of extra hands as well as the use of special rolling stock. The amount of this business, however, is much greater than that of the express business, so that its total receipts are correspondingly larger. It may be mentioned that the saving in time of express shipments over freight shipments is not nearly so much in the case of this company's service as it is with companies operating steam lines. In the case of express packages they are carried on the next passenger car passing the point where they are received, while freight shipments from Cincinnati are delivered to all other points early the next morning after being received, and freight going towards Cincinnati will often be delivered the same day. In this case the freight service is therefore practically an express service at freight rates.

As previously mentioned, the company uses all of its passenger

cars for express service, thus giving an hourly service in summer, and hourly service morning and evening and two-hourly service during the middle of the day in winter. Express is received all day at the terminal station in Cincinnati up to 5:00 p. m. Freight is received at the terminal station all day up to 6:00 p. m. The freight cars from the three divisions come into this station at 12 o'clock, midnight, bringing in freight from the different stations along the line, which is taken off the cars and the outgoing freight is loaded. The regular freight car crews do the unloading and loading at the terminal stations between midnight and 5 o'clock a. m., at which time the freight cars leave the station carrying the outbound freight. The time when this unloading and loading is done at the terminal station is the time during which the company's power plant is shut down, so that no extra expense is incurred for operating the power plant beyond the time it is required for the regular passenger service. After distributing the outgoing freight in the morning the freight cars lay over at the ends of the division for an hour, and then commence their return trip, stopping at all the freight stations along the line to pick up the incoming freight. In addition to the regular freight stations a large number of platforms have been built at various points along the line for the accommodation of farmers who leave their produce and receive their goods from the city at these platforms.

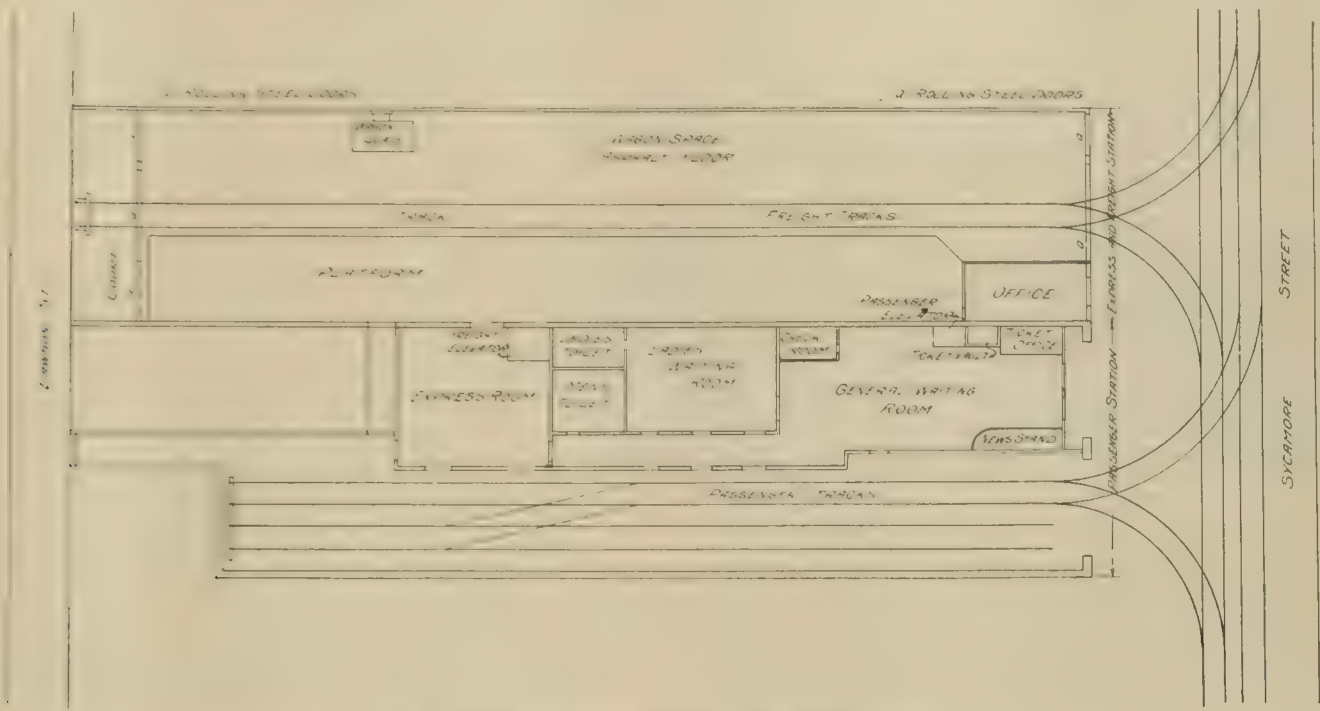


FIG. 5. GROUND PLAN OF PASSENGER AND FREIGHT STATION.


FIG. 6. FREIGHT AND EXPRESS STATION, AMELIA, O.

It has also been found advantageous to build sidings at important industrial establishments in order to facilitate the loading and unloading of freight in car load lots.

The company has ten cars used exclusively for freight business, five of which are box cars and three flat cars, and two gondola cars for carrying heavy freight. Three of the company's freight cars are 46 ft. long and have a loading space of 40 ft. with ceilings 9 ft. high. There are two sliding doors on each side of these cars and their capacity is 40,000 lb. They are equipped with Westinghouse No. 56 motors and are geared for a speed of 42 miles an hour, thus allowing for a fast schedule so as not to interfere with the regular passenger cars. One of these cars runs regularly on each of the three divisions. On the Cincinnati & Eastern division and on the Suburban division two box cars are used specially for berry cars. Small fruits and berries are extensively produced in the section of the country adjacent to these two divisions and the cars have a capacity of 500 crates of berries each. The flat cars are used for heavy machinery, brick, building materials, etc., and the two gondola cars have a capacity of 50,000 lb. each and can be used either as flat or gondola cars. Tarpaulins are provided for covering the loaded flat cars when necessary.

TARIFFS.

The express tariff which has been in effect since Sept. 10, 1903, is given for the Rapid Railway division in the following table:

STATION DISTANCE, MILES.	PACKAGE RATES, CENTS.							Per 100 lb.
	5 lb. and under	10 lb. and not under 5 lb.	15 lb. and not under 10 lb.	20 lb. and not under 15 lb.	30 lb. and not under 20 lb.	50 lb. and not under 30 lb.	100 lb. and not under 50 lb.	Produce & Dressed Poultry
Up to 9 mi..	10	15	20	20	20	25	25	20
9 to 13 mi..	10	15	20	25	25	30	35	20
13 to 25½ mi	10	15	20	25	25	30	35	25
25½ to 32 mi	15	20	25	30	35	40	40	25

For the Suburban Railway division the express tariffs are as follows:

STATION DISTANCE, MILES.	PACKAGE RATES, CENTS.							Per 100 lb.
	5 lb. and under.	10 lb. and not under 5 lb.	15 lb. and not under 10 lb.	20 lb. and not under 15 lb.	30 lb. and not under 20 lb.	50 lb. and not under 30 lb.	100 lb. and not under 50 lb.	Produce & Dressed Poultry.
Up to 8½ mi.	10	15	20	20	25	25	25	20
9 mi.	10	15	25	25	25	25	25	20
12 mi.	10	15	25	25	25	30	25	20
14 mi.	10	15	25	25	25	30	35	20
15 mi.	10	15	25	25	25	35	35	25
15 to 21¼ mi.	10	15	25	25	30	35	35	25
21¼ to 29¼ mi.	10	15	30	30	35	35	40	25

The following table gives the express tariff for the Cincinnati & Eastern division.

STATION DISTANCE, MILES.	PACKAGE RATES.							Per 100 lb.
	5 lb. and under.	10 lb. and not under 5 lb.	15 lb. and not under 10 lb.	20 lb. and not under 15 lb.	30 lb. and not under 20 lb.	50 lb. and not under 30 lb.	100 lb. and not under 50 lb.	Produce & Dressed Poultry.
Up to 8½ mi.	10	15	20	20	25	25	25	20
9 mi.	10	15	20	25	25	25	25	20
9 to 21½ mi.	10	15	20	25	25	30	35	25

In addition to these schedule tariffs a number of special rates are made which are the same for all three divisions, and are as follows:

Ice, packed to any point, 10 cents per 100 lb.

Live poultry, per coop, 30 cents.

Bread, in baskets, 25 cents.

Fresh meat, in sacking, 25 cents per 100 lb.

Milk, 2 cents per gallon, but no shipment less than 10 cents.

Berries, per crate, 15 cents. Per two-bushel stands, 25 cents.

Ice cream, per can, two gallons or less, 25 cents. Each additional gallon 10 cents.

Eggs, per case, 15 miles or under, 20 cents; over 15 miles, 25 cents.

Bicycles or baby carriages, 25 cents each

Tomatoes and peaches, bushel boxes, 10 cents each.

Sewing machines, created, 40 cents each.

Bananas, tariff rates.

Sugar, to all points under 15 miles, 35 cents per bbl.; over 15 miles, 40 cents per bbl.

Flour, to all points under 15 miles, 25 cents per bbl.; over 15 miles, 30 cents per bbl.

Beer, one to two quarters, 25 cents each; one to two half barrels, 30 cents each.

Beer, three to ten quarters, 20 cents each; three to ten half barrels, 25 cents each.

Beer, above ten quarters, 15 cents each; above ten half barrels 20 cents each.

Beer, if packed in ice in barrels, add 5 cents additional to rate.

Beer, in cases, one dozen bottles same as quarters, two dozen bottles same as half barrels.

Beer, for rate to Lebanon add 5 cents to above rates.

Dogs, when with passengers, 25 cents each.

Dogs, when for shipment must be securely crated, double tariff rates.

Calves, in crates (not otherwise taken) to Cincinnati, 60 cents each.

Laundry, in baskets, 25 cents each.

Trunks (not exceeding 150 lb.), 25 cents each.

Corpse, $5.

Hand baggage when carried by passengers is taken without charge. No charge is made for the return of empties to point of shipment except empty beer kegs, barrels and cases, which must be returned by freight at freight rates. Goods are received at regular stopping places and are delivered at terminals or crossings nearest the consignee. The delivery of goods at points where there are no agents ends the company's responsibilities.

Freight is divided into six classes, the classification being the same as is used by all the steam railroads entering Cincinnati. The freight tariff in effect Sept. 12, 1903, on the Suburban Ry. division is as follows:

Station Distance, Miles.	Rates per 100 lb., ce ts. Classes.					
	1st.	2d.	3d.	4th.	5th.	6th.
Up to 9 mi	12	10½	10	9	7½	5
9 to 15 mi.............	12	10½	10	9	8	6
15 to 19 mi.......... ..	12	11	10	9½	8½	6½
19 to 25 mi..............	14	11½	10½	10	9	7
25 to 29½ mi...........	15	12½	11	10½	9	9

On the Cincinnati & Eastern division the freight tariff is as follows:

Station Distance, Miles.	Rates per 100 lb., cents. Classes.					
	1st.	2d.	3d.	4th.	5th.	6th.
Up to 9 mi...........	12	10	10	9	7½	5
9 to 15 mi............	12	10½	10	9	8	6
15 to 16½mi............	12	11	10	9½	8½	6½
18 mi....	14	11½	10½	10	9	7
21 mi	15	12½	11	10½	9½	9

The freight tariff on the Rapid Ry. is given in the following table:

Station Distance, Miles.	Rates per 100 lb., cents. Classes.					
	1st.	2d	3d.	4th.	5th.	6th.
Up to 10 mi............	12	10	9	8	7½	5
10½ to 15 mi	12	10	9½	8	8	6
18 mi............	12	11	10	9½	8½	6½
21½ to 25 mi............	14	11½	10½	10	9	8½
28 mi...........	15	12½	11	10½	9½	9
32 mi............	17	13	11½	11	10	9

No freight shipment amounting to less than 25 cents is taken on any of the divisions. A special car known as the Lebanon beer car makes two trips a week between Cincinnati and Lebanon, carrying only beer and ice. This car leaves the terminal station at Cincinnati every Tuesday and Friday at 8 a. m., and shipments for this car are received at 7 a. m. The rate on ice carried on this car is 10 cents per 100 lb. and on beer 9 cents per 100 lb. The shipments by this car are delivered in from two to three hours.

During the summer season the Cincinnati & Eastern division and the Suburban division do a large business in market garden and farm produce, and special rates for produce coming into Cincinnati have been in effect since May 18th. Berries form a large portion of these shipments, and on the Cincinnati & Eastern and on the Suburban divisions the west bound produce rates are as follows:

From county line:

Berries in small crates carried in freight car.........10 cents each

Berries in small crates carried in passenger car......12½ cents each

Berries in two-bushel stands........................25 cents each

East of county line:

Berries in small crates carried in freight car.........12½ cents each

Berries in small crates carried in passenger car.......15 cents each

Berries in two-bushel stands........................25 cents each

From all points:

Tomatoes, peaches, apples and pears in one-bushel boxes ....10 cents each

Sugar corn in sacks of 10 dozen each................10 cents each

5 cents for each additional five dozen or fraction.

Vegetables, apples and pears in small barrels........15 cents each

Vegetables, apples and pears in sugar barrels........25 cents each

No single shipment is taken for less than 25 cents.

While the express rates given herewith are somewhat lower than the charges of the regular express companies and have been so fixed on account of the absence of the wagon delivery system, the freight rates are practically the same as those of the steam railroads. The very rapid growth of the freight business is evidence of the fact that no necessity exists for the cutting of rates for this service. The frequency and promptness of the freight service is all the inducement which it has been found necessary to offer shippers, although besides this the company does everything in its power to accommodate customers. The company's telephones at all points along the lines are freely offered to customers desiring to order goods in Cincinnati by that means, and the company also makes a specialty of providing a car whenever wanted to large shippers, so that no delay is incurred. During the winter perishable goods are kept in a separate room and are loaded into heated cars.

The shipments both by freight and express include almost every conceivable class of goods; they may, however, be roughly classified in the order of their importance as follows: First, general merchandise; second, market garden produce; third, cartridges; fourth, milk; fifth, castings. A large dairy company on the Rapid Railway division brings in from 85 to 130 cans of milk per day and makes shipments of butter twice a week varying from 50 to 90 tubs. Outside of this there are about 120 cans of milk per day divided equally beteween the three divisions, the latter being carried on regular cars. The shipments of general merchandise amount at the present time to from 60,000 to 70,000 lb. per day. The company has contracts for about 200 car loads of canned goods. One of the most important industries furnishing business to the Interurban Railway & Terminal Co. is the Peters Cartridge Co., which is located at Kings Mills on the Rapid Railway division. In addition to carrying all the supplies for the factory the cartridge company sends all of its output to the Interurban Railway & Terminal Co., which carries it into Cincinnati, where it is reshipped to all parts of the country. The Columbia Foundry Co., of New Richmond, on the Cincinnati & Eastern division, also furnished a large amount of freight to the railway company, which has built a switch into the foundry to facilitate the handling of this business. The season for shipping garden and farm produce in this part of the country extends from March to January.

FIG. 7—FREIGHT AND EXPRESS STATION, [illegible], O.

Forms, Records, Etc.

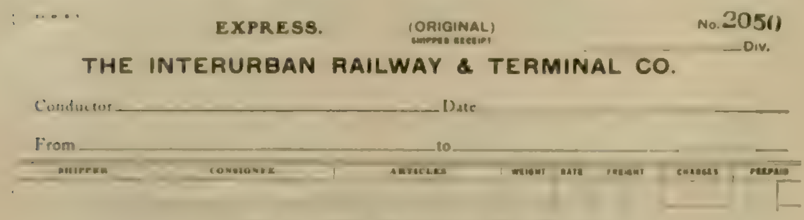
The company has a number of forms used in connection with both the express and freight business, some of which are conventional and others have been specially devised to meet the exigencies of this particular business. A number of these forms are illustrated herewith. Fig. 9 shows the heading of the express way bill, which is in duplicate and folded so as to use with carbon paper. A third copy is also made in the billing book and the conductor of the car on which the shipment is carried signs for it on the book copy. The original way bill goes with the goods, the duplicate to the auditor and the book copy is kept by the billing clerk. Fig. 10 shows the form of express receipt which is given to the shipper. Fig. 11 shows the heading of a special express receipt used by conductors only. The forms shown in Figs. 9 and 10 are only issued at points where the company has agents, but as express matter is received by the conductors on any car and at all points the form shown in Fig. 11 is printed in triplicate and bound in books 8 in. long by 3½ in. wide, and each conductor carries one of these books. The original form is printed on white paper and when filled in and signed by the conductor constitutes the shipper's receipt. The second, or duplicate copy, is printed on yellow paper and accompanies the goods and the triplicate copy is printed on pink paper and is handed in to the auditor. The duplicate and triplicate forms are carbon copies of the original.

FIG. 8—STANDARD FREIGHT AND EXPRESS BOX CAR.

The bill of lading for freight shipments is a form 8½ x 11 in. in size, the heading of which is shown in Fig. 12. This is made out in duplicate, one copy being held by the shipper and the other by the agent. The heading of the freight way bill is shown in Fig. 13, the size of the original being 14 x 4¼ in. The way bills for both freight and express have serial numbers beginning with No. 1 at the first of each month, and are made out in duplicate and a third copy is made in the billing book. The original way bill goes with the goods, the carbon copy goes to the auditor and the book copy is kept for the billing clerk. The expense bill is shown in Fig. 14 and is made out in duplicate, the original being the freight receipt and the duplicate the freight bill. The consignor is given the original copy when he pays the freight charges and the duplicate is signed by the consignee and is held by the company's agent to show delivery of the goods. Fig. 15 shows the heading of a form which is used by the agents for making a daily abstract of all the expense and freight business at their respective stations. This abstract shows the total amount of freight and express business done at each station, for shipments both forwarded and received, and is made out daily by the agent.

Each agent attends to his own collections, remitting the same to the auditor, who checks up his account by the duplicate way bills previously received. These remittances are sent in to the auditor as express packages on the cars and a receipt is returned to the agent. The remittance blank which accompanies the remittances is 3½ x 8½ in. in size, and the heading of this blank is shown in Fig. 16. A monthly blank is also filled out by each agent, showing the amount of freight and express business for each month.

A special form has been devised for a freight and express cash book giving a record of cash receipts and disbursements at each station for each month. The headings for the two facing pages of the book are shown in Figs. 17 and 18. The book is 18 x 11¾



EXPRESS. (ORIGINAL) SHIPPER'S RECEIPT No. 2050 ____ DIV.

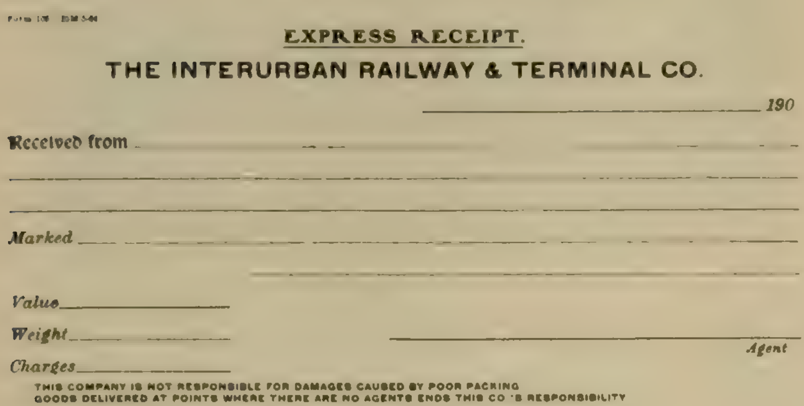
THE INTERURBAN RAILWAY & TERMINAL CO.

Conductor ________ Date ________

From ________ to ________

SHIPPER	CONSIGNEE	ARTICLES	WEIGHT	RATE	FREIGHT	CHARGES	PREPAID

FIG. 9. (SIZE OF ORIGINAL $8\frac{1}{2}$x$4\frac{3}{4}$ IN.)



Form 108 25M 5-04

EXPRESS RECEIPT.

THE INTERURBAN RAILWAY & TERMINAL CO.

________ 190

Received from ________

Marked ________

Value ________

Weight ________ ________ Agent

Charges ________

THIS COMPANY IS NOT RESPONSIBLE FOR DAMAGES CAUSED BY POOR PACKING
GOODS DELIVERED AT POINTS WHERE THERE ARE NO AGENTS ENDS THIS CO.'S RESPONSIBILITY

FIG. 10. (SIZE OF ORIGINAL $8\frac{1}{4}$x$4\frac{1}{4}$ IN.)

in. in size, and, as will be seen from the headings shown herewith, contains a complete record of the entire freight and express business of the company.

Operating Expenses.

As is necessary in the case of every successful business, a careful study has been made by the management of the Interurban Railway & Terminal Co., while offering every facility and inducement possible to shippers, to keep the operating expenses of the freight and express department at the very lowest point consistent with good service. As we have pointed out before, the receipts from the express business are practically all profit, as no extra men are employed for this department and the work is carried on entirely by the crews of the passenger cars in connection with their regular trips. The freight business of course requires the use of special rolling stock and extra help. The agents employed by the company at the several stations are, with one exception, storekeepers in the towns in which they are located, and their compensation is generally in the form of a commission or percentage of the business handled by them. This work requires but a comparatively small part of their time, and no trouble is found in securing storekeepers to act as agents of the company for a comparatively small remuneration. Only a portion of this remuneration, however, is chargeable to the freight and express business, as the same party acts as ticket agent for the railway company and considerable of his commission is chargeable to the passenger business.

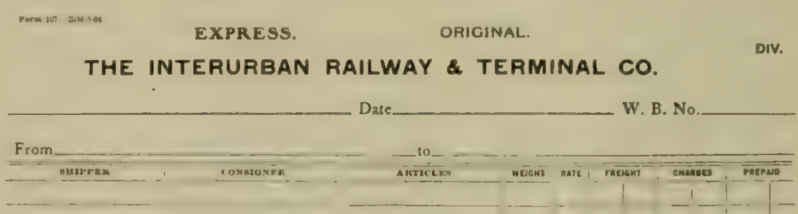
New Richmond, the terminus of the Cincinnati & Eastern division, is the only station where a freight agent is engaged to attend to the company's work exclusively. There are 14 agents employed on the different divisions.

In addition to these agents and the general freight agent in Cincinnati the entire operating force for the freight department includes six motormen and conductors, one night inspector, two clerks at the general agent's desk, one bill clerk, one receiving clerk and two laborers. We have, therefore, as the total charges against the freight and express business a portion of the commission of 14 agents, the wages of 14 men, the maintenance and interest on the freight rolling stock and a proportional part of the maintenance and interest on the terminal station. This amounts to about 25 per cent of the gross income from freight and express.

Since the beginning of 1904 the company has been doing a freight and express business which will, at the same rate, easily reach $50,000 a year, and, as is shown by the proportion of operating expenses just given, fully three-fourths this amount is net profit. This department of the business has grown even beyond the expectations of the management and no stronger argument than these figures could be urged to prove the importance of pushing this department of the electric railway business. A good idea of the rate of increase of this business is shown in the following table, which gives the increase in gross business for each month over the preceding one for the past year.

July, 1903	$ 93.72
August, 1903	108.69
September, 1903	186.82
October, 1903	213.30
November, 1903	238.53
December, 1903	388.77
January, 1904	262.99
February, 1904	347.52
March, 1904	291.85
April, 1904	162.45
May, 1904	224.54
June, 1904	574.21

These figures point to a rapid and steady growth of this department of the business, which is yet scarcely more than a year old, but which, nevertheless, adds very appreciably to the company's net income. The business is, moreover, only in its early stages of development, and with energetic management can undoubtedly be very greatly increased within the next few years. It is well known that the revenues from the freight business constitute the principal part of the incomes of the steam railroads, and while this condition is not likely to obtain in the case of most electric roads there is good reason to believe that with economical management and careful attention to the matter of operating expenses, the freight and express business should form a large item of the revenues of almost all electric railways.



Form 107 25M 5-04

EXPRESS. ORIGINAL. DIV.

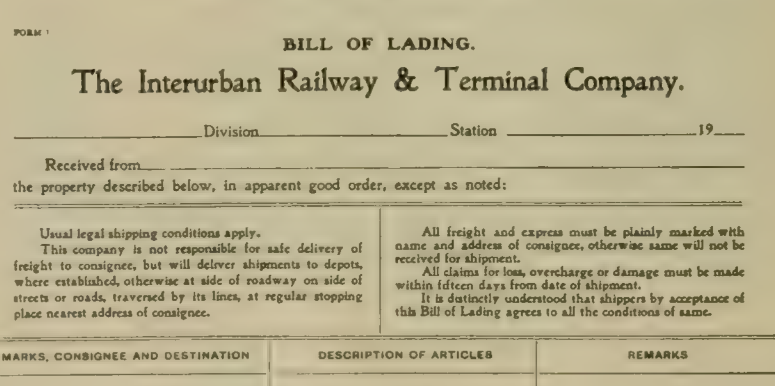
THE INTERURBAN RAILWAY & TERMINAL CO.

________ Date ________ W. B. No. ________

From ________ to ________

SHIPPER	CONSIGNEE	ARTICLES	WEIGHT	RATE	FREIGHT	CHARGES	PREPAID

FIG. 11. (SIZE OF ORIGINAL 8x$3\frac{1}{2}$ IN.)



FORM 1

BILL OF LADING.

The Interurban Railway & Terminal Company.

________ Division ________ Station ________ 19____

Received from ________

the property described below, in apparent good order, except as noted:

Usual legal shipping conditions apply.

This company is not responsible for safe delivery of freight to consignee, but will deliver shipments to depots, where established, otherwise at side of roadway on side of streets or roads, traversed by its lines, at regular stopping place nearest address of consignee.

All freight and express must be plainly marked with name and address of consignee, otherwise same will not be received for shipment.

All claims for loss, overcharge or damage must be made within fifteen days from date of shipment.

It is distinctly understood that shippers by acceptance of this Bill of Lading agrees to all the conditions of same.

MARKS, CONSIGNEE AND DESTINATION	DESCRIPTION OF ARTICLES	REMARKS

FIG. 12. (SIZE OF ORIGINAL $8\frac{1}{2}$x11 IN.)

The Interurban Railway & Terminal Co.

W. B. No. ________

Car No. ________

Freight Way-Bill from ____________ *to* ____________ *190*

____________ DIV.

SHIPPER	CONSIGNEE	NO. PKGS.	DESCRIPTION OF ARTICLES	WEIGHT	RATE	FREIGHT	BACK CHARGES	PREPAID	UNPAID

FIG. 13. (SIZE OF ORIGINAL 4X4¼ IN.)

ORIGINAL.

FREIGHT BILL.

____________ 190 .

To THE INTERURBAN RAILWAY & TERMINAL COMPANY,

____________ Division, Dr.

WAY-BILL No.	No. Packages	ARTICLES	Weight	Rate per___	FREIGHT	Advanced Charges
DATE						
CONSIGNOR						
POINT OF SHIPMENT						
CONNECTING LINE	Received Payment,				*Total to Collect*	
			Agent 19—		*Drayage*	

Original Freight Bill must accompany all claims for Overcharge, Loss or Damage.

FIG. 14. (SIZE OF ORIGINAL 8½X5¼ IN.)

10m 4-11-04. S & C. **Form 115.**

The Interurban Railway & Terminal Company.

FREIGHT AND EXPRESS REMITTANCES.

____________ Station.
Conductor.

____________ 190 .

This Remittance Blank should be forwarded with your collections of freight and express to the Auditor's Office daily and a duplicate kept on file.

C. J. WILLIAMS, Auditor.

DATE OF W. B.	W.B.No	FREIGHT	EXPRESS

FIG. 16. (SIZE OF ORIGINAL 3½X8½ IN.)

____________ Division

THE INTERURBAN RAILWAY & TERMINAL CO.

DAILY ABSTRACT OF EXPRESS / FREIGHT BUSINESS AT ____________ 190

	W B	BILLED FROM	BILLED TO	CONSIGNOR	CONSIGNEE	No. Pkgs.	DESCRIPTION OF ARTICLES	WEIGHT	Rate	FREIGHT	CHARGES	PREPAID	COLLECT	

FIG. 15. (SIZE OF ORIGINAL 17½X12 IN.)

THE INTERURBAN RAILWAY

Dr. *Record of Cash Receipts and Disbursements at* ____________ *Station*

DATE	NAME OF CONSIGNOR OR CONSIGNEE	STATION	COLLECTIONS ON RECEIVED				COLLECTIONS ON FORWARDED				TICKET SALES	OTHER SOURCES	TOTAL RECEIPTS
			FREIGHT		EXPRESS		FREIGHT		EXPRESS				
			Way Bill No.	Amount	Way Bill No.	Amount	Way Bill No.	Amount	Way Bill No.	Amount	Amount	Amount	Amount

FIG. 17.

AND TERMINAL COMPANY.

During the Month of ____________ *190* **Cr.**

DATE	PAID TO	REMITTANCES TO CASHIER				CHARGES PAID ON FORWARDED			Prepaid Beyond to Connecting Road	Miscellaneous Entries	Total Disbursements
		Freight Amount	Express Amount	Ticket Amount	Total Remittance	Way Bill No.	Freight Amount	Express Amount			

FIG. 18

The new station opened for business September 11th, and at the same time an express service was inaugurated inside of the city of Cincinnati by the Cincinnati, Dayton & Toledo Ry. under the name of the Southern Express Co. The latter company does all of the express business of the C. D. & T. Ry., whose service has heretofore stopped at the city limits, owing to the difference in the gage between its lines and those in the city. The C. D. & T. Ry. has built a number of new express cars which will operate several times daily between its terminal at the city limits and the Sycamore St. station.

Electric Traction in Belfast, Ireland.

Mr. Edward Harvey, M. D., vice-consul, Belfast, Ireland, writes, under date of Sept. 12, 1904, that at an early date a new system of street tramways will be inaugurated in this city. The present horse cars will be replaced by electric cars at a cost of over $4,000,000. There are now about 40 miles of rails in and about the city, and it is still a matter of controversy whether these rails will be heavy enough for the new traction, but as the system will be extended, 10 or 12 miles of new rails will be required in any case. The present cars will be discarded and replaced by one hundred or more new electric cars. The tenders for these have not been published by the city corporation.

Motormen's School of the Cincinnati Traction Company.

BY R. E. LEE, GENERAL SUPERINTENDENT.

Prior to the introduction of the school for motormen this company followed the old plan of instruction, namely, after employing a man he was sent to a barn and the barn foreman was supposed to enlighten him on the subject of the equipment of a car, the method of properly handling it, what to do in making emergency repairs, and after several days, usually a week, he was put on with an experienced motorman to complete his education.

This system has been found faulty for many reasons, among which the most important is lack of interest on the part of the barn foreman, who in many cases would use the recruit as a laborer, instructing him how to fill a scrap car with iron, put new wheels under a car, replace armatures, dry sand, and I have seen a new man being taught how to saw a nine-inch girder rail. All of these

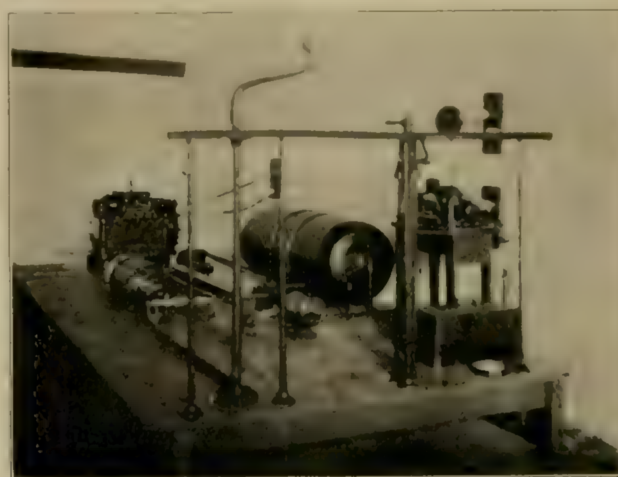
GENERAL VIEW OF SCHOOL CAR.

things of course never should be a part of his duties as a motorman.

Our company seeing how unsatisfactory the old system was, took an old 18-ft. car body and equipped it with a truck, motors, etc. The interior of the car is exposed and each wire can be followed its entire length. There is no floor to the car, so that a plain view of the motors can be had. Attached to the hood is an ammeter, which is used to illustrate the economy to be obtained in properly feeding the controller.

The car is blocked up, so that when desired the electric equipment can be operated. In addition to this car a platform has been built, upon which we have erected a complete air equipment, as shown in one of the accompanying illustrations for which we are indebted to the Cincinnati Times Star. A motorman can be taught how to run a car by means of this equipment, and he can at the same time see of just what it is composed.

The plan which we now follow, and from which good results are being obtained is, after appointment the prospective motorman is



VIEW OF PLATFORM WITH AIR BRAKE APPARATUS.

sent to the inspector of motormen, who is in charge of the school. There he is told of the value of the equipment, what careless in operating it is liable to cost, also the financial loss to the company through unnecessary blockades by burn-outs.

He is then put on the dummy car and taught how to handle the brake, how to feed the controller, the use of the bell signals and is then sent to the division to which he has been assigned and put on with a motorman selected by the inspector.

Here he gains his knowledge of how to operate under actual conditions such as condition of track, stopping and starting, how to approach vehicles, rounding curves, running over special work, cutting out disabled motors, cutting out disabled controllers, putting in fuses, connecting burnt off leads, etc.

After the tutor is satisfied that the new man understands how to handle a car, he is sent back to the school and cross-examined as it were; he is put on the dummy car and told to start up while the power is on and everything is running smoothly. The inspector throws a switch and cuts out a motor; the new man soon ascertains that something is wrong and he is made to locate the trouble and is shown how to remedy it, so that the car can be moved. The instructor then goes over the entire car with him and explains things very plainly and fully.

The new man is then sent back to the division and is taught the running time and time points on all lines of the division. The instructor then makes a trip or two with him, and if he handles the car all right, and runs according to schedule, he is turned over to the division superintendent as O. K.

The instructor is required to keep a record of each man, as to when he enters and leaves the school, to what division he is assigned, and the name of the experienced motorman who broke him in.

The instructor is still required to follow up this man, having three days set aside each week for the purpose of riding with men who are new; in addition to this our division superintendents and inspectors are required to report any mistakes made by motormen, and if serious, the men are sent back to the school.

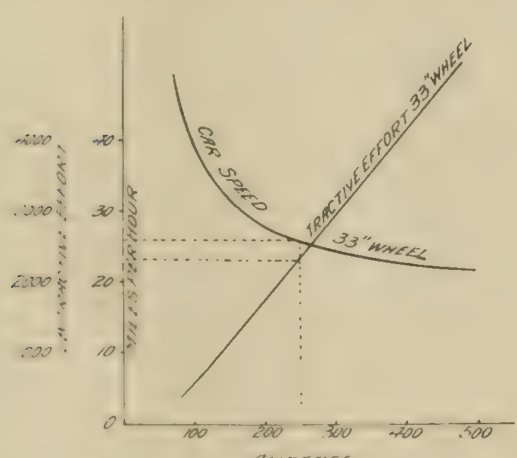
Every motorman who was appointed prior to the introduction of the school is being required to take the course. The beneficial results already obtained lead us to believe that we will soon have a most competent set of motormen, which means economical conditions in maintenance of track and equipment, reduced cost of power, very little loss of revenue resulting from blockades caused by burn-outs, and last but not least, a saving in the claim department.

The Determination of Schedules by Speed Templates.

BY HOWARD S. KNOWLTON

During the past five years the speed-time curve has been more widely applied to the solution of schedule problems upon electric railways than ever before. This is due in part to the publication and free distribution of motor characteristic curves by the manufacturing companies, and in part to the extended discussions of these problems by such authorities as Armstrong, Potter, Mailloux, Davis and Storer in the proceedings of various professional organizations and in the columns of the technical press. The value of this method of attacking the complicated questions of running time which always spring to the front when a new rapid transit line is projected, has now become well established by the experience of a large number of interurban and even city railways, and although considerable technical knowledge is required to properly apply the motor characteristic to schedule problems, the use of the speed-time curve is constantly growing in favor among electric railway experts.

The use of the speed-time curve is attended by certain obstacles, however, in the cases of roads whose alignment and grade is complicated. A simple curve of acceleration upon a level track for a given equipment involves no small amount of experimental application and enlargement before it can be safely applied to determine the possible running time upon any but the simplest profiles. In fact, the number of "trial trips" which must be made over a given line on paper by the speed-time method is often so considerable that the whole process has been known to go overboard in favor of so-called "educated guess-work." Gradually there has come to be needed some process of simplifying the application of the speed-time curve to all sorts of alignments and grades—a process which could be applied by the average man in the engineering department as well as by the experienced student of railway kinematics. The writer believes that this problem has been solved by the construction of the speed template from the original speed-time curve, and the object of this article is to show how the speed template may be prepared and utilized.



CHARACTERISTIC CURVES OF WESTINGHOUSE 50C MOTOR
550 VOLTS GEAR RATIO 50 21-2.38

FIG. 1.

At the outset it is well to recognize that the solution of schedule problems in railway work involves a number of uncertain assumptions. No one who has read the discussions which have been waged upon the ever-shifting battleground of train resistance and car friction can fail to realize that finality has yet to be reached in the drawing of definite conclusions. In order to simplify this paper, a car resistance of 17 lb. per ton has been assumed, based upon the writer's experience several years ago in connection with some tests made in the Boston subway. Although the method of plotting speed-time curves has been published before, it is deemed advantageous to include a description of that process in this article, in order to present a complete account of the speed template's origin and application.

In the preparation of the speed-time curve, a formula is frequently used to calculate the time required to accelerate or retard through a certain range of miles per hour when the car or train is acted upon by a definite tractive effort per ton, viz.:

$$t = (m.\ p.\ h. \times 91.1) \div T$$

The derivation of this formula is of interest, depending as it does upon the fundamental equations of moving bodies:

Let

t = time in seconds to accelerate or retard through a range of speed, $m.\ p.\ h.$

$m.\ p.\ h.$ = gain or loss in speed in time, t.

T = net tractive effort in lb. per ton.

W = weight of car in lb.

M = mass of car.

f = total tractive effort in lb. pull.

a = acceleration or retardation in ft. per sec., per sec.

v = final speed attained in ft. per sec.

From the fundamental equations of mechanics:

(1) $f = M a$.

(2) $v = a t$.

Hence,

(3) $f = W a \div 32.16$, since $W = M g = 32.16 M$.

Substituting we have,

(4) $f = W v \div 32.16\, t$, since $a = v \div t$ from (2).

For 1 ton, $f = T$ and $W = 2{,}000$.

Whence

(5) $T = 2{,}000\, v \div 32.16\, t = 62.2\, v \div t$.

Since $v = 1.466\ m.\ p.\ h.$, we have

(6) $T = (62.2 \times 1.466\ m.\ p.\ h.) \div t$.

Whence,

(7) $t = (91.1\ m.\ p.\ h.) \div T$

Illustrating, we find that it takes 11.4 seconds to accelerate a car from standstill to 25 miles per hour, with a net tractive effort of 200 lb. per ton.

In the development of the speed-time curve and preparation of the speed templates herewith the data assumed are as follows:

Weight of car, 29.5 tons.

Equipment, two Westinghouse 50 C motors.

Gear ratio, 2.38.

Car resistance, 17 lb. per ton.

Braking rate, 1.8 $m.\ p.\ h.$ per sec.

Maximum current per motor, 250 amperes.

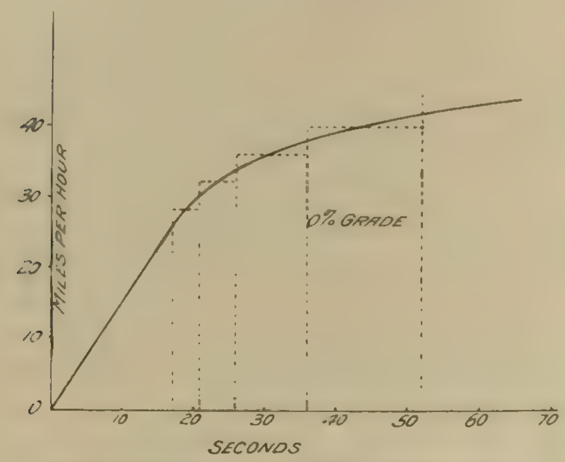
Voltage, 550.

Wheel diameter, 33 in.

Fig. 1 represents the characteristic of the 50 C motor, plotted for a 2.38 gear ratio. The efficiency, heating and output curves are omitted, as they are not directly used in the construction of the speed-time diagram. Fig. 2 shows the speed-time curve on a straight and level track for the equipment and data assumed. The curve is not carried to its maximum speed or flat point because methods rather than complete results are sought in the following description. It will be noted when the current is thrown upon the car, acceleration proceeds at a constant rate to a speed of 26 m. p. h., after which the speed follows what is known as the motor curve, decreasing in its rate of acceleration until the curve becomes flat and a constant or maximum speed is attained. The car is running upon resistance during the entire period of "straight acceleration," and economical operation does not begin until the motor curve is reached and all the resistance cut out.

The construction of the straight portion of the acceleration curve depends upon the rate of acceleration assumed, or, in other words, upon the maximum current permitted in the motors. It will readily

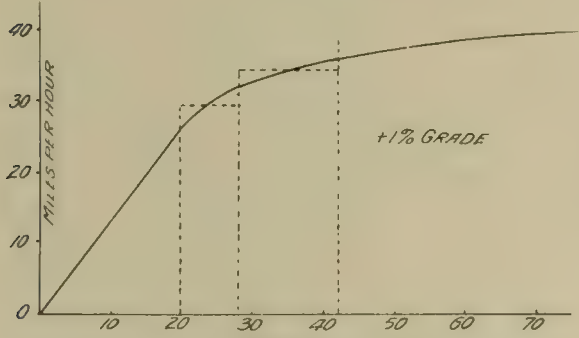
be seen that rapid acceleration calls for heavy current supply, and that the higher the aceleration becomes, the greater becomes the cost of installation, and frequently, of operation. In practical railway work an acceleration of two miles per hour per second is about as high as is advisable; two and a half miles is pretty nearly the limit of the ordinary passenger's comfort, and three miles, while perfectly possible with many equipments, is almost always out of the question. The longer the distance between stops, the less important becomes the acceleration. The choice of acceleration and the maximum



SPEED-TIME CURVE LEVEL TRACK - 29.5 TON CAR
TWO 50 C MOTORS - GEAR RATIO. 2.38 - 550 VOLTS

FIG. 2.

current in the motors resulting depends upon the conditions of operation expected on each particular road, and upon a certain knowledge of the safe momentary capacity of the motors themselves. If the product of the percentage of the car weight on the drivers into the percentage of adhesion assumed between wheel and rails, multiplied by the weight of the car, is less than the net tractive effort of the motors available for acceleration at the wheel circumferences with a given maximum current input, the wheels will slip in starting. Thus, with 63 per cent on the drivers and 20 per cent adhesion in the car under consideration, a net tractive effort of $(.63 \times .20 \times 2{,}000) - 17 = 235$ lb. per ton could be applied before the wheels would slip,



SPEED-TIME CURVE +1% GRADE 29.5 TON CAR
TWO 50 C MOTORS - GEAR RATIO. 2.38 - 550 VOLTS

FIG. 3.

giving an acceleration of nearly 2.6 miles per hour per second. We are evidently safe in the case in hand, which is figured for such conditions of track as prevail upon elevated and in subway structures.

Taking 250 amperes as the maximum per motor, we find that the tractive effort corresponding is 2,300 lb. per motor, or 4,600 per car. The total pull is then 156 lb. per ton, from which 17 lb. per ton must be deducted for friction, leaving a net tractive effort available for acceleration of 139 lb. per ton. This is the value of T, and the motor characteristic curve shows that this corresponds to a speed of 26 m. p. h. At lower speeds the current must be held down to values no greater than 250 amperes per motor. In a multiple unit system this may be done by an automatic throttle, or it may be approximated by careful designing of the resistances and very skillful handling of the controller. In practice the acceleration is generally more or less irregular, but it is smooth enough not to be noticed by passengers unless a resistance is out of circuit, changed, or the car improperly handled. Substituting in our equation $t = (\text{m. p. h.} \times 91.1) \div T$, we find that 17.1 seconds are required between standstill and 26 m. p. h. In plotting the curve beyond the straight acceleration a table must be used, as in Table I, for a level track:

Table I. (Level Track.)

M.P.H. Speed.	Lb. T. E. per motor.	Lb. T. E. per car.	Lb. T. E. per ton.	Lb. Net T. E. per ton.	Mean T. E. per ton.	Value of t.
26	2300	4600	156	139	118.5	1.54
28	1700	3400	115	98	88	2.07
30	1400	2800	95	78	67.8	2.7
32	1100	2200	74.5	57.5	50.8	3.6
34	900	1800	61	44	40.7	4.47
36	800	1600	54.3	37.3	33.9	5.38
38	700	1400	47.5	30.5	25.8	7.08
40	560	1120	38	21	18.0	9.6
42	500	1000	34	17	13.6	13.4
44	400	800	27.2	10.2		

This table is derived from the motor characteristic, and is used simply for convenience in calculating the step by step accelerations of the motor curve. Thus, in the next to the last column the first net tractive effort available for the work of acceleration is the mean of that at 26 m. p. h. and that at 28 m. p. h., or 118.5 lb. per ton for the 2 m. p. h. speed between. A recourse to the formula $t = (m.\ p.\ h. \times 91.1) \div T$ gives 1.54 seconds as the time to reach 28 m. p. h. from 26 m. p. h.; it is then plotted, and the work proceeds until the curve becomes flat at a point where the net tractive effort beyond the pull required to overcome friction is zero. The greatest accuracy is obtained by taking speed points close together, but the game is hardly worth the candle in view of the uncertain quantities always present in the preliminary data.

Table II shows the acceleration data of our equipment upon a + 1% grade, used in plotting the speed-time curve corresponding. It must be borne in mind that the tractive effort per motor corresponding to a given current input is always the same, regardless of the track layout, so that the first four columns of each table are composed of the same quantities. The net tractive effort, however, is diminished by 20 lb. per ton for every per cent of up grade encountered, and increased by that amount upon down grades. Thus, on the + 1% grade at 26 m. p. h. the net tractive effort available for acceleration is 119 lb. per ton instead of 139, as upon the level track, the 17 lb. per ton being deducted on account of friction, with 20 lb. per ton lifting effort in addition. If greater accuracy is required, values of train and car resistance corresponding to different speeds and groupings of cars should be employed in place of a constant friction value; the calculator choosing between the formulæ of W. J. Davis, Jr., Lundie and others, published in the technical press within the last few years.

Table II. (+ 1% Grade.)

M. p. h. speed.	Lb. net T. E. per ton.	Mean T. E. per ton.	Value of t.
26	119	98.5	1.85
28	78	68	2.68
30	58	47.8	3.82
32	37.5	30.6	5.05
34	24	20.7	8.8
36	17.3	13.9	13.1
38	10.5	5.8	31.5
40	1		

The speed-time curve of Fig. 3 is plotted from Table II in a similar manner to the curve of Fig. 2 which was derived from Table I. In plotting the straight acceleration, the rate of speed increase will be less than that of Fig. 2 by 20 lb. per ton, assuming that the current remains at 250 amperes per motor as before. A current-time curve may easily be plotted upon the speed-time sheet if desired, by referring to the values of current per motor corresponding to the different speeds in the motor characteristic. It is important to recognize, however, that during approximately the last half

of the straight acceleration with a two motor equipment, the current per car is double the value maintained during the first half, on account of the motors' passing from the full series point on the controller to the full multiple position. Thus, in the case at hand the current per car averages 250 amperes up to a speed of 13 m. p. h. in starting from rest; it then jumps to 500 amperes and does not begin to fall off until the motor curve is reached at 26 m. p. h. The current curve is not plotted upon the diagrams herewith because we are dealing with speed problems in this article rather than with energy problems. In any investigation of feasible schedules from the practical standpoint of motor heating, it is most important to consider the energy questions, average and maximum power consumption, etc., which apply to different schedules and numbers of stops per mile. To plot a speed-time curve for a run which does not involve full multiple running of the motors the process followed is the same as has just been described, except that the motor curve begins at 13 m. p. h. instead of 26 m. p. h., and the speed-time curve is derived from a 275-volt speed curve on the motor characteristic. The latter is plotted with ordinates $275 \div 500$, or one-half as high as those of the 550-volt curve, the current-torque curve remaining the same, on the assumption that the speed of the motor varies directly with the voltage impressed upon its terminals.

Fig. 4 shows the speed-time curves for coasting upon level track and a + 1% grade, and for straight line braking at the rate of 1.8 m. p. h. per second. The formula $t = (m.\ p.\ h. \times 91.1) \div T$, is equally applicable to positive and negative acceleration, the braking

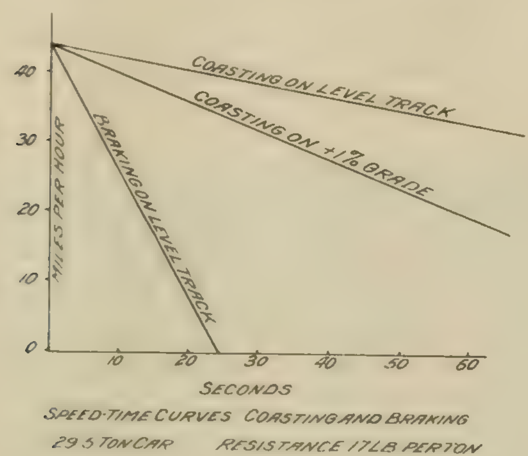


FIG 4.

rate of 1.8 m. p. h. per second, corresponding to a retarding effort of 164 lb. per ton, including friction. In actual practice the braking line is nearly always curved at the upper portion on account of the light application made at the beginning of a stop. It is assumed straight in this article for the sake of simplicity, and the error involved is not serious in view of the wide latitude of braking force which may be applied to any given car by skillful handling of the engineer's valve. In the same way, the actual coasting line is generally a curve, on account of the decrease in train friction as the speed falls off, but a fair average for present purposes may be struck by the straight line method.

The next step consists in plotting a set of time-distance curves from all the speed-time diagrams drawn. This is a simple matter, as the product of speed and time gives distance. The area underneath any portion of the speed-time curve is proportional to the distance traversed during that part of the curve, and if a planimeter is at hand, the area may be readily integrated and converted into distance for each speed-time curve at hand. If a planimeter is not available, perhaps the simplest method is the one followed in determining the area of steam engine indicator diagrams—dividing the area beneath the curve into equivalent rectangles, and computing the distance traversed from their area. Of course, the greatest accuracy calls for the construction of a large number of rectangles. In Figs. 2 and 3 only enough rectangles have been drawn to show the principle involved and to obtain a very approximate part of curves in Fig. 5. The area beneath the straight acceleration is easily calculated by recalling that the average speed between any two points is half of the sum of the limiting speeds; thus, the distance covered in the straight acceleration of Fig. 1 is

Average speed 13 m. p. h. for 17.1 seconds, which is equal to 326 ft.

On the first rectangled portion of the motor curve the average speed is approximately 28.3 m. p. h. for a period of 3.9 seconds, covering a distance of 162 ft. Adding this to the distance previously gone over, 326 ft., we have 388 ft. as the point reached 21 seconds from starting. In this way the entire curve is plotted, and the result is most convenient for reference. The braking curve bends to the right, as the ground covered is greatest at high speed. For the sake of brevity the distance-time curves derived from coasting have been omitted.

We now come to the preparation of the templates—the final set of speed forms for the equipment. By referring to the speed-time and distance-time curves for each grade, the speed-distance curve for each grade is plotted, and cut out by scissors or a sharp knife to the line of speed as in Figs. 6, 7 and 8. Along the edge of the speed-template are graduated both speeds and times, and on the bottom is marked the horizontal scale of distances. With a set of templates for a given equipment made up from stiff cardboard or celluloid for the common grades encountered in practice, the equipment may be made to make a "paper run" over any complication of

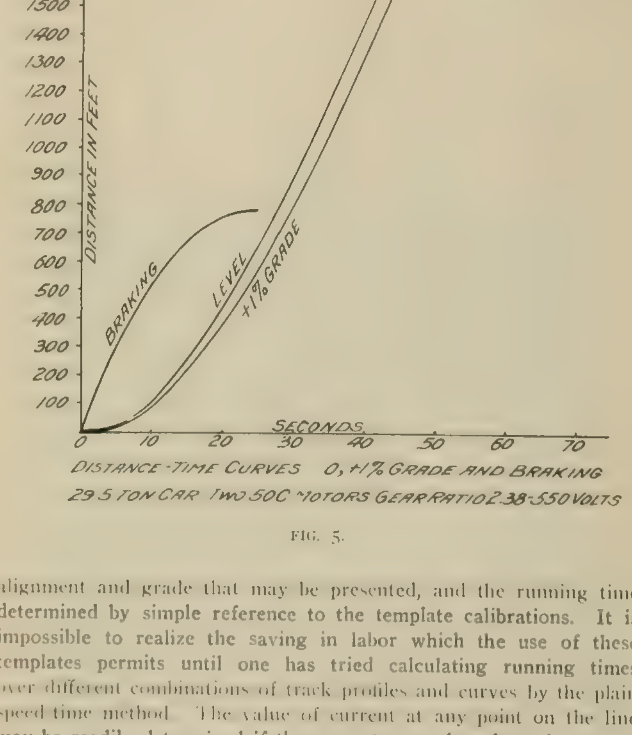


FIG. 5.

alignment and grade that may be presented, and the running time determined by simple reference to the template calibrations. It is impossible to realize the saving in labor which the use of these templates permits until one has tried calculating running times over different combinations of track profiles and curves by the plain speed time method. The value of current at any point on the line may be readily determined if the currents are plotted on the curved edge of the template corresponding to different speeds. Fig. 9 illustrates the application of the templates to a 1,500 ft. run, 500 ft. being level, the 300 ft. following being + 1% grade, and the remaining 700 ft. being level. Taking the "level" template, we apply it to the alignment and grade (which must, of course, have the same horizontal scale), and draw our speed line until it intersects the 500 ft. ordinate which marks the end of the level stretch. We read on the template that this is 22 seconds' run, and note that a speed of 31 m. p. h. is reached. At the intersection with the 500 ft. ordinate we apply the "+ 1% grade" template, draw the curve along its edge to the limit of that grade, and note that 7 seconds are required to cover this run. At the end of the + 1% grade the level track begins again, and we slide the "level" template along the base line until its curve intersects the point where the + 1% curve stops; we draw the curve of level running along the edge of the template

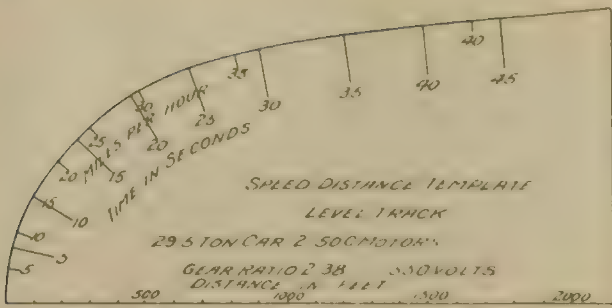


FIG. 6.

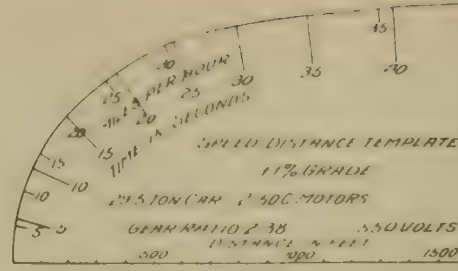


FIG. 7.

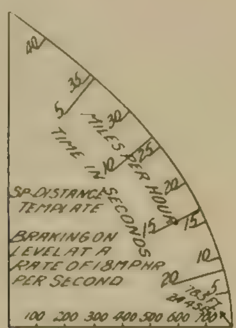
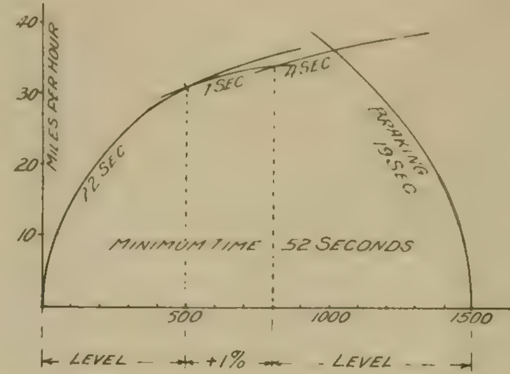


FIG. 8



1500 FT RUN 29.5 TON CAR TWO 50C MOTORS
GEAR RATIO, 2 38 550 VOLTS
DETERMINATION OF FASTEST POSSIBLE TIME

FIG. 9.

again, this time indefinitely to the right. Taking the "braking" speed-distance template, we place its end of zero speed at the 1,500 ft. point on the horizontal scale, and draw in the braking curve. The intersection of the braking curve with the "level" curve just drawn marks the completion of the speed-distance diagram for the run, and from the graduation of the templates we find that the fastest possible running time which can be made over this route by the given equipment is 52 seconds. By plotting various coasting curves and applying them to the run through templates, any sort of a run may be made over the line. Curves are best allowed for equipment may be run over any sort of alignment and grade with the greatest facility.

Fig. 10 shows a run between Pleasant and Boylston St. stations in the Boston subway, plotted by speed templates, and drawn from the writer's data secured in preliminary calculations with which he was associated upon the Boston Elevated Ry., prior to the commence-

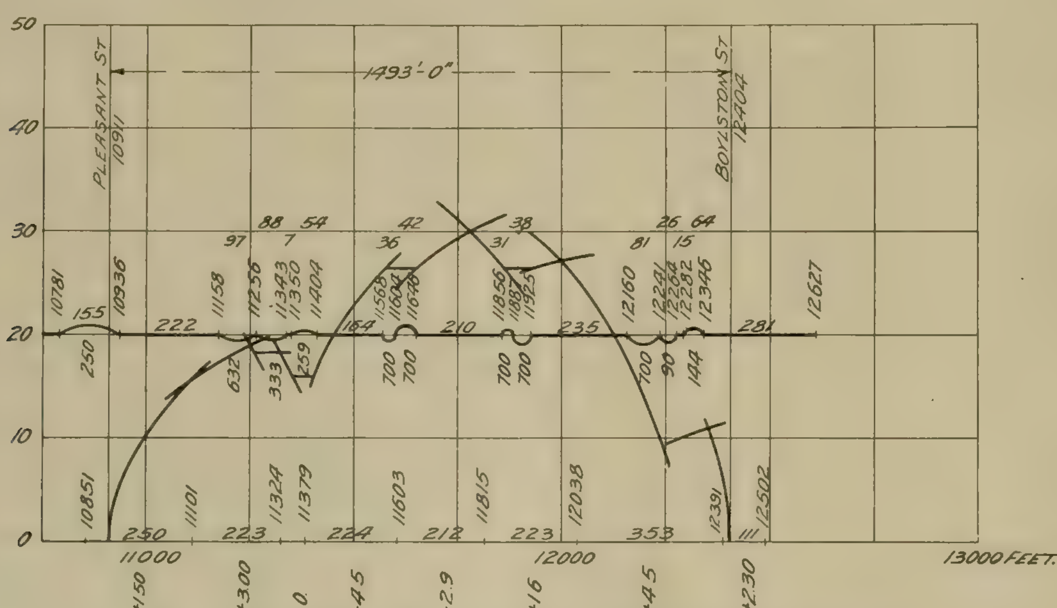


FIG. 10—APPLICATION OF SPEED TEMPLATES TO BOSTON ELEVATED RY. SCHEDULES.

by reducing them to equivalent grades, braking or coasting to the limiting speeds of each particular radius. As a rough rule, the speed in m. p. h. should not exceed the square root of the curve radius in feet. The energy input during acceleration, or whenever the current is on, may also be plotted in ft.-lb. or kw. h. on the templates, and the economy of different schedules investigated. Once a set of templates is made up for a given equipment, that ment of operation. The earlier figures of schedules upon this road were made from speed-time curves, but the process was so laborious that the speed-template method was adopted. Later calculations upon the speeds expected over the tortuous and difficult alignment of the subway were thus carried out with the utmost ease, and the method has since been followed with satisfaction to all concerned in the preliminary studies of new elevated and subway routes.

The whole question of train movement is constantly being studied by the progressive management of the road. Another instance of extended application of speed templates is the case of the Puget Sound Electric Railway, connecting Seattle and Tacoma. Here the schedules were predicted with close accuracy, and were based upon a long series of studies of motor characteristics and the resulting curves. Care is necessary, however, in plotting the curves, as is evidenced by the experience of a firm of engineers who omitted the motor curve in making an exhaustive report to a railway company—assuming that straight acceleration was possible from zero to maximum speed. Needless to say, the clientage of the road was speedily withdrawn when the fundamental error was discovered. Properly constructed and used, the speed-time and speed-distance curves offer a most valuable means of studying transportation problems dealing with train and car movements. The writer is indebted to Messrs. John Balch, John Lundie, Paul Winsor, P. H. Wynne, and J. M. Ayer, of Boston and New York, for many valuable suggestions advanced from time to time upon this method of train movement analysis.

Test Car of the Great Tramway Co. of Berlin.

BY OUR BERLIN CORRESPONDENT.

The Great Tramway Co., of Berlin, soon after changing the whole of its system to electric operation, used a double track accumulator car fitted with numerous measuring instruments for the purpose of ascertaining the consumption of energy and other working conditions on its various lines. It was eventually found necessary, however, to construct a separate and distinct car for this purpose, sim-

DWELLING COMPARTMENT.

ilar to those used in the United States, and containing a complete testing outfit for determining any difficulties that might arise in the course of operation. The car, several views of which are shown in the accompanying illustrations, contains two main compartments, one of which is used exclusively for testing and measuring instruments, while the other is designed as a dwelling room for the officials engaged in the experiments.

The external appearance of the car hardly differs from that of the convertible cars in general use. The test car is mounted on maximum traction trucks, the distance between the driving axles being $5\frac{1}{2}$ meters and the wheel distance 1,300 mm. The total weight of the car is 15,050 kg. The electrical equipment was supplied by the Union Electric Co., of Berlin, and includes two General Electric No. 52 motors, having a normal capacity of 23 h. p., and two B-8 controllers, in addition to the main and automatic cut-outs, lightning arresters, fuses, etc. Any of the types of motors used on the company's cars can be mounted on the axles of this car to be tested.

There are three brakes entirely independent of each other, namely, a hand brake, a magnetic brake of the Sperry type and a com-

SWITCHBOARD.

pressed air brake of the Böker system. This combination of brakes permits the different ones being compared on the same car and reliable data as to their respective efficiency, current consumption,

MEASURING TABLE.

etc., may be obtained. The current is supplied to the car either by overhead or by underground conductors. In the testing compartments various instruments have been installed, partly on a marble switchboard and partly on a testing table, the former serving main

ly for demonstrating purposes while the latter are instruments of precision intended for accurate investigations. The switchboard contains a main and automatic cut-out for the car circuit in addition to ammeters, voltmeters and speed indicators; two watt-hour meters, made by the Union Electric Co., for measuring the energy

TESTING CAR-ALLGEMEINE ELEKTRICITAETS GESELLSCHAFT.

consumption of the motors, these being connected in series so as to check each other; a watt-hour meter of the Allgemeime Elektricitaets Gesellschaft make, for measuring the electric meter consumption, and registering instruments for the amperes, voltage and speed. The latter are equipped with Siemens & Halske spark re-

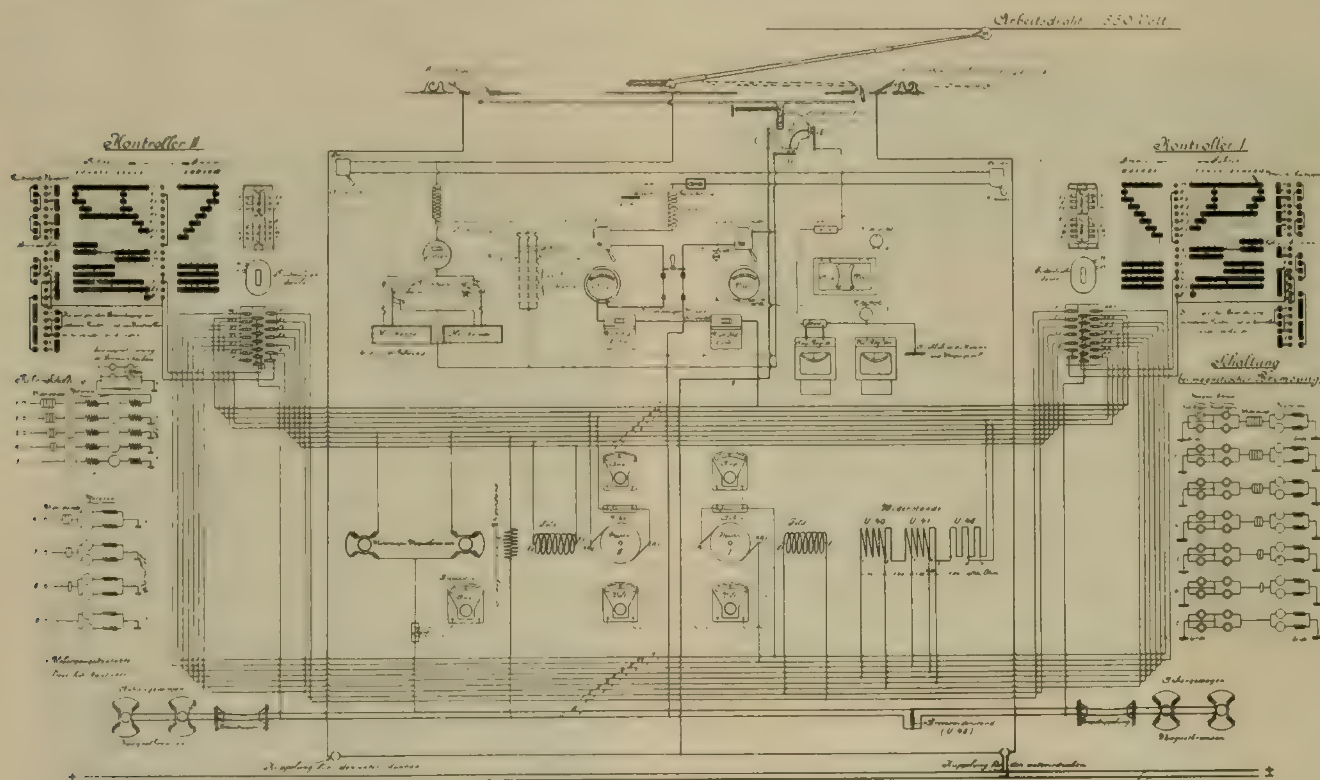


DIAGRAM OF CONNECTIONS.

cording device, which is well adapted for registering with the utmost accuracy even the most rapid oscillation. There is further a speed indicator operated by electricity and indicating directly the number of kilometers per hour. The table containing the measuring instruments measures the quantity and voltage of current used for the car motors only, an ammeter and voltmeter for each of the motors, an ammeter for the magnetic brake circuit, all of which were supplied by the European Weston Instrument Co. There is further, a distance recorder measuring in meters the distance traversed by the car, an apparatus reading directly the grade of the track by means of a pendulum the deflection of which is transmitted to an index moving along a scale, a pressure gage for measuring the pressure in the air brake reservoir, another pressure gage for ascertaining whether the compressor is running at no load or is compressing air, and finally a chronograph for counting seconds. Between the measuring table and the two motormen's cabs there have been provided loud-speaking telephones of the Mix and Genest system. There remains to be noted a recording traction dynamometer, which is for use in pulling trail cars, and an insulation testing apparatus designed by Siemens & Halske. The car also carries a complete set of maps and plans for all the lines containing particulars as to the length of track, position of power stations, feeding points, etc. Besides its use for practical testing purposes, the car is made use of to instruct the heads of the operating departments and especially the mechanics.

A Recent Invention.

A device to indicate the names of the street to the car passengers is the latest means for accommodating street car patrons that will be tried by the Cleveland Electric Railway Co. It is about the size of the fare indicator, and is placed in the forward end of the car. On the face of the dial are printed the names of the streets on the line in consecutive order, while below are numbers corresponding to the distance the given street is from the starting point of the cars. As the cars run along a rod projecting from the top of the car strikes, just before it reaches every block, a weight suspended from one of the trolley suspension wires. This blow to the rod causes it to fly back, releasing a spring which moves the indicator point forward to the name of the next street. The indicator is set for a round trip and can be regulated by the conductor. D. P. Jones and N. C. Butler, of Cleveland, are the inventors.

The business of the York Street Railway Co., York, Pa., exceeded all previous records during the week of October 10th, in four days of which something over 125,000 passengers were carried. The people were handled with safety and no accidents occurred that would entail any loss or damage.

The Electric Railway of the White Knob Copper Co., Ltd.

The White Knob Copper Co., Ltd., of Mackay, Idaho, last year built a single track road 7.1 miles long for the purpose of hauling ore. The road was put into operation last fall and is used entirely for freight trains, eight or ten cars being operated in one train. There are two trains in regular service each of which carries about 80 tons of ore and each train makes from three to four trips daily. The entire line is on a grade of about 6 per cent and the roadbed is laid with 60-lb. T-rails on rough cedar ties, 2 ft. between centers. Angle-bar joints are used and the road is rock ballasted.

ORE CARS ON TRESTLE.

SNOW CUT ON LINE OF WHITE KNOB COPPER CO., LTD.

VIEW OF ELECTRIC LOCOMOTIVE AND ORE CARS ON THE RAILWAY OF THE WHITE KNOB COPPER CO., LTD.

The rolling stock includes two Baldwin Westinghouse electric locomotives 21 ft. 3 in. long and 6 ft. 9 in. wide over all. The locomotives have 30-in. chilled castiron solid wheels with journals [illegible] x 7 in. They are equipped with Westinghouse automatic air brakes. The rolling stock also includes 40 ore cars of 8 tons capacity, of the gondola type, each weighing 6,500 lb., also two flat cars and two side dump ore cars, all of which were made by the American Steel & Foundry Co. These are all equipped with Westinghouse automatic air brakes.

As may be seen from one of the illustrations, the snow on the tracks of this road was 10 ft. deep in some places last winter, but the company was able to operate it every day. The snow plow equipment consists of two home-made pilot plows which were attached to locomotives.

The overhead line consists of a No. 00 trolley wire and two aluminum feeders of seven-strand No. 4 wires, each of which is four miles long. The overhead material was furnished by the Ohio Brass Co. The railroad winds up through the hills and the feeders cut across ridges at times and in other places follow the track in order to give tapping points at a distance of every 500 ft. The poles are 25 ft. long, of pine, and are 6 in. in diameter at the top.

The power plant operates both the smelter and the railroad so that individual data are difficult to obtain. A water power has been

acquired by the company and steps are being taken to construct a new power house, to supply both the smelter and the railroad from this water power instead of by the steam plant at present in use. The present power house is 150 ft. x 70 ft. wide and is a wooden building. It contains six 60-h. p. flue tubular boilers and three 155-h. p. McEwen engines direct connected to Westinghouse 500-volt direct current generators. The boilers are fed with hot water from the blast furnaces. The switchboard is of marble, having six panels. It contains Weston ammeters and voltmeters and Westinghouse circuit breakers.

There is a car-house and a repair shop owned by the company, located at the smelter terminal of the road. The car-house is 35 x 75 ft. in dimensions and is used for storing the locomotives and

REPAIR SHOP, WHITE KNOB COPPER CO., LTD.

for repairing cars. The building is of wood and has a 3-in. fire line for fire protection. Two repair men are constantly employed at this shop and it is equipped with a lathe, shaper, drill press, bolt machine, pipe machine and emery grinder; also a complete outfit for rewinding the motors of the locomotives and a blacksmith shop.

The regular scheduled speed of cars is 12 miles an hour and the trains are operated by a dispatcher. A telephone system is installed along the line for use in dispatching.

From the foregoing description it will be seen that this road, is used exclusively as an industrial railway and it is under the management of the White Knob Copper Co., Ltd. The superintendent and electrical engineer of the railway is E. E. Slaughter; chief engineer, C. G. Gunther; master mechanic, Roy Hoffman; electrician, E. M. Jones.

New Lines and Extensions.

October 5th service was inaugurated on the Ft. Wayne, Van Wert & Lima Traction Co., between Lima and Delphos.

October 1st the first passenger car coach was run over the line of the Petaluma & Santa Rosa Railway Co.

October 3d the line of the Dayton & Muncie Traction Co. between Greenville, O., and Winchester, was put into complete operation.

October 8th the last spike was driven on the Joliet and Aurora division of the Joliet, Plainfield & Aurora Ry.

October 9th service on the Toledo, Ft. Clinton & Lake Side Railway Co. was inaugurated.

October 6th the Densmore & City Railway Co., Densmore, Ia., opened its new line up Fourth street to Mercy Hospital.

September 14th engineers completed the survey for the Philadelphia, Harrisburg & Lancaster Street Ry. which is to run from Mt. Joy to Middletown, and which will be the connecting link to Harrisburg.

The new Pennsylvania & Mahoning Valley line has been opened for traffic between Lansingville and Struthers.

The car barn of the Portsmouth, Dover & York Electric Railway Co. at York Beach., Me., was destroyed by fire October 9th.

Car Inspection.

BY H. J. LAKE, MASTER MECHANIC, MUNCIE, HARTFORD & FT. WAYNE RY.

Car inspection is something that cannot be followed too closely on all electric railways at all times. Each year shows rapid progress towards better service and higher speed, and with the higher speed has come greater chances of accidents. Accordingly it is the duty of car inspectors to see that each and every car is in the best possible condition when it is placed in service.

When a railway system can arrange to have the car house at one end of the line it will be found very convenient to change cars at the end of each round trip, and the cars can then be inspected in the house, but if the car house is located some miles from the end of the line, the cars should be inspected when they pass the car house. On our road we are able to make such an inspection without any additional car house help as a man in this position, who is lively and quick at sight, should not take more than two minutes to examine all the car bearings and take a glance at all the principal parts of the trucks of a four-motor car.

We have all been tanght that a "stitch in time saves nine;" so in car inspection if a worn bearing is taken in time it will save an armature. A cotter out of a bolt in the brake rigging will allow the bolt to work loose; a chipped flange will allow the wheel to leave the rail. Either of these minor defects should be seen at a glance by the inspector and remedied before there occurs an accident that may result in serious damage to property and perhaps loss of life.

When the cars are in the house for their daily oiling they should be inspected by a thoroughly competent man, who is quick to see defects. It is the experience of the writer that such thorough inspection pays and pays well.

An Uptown Resort for Manhattan Island.

Recent issues of the New York daily papers have given prominence to the announcement that Thompson & Dundy, of Luna Park and Coney Island fame, associated with John T. Brush, president of the New York National League Baseball Club, are about to carry out a scheme for the creating of a gigantic amusement resort on the upper end of Manhattan Island on the site of the Manhattan Field near the Polo Grounds. The resort, it is said, will be ready early next summer, and will cost more than $1,000,000, surpassing in scenic effect anything else of the sort on this side of the Atlantic. The promoters say the resort will be somewhat like Coney Island in its amusement features, but will be run on a more dignified basis. Manhattan Field comprises an area of about 9 acres, and it is said the entire field will be covered with permanent buildings and attractions, except for the necessary courts and avenues.

The business of creating large and extensive attractions erected solely for the purpose of furnishing amusement to pleasure seeking crowds has developed with gigantic strides during the past two or three years, as has been well exemplified at Coney Island during the past season and on the Pike at the St. Louis Exposition. The proprietors of the mammoth amusement resort for upper New York will take advantage of this development in creating attractions for their new enterprise, and they will also draw from foreign countries in their effort to obtain the newest and best amusements for the education and pleasure of the summer crowds. There will be large German restaurants and terraces, French gardens, English Plazas, performing animals from Brussels and performing animals and vaudeville acts from Europe, Asia and Africa.

The new resort will draw patronage from a thickly populated section of Manhattan and the Bronx, and it is believed will be a complete success from the start, inasmuch as this section of the city is now without attractive outdoor pleasure resorts sufficient to meet the wants of the people for a clean and attractive outdoor place of amusement. Coney Island is too far away to attract thousands of people living in Manhattan and the Bronx who it is believed will be glad to patronize a first-class pleasure park nearer home.

An official order has been issued by the Tri-City Railway Co., notifying all trainmen that they will be required to wear regulation overcoats to harmonize with their suits.

Blank for Tabulating Data of Electric Cars.

We produce herewith the data sheet devised by the Electric Railway Test Commission at the St. Louis World's Fair for collecting information in regard to the cars that will be tested upon the special test tracks, and also for collecting information in regard to electric cars in general. The blank is of interest not only to those directly concerned with the work of the test commission, but also to managers or master mechanics who for any reason may wish to tabulate in concise form a description of any car or any type of cars. This is often desirable in making inventories of property, in making specifications, or for general reference purposes. The blanks seem to cover all the essential details of a complete car. The blank is printed on a sheet 8½ in. wide by 10⅞ in. high.

ELECTRIC RAILWAY TEST COMMISSION
DATA SHEET

NUMBER________ DATE________________

SOURCE OF INFORMATION ________________________

CAR BODY

	DATA	REMARKS
MAKE		
TYPE		
LENGTH—OVER CAR LINES		
LENGTH—OVER CORNER POSTS		
LENGTH—FRONT PLATFORM		
LENGTH—REAR PLATFORM		
WIDTH—OVER ALL		
WEIGHT		
WEIGHT—EQUIPPED		
NUMBER OF SEATS		
KIND OF SEATS		
CAPACITY—SEATING		
CAPACITY—STANDING*		
SHAPE OF FRONT		

*ALLOWING________ SQUARE FEET PER PASSENGER

TRUCKS

MAKE		
TYPE		
WEIGHT		
CARRYING CAPACITY		
SPEED RATING		
WHEEL BASE		
DISTANCE BETWEEN TRUCK CENTERS		
DIAMETER OF WHEELS		
DIAMETER OF AXLES		
SIZE OF JOURNALS		
SYSTEM OF SPRINGS		
KIND OF TIRES		

MOTORS

MAKE		
TYPE		
NUMBER PER CAR		
VOLTAGE		
CAPACITY (ONE HOUR RATING)		
GEAR RATIO		
WEIGHT (TOTAL)		
WEIGHT (ARMATURE)		
DIAMETER OF ARMATURE		
SIZE OF BEARINGS		
ARRANGEMENT ON TRUCKS		
METHOD OF SUSPENSION		
MAXIMUM SPEED		

GENERAL EQUIPMENT

HAND BRAKE		
POWER BRAKE		
SYSTEM OF CONTROL		
TYPE OF CONTROLLER		
METHOD OF HEATING		
TROLLEY STAND		
TROLLEY WHEEL		
CIRCUIT BREAKERS		
NUMBER OF LAMPS		
KIND AND POSITION OF HEADLIGHT		

HEIGHT OF CAR FLOOR FROM TRACK	
HEIGHT OF CAR ROOF FROM TRACK	
WEIGHT OF CAR COMPLETE	

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We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

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If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

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SUMMARY OF CONTENTS.

FREIGHT CARS IN CITY STREETS.

One of the alleged reforms now being promoted by the mayors of the various cities of the state of New York looks to the removal of electric freight and express cars from city streets. An attempt will be made to secure the passage of an act by the New York Legislature at the next session, prohibiting the transportation of freight cars through the city streets by electric railways, and the project is said to be a very popular one with the public at large.

It is difficult to imagine a movement which has behind it so little reason. The operation or freight and express cars on electric railways has been found a great public convenience This method of transportation is more rapid and more economical than trucking by wagons; being handled in large loads, the transportation of a given amount of material requires fewer vehicles and as these operate over a special track they cause no wear upon the street pavements. An additional advantage is that the substitution of freight cars for wagon trucks removes from the streets a large number of horses with a great improvement in the sanitary conditions and reduction in the cost of street cleaning.

SINGLE PHASE RAILWAY MOTORS.

In the "Review" for September was published a description of the new single phase motor with compensated winding which has been developed by the General Electric Co. and which has been the object of a public test on the Ballston division of the Schenectady Ry. It is worthy of comment that both of the large manufacturing companies who have entered the alternating current railway field have adopted single phase motors with laminated fields, similar in a general way to the type of direct current motor which has been in successful use for many years. The consensus of opinion in this country is apparently strongly in favor of single phase motors, and although polyphase motors have made considerable progress on a number of European railways they are not looked upon favorably by American engineers. The polyphase induction motor is practically a constant speed machine and for this reason is not so suitable for electric traction as a motor having variable speed and whose torque decreases as the speed increases.

That there is a broad field of usefulness for motors of the type under discussion cannot be denied but their field will be practically a new one as it seems hardly probable that they will, to any extent, replace the direct current motor in city and suburban service where it has proved itself so eminently satisfactory. The fact that the new motor is heavier, more expensive and somewhat less efficient during acceleration still leaves the direct current machine without a competitor for purely city service. The single phase motor seems, however, to be particularly well adapted for interurban lines where the converter sub-stations and necessary attendants can be dispensed with, and the engineers of the company are certainly to be congratulated on the happy adoption of a system of control which will permit the cars equipped with these motors, to operate with almost equal facility over alternating current lines in the country and direct current lines within the city limits.

It may be questioned whether this type of motor is well qualified for handling heavy freight trains or taking the place of locomotives on long distance railroads, but it is equally questionable if there will be any demand for electric motors in this class of service for sometime to come. For interurban lines, however, and especially those of great length which have heretofore required a considerable number of rotary converter sub-stations, the new motors appear to be particularly well adapted, and the corresponding saving in construction due to the use of complete alternating current distribution will be very marked.

WHEEL MATTERS.

There has recently been considerable discussion concerning the relative merits of chilled cast iron and solid steel and steel tired wheels for electrical railway service. The two general heads under which car wheels may be discussed are safety and economy. On the score of safety we have to consider the liability of the wheels to injury of such a nature as to endanger the safety of the car. Practically the only injury which endangers the safety of the car and its passengers is that resulting from a broken flange which in a great many instances means a derailment. Both chilled wheels

and steel tired wheels have burst in service but accidents of such a nature are very rare so that injuries of this character, that is the failure of the wheel as a whole, may be left out of practical consideration.

While a derailment is always a thing to be avoided there are certain classes of service where an accident of this kind will be so very serious that the management cannot afford to take even slight chances and accordingly steel tired wheels with cast steel or wrought iron centers have been adopted by all elevated railroads, for the reason that steel is a stronger metal than cast iron.

For service under ordinary conditions there seems to be no question but that chilled cast iron wheels can be made to give satisfaction, and the makers of chilled wheels have no difficulty in meeting all requirements if they are paid for it. Much of the complaint about inferior quality in cast wheels has for its cause the desire of the purchasing agent to get a dollar's worth of metal for 75 cents.

In city service the old street railway car had light wheels with narrow treads and shallow flanges. These wheels were of ample strength for service under light cars and as cars have increased in weight the wheels put under them have been made heavier and stronger. The design of rails and pavements in city streets, however, has not kept pace with the developments of the car itself, so that the track now imposes undesirable conditions as to tread and flange dimensions. While for city service the narrow treads and shallow flanges are reasonably satisfactory, when city tracks have to be used by interurban cars the conditions of rail and pavement very seriously affect the interurban company.

Wheels used under city cars are for the most part 30 in. or 33 in. in diameter, the 33-in. wheels having treads about 2¼ in. wide and flanges ⅝ in to ¾ in. high. Interurban cars are of practically the same weight as those on steam railroads and often are operated at quite as high speeds, and therefore have the same need for heavy wheels. The Master Car Builder's standard section is a 4 in. tread and a 1⅛ in. flange and when such cars are run over the tracks designed for a 2¼ in. tread and ¾ in. flange it is evident that injury to the wheels and perhaps also injury to the special work and pavement is bound to result. To meet this condition some of the interurban companies are using tired wheels or wheels entirely of steel which are made by various processes, including rolling. The wheels so adopted are, in some instances, made of the standard M. C. B. section in order to meet the interurban conditions on the interurban lines and at the same time to better withstand the rough usage due to running over special work designed for the shallow flange and tracks in paved streets designed for the narrow tread. Other roads use a wheel and tire section corresponding to city tracks and rely upon the greater strength of the steel as compared with cast iron to make the light section wheel carry the heavy cars over the outlying portions of the line. This latter scheme is not to be recommended from the standpoint of the interurban company; it is better for the city company, however, as the wheels with the M. C. B. flange and tread ride on the flanges when on city tracks, a condition not conducive to a long life for grooved rails. If wheels with narrow treads be used, the track must be laid with a close gage, which means excessive wear on both rails and wheel flanges.

A step in the right direction has been made by the Milwaukee Electric Railway & Light Co. in adopting for its new track work a rail having a head 3 in. wide. This is in accordance with the recommendation of the American Street Railway Association committee on standardization and has for its principal object the making of city tracks suitable for the use of high speed interurban cars having wheels of M. C. B. section. Such a wide-head rail will prevent chipping of treads by contact with the paving, at least to a considerable extent.

Excepting such special conditions as those which obtain on the elevated railways and the aggravated cases where an interurban car has to use city tracks designed for particularly light wheel sections it may be safely assumed that either the steel tired wheel or the chilled iron wheel can be made to give satisfaction on the score of safety; discussion of relative merits therefore, involves the condition of economy. Under this head several points need consideration: First comes the wear of the wheel. The round figure, 40,000 car miles for the chilled wheel is pretty well accepted as a satisfactory life. It is unfortunate that so few roads have records extending over any considerable period which show the life of different portions of the equipment, making an extended compilation of statistics impracticable.

The Denver City Tramway Co. has under its larger cars, which are 41 ft. long, weigh 18 tons and are equipped with four motors and air brakes, 33-in. chilled cast iron wheels of the channel spoke type weighing 510 lb. each. These have treads 3 in. wide and flanges ¾ in. deep and 1 3/32 in. thick. The average life obtained in this service is 40,000 miles. Under smaller cars, which are 39 ft. long, weigh 13 tons and are equipped with two motors and hand brakes, 30-in. chilled cast iron wheels, weighing 340 lb. each, are used. These wheels have treads 2¼ in. wide and flanges ¾ in. deep by 15/16 in. thick. The average life under the lighter cars is 55,000 miles per wheel.

Some recent data on the life of the steel tires are as follows: Motor car wheels on the Northwestern Elevated, Chicago, show 22,600 miles per ⅛ in. wear of tire or 271,200 miles as the life of the 3-in tire. Coach wheels (not motor driven) on the Northwestern Elevated show 38,400 miles per ⅛ in. wear of tire or 460,800 miles for a tire 3 in. thick.

Data given by Mr. Knox Taylor in the "Review" for July 20th place the life of the fused steel tired wheel at 25,000 miles per ⅛ in. wear of tire. This of course, is for motor wheels and agrees very closely with the figure given for the Northwestern Elevated.

It is perhaps, then, safe to take the life of the steel tired wheel as compared with the chilled wheel as 6.8 to 1. The net cost of the chilled wheel is probably not far from 1 cent per pound after allowing for the scrap value, or we will say $6 for a 600-lb. wheel. One maker furnishes the following data as to the cost of steel tired wheels having 28-in. centers with tires 5½ in. wide by 3 in. thick: First cost of wheel, $51; two new tires furnished complete at $27 each, $54. Total, $105. Thus, as the wheel centers are considered good for at least two re-tirings the cost of the wheel may be figured as $35 for the life of one tire. If interest on the additional investment required for the steel wheel is considered it will probably be found that the costs of the two kinds of wheels are about in proportion to their respective lives and the relative economy will depend upon other items than the first cost.

For chilled wheels there would have to be seven renewals on the estimate which we have made, to one renewal for the steel tires. To some extent this cost of replacing wheels is counterbalanced by the cost of re-turning the steel tires as they wear. On the other hand, chilled wheels are more easily flatted. If the flat spots are small they can be removed economically by means of wheel truing brake shoes, but if they are large, the wheel must either be scrapped or ground.

The Denver City Tramway Co. gives the cost of regrinding a pair of wheels at $1, being four hours' time at 25 cents. The cost of grinding a pair of wheels is, by some companies, placed at 50 cents.

Mr. E. D. Bronner, superintendent of motive power and equipment for the Michigan Central R. R., furnishes the following data on cost of labor for work on steel tired and on cast wheels:

Turning 36-in. steel-tired wheels..........	80	cents per pair.
Turning 42-in. steel-tired wheels...........	90	cents per pair.
Boring 33-in. cast wheels....................	2¾	cents each.
Pressing 33-in. cast wheels on axle........	7	cents each.
Pressing 33-in. cast wheels off axle.........	5	cents each.

The foregoing figures cover cost of labor only; no data are at hand to cover fixed charges and operating expenses on the tools used.

Another point made in favor of the use of steel tired wheels is that there being fewer renewals necessary because of their longer life and the non-recurrence of such defects as chipped flanges and spalled treads there is not so much time lost by the car being out of service because of defects.

The question of rail wear has been mentioned in connection with wheels but we believe there are no authentic data on this point. Experiments made with brake shoes indicate a greater wear between steel and steel than between steel and iron and consequently we may presume that the rail wear might be slightly greater with the steel wheel than with the iron wheel.

The comparisons made here as to the first cost are open to the objections that electrical railway companies for the most part are not using cast iron wheels as heavy as 600 lb., but as the estimate on

the cost of steel tires are for a wheel which could not be replaced by a chilled wheel weighing less than 600 lb. this weight is properly assumed.

It would appear that there are at this time no records available upon which the makers of steel wheels can base a guarantee of their performance in electric railway service. The conditions as to track which obtain on elevated lines and on the street surface are so different that it is not safe for the manufacturers to guarantee results based on the performance of steel wheels in elevated service. The fact that the wheels are operated over tracks covered with dirt carried onto them by other vehicles in the street and often over grooved rails, where the grooves are half filled with sand or dust, makes it probable that a rapid wear of steel tires is to be expected. The managers of electric railways are not in a position to know what they should ask in the way of a guarantee any more than are the manufacturers in a position to know what they can safely give.

It must not be overlooked that on an electric car all or one-half of the wheels are driving wheels and consequently subjected to much harder service than are wheels under railroad coaches. The increased weight of cars and the requirements as to higher speed and more rapid accelleration are constantly increasing the severity of the conditions to be met.

A SENSIBLE LABOR ORGANIZATION.

During 1903 there were a number of very serious labor controversies affecting street railways, and among these will be recalled the strikes at Waterbury and Bridgeport, Conn.; Richmond, Va.; Chicago, New Orleans, Dubuque, Ia., and Seattle and Tacoma, Wash. In every case the demand was for a "recognition of the union." Such recognition as is satisfactory to labor organizations involves a divided responsibility in the administration of discipline, but as upon the discipline in effect depends the safety of a railway company's patrons and also to a great extent the relations which obtain between the company and the public in general, a railroad cannot with safety to itself yield to the demands for recognition of the union. The liability for negligence of its servants is placed upon a common carrier by law and cannot be evaded, nor divided with an organization that is not financially responsible. A transportation company comes into relation with the general public only through its employes, and upon their conduct depends to a very considerable extent the character of the feeling of the patrons towards the management. Anything that tends to impair cordial relations is a serious detriment to the company, and if the men are serving two masters, one incentive to properly perform their duty is removed.

Mar. 26, 1903, the trainmen of the Seattle Electric Co. went on a strike, and as the company's franchise provided for a submission of labor disputes to arbitration, a board of arbitration was appointed and on March 31st an award was made and the men returned to work. Not being satisfied with the findings, considerable negotiating followed and finally a second strike was ordered Sept. 9, 1903. The men, however, were not in sympathy with this action and the company was able to operate 90 per cent of its cars.

Realizing the fact that the organization had got into the control of the radical element and that satisfactory relations with employers could not be expected, the majority of the men withdrew from the union and organized an association, which was incorporated under the state law Sept. 15, 1903, the by-laws being framed with the object of protecting the rank and file against the effect of unwise leadership.

The new association defined its object as being to serve, advance and protect the best interests of its members as workingmen, to encourage the principle and practice of conciliation and arbitration; to increase the efficiency of the service on the street railways operated by the Seattle Electric Co.; to promote the welfare of its members and provide for sick, disability and death benefits. The association is declared to exist on the theory that the employes of the street railways operated by the Seattle Electric Co. have sufficient ability and business judgment to manage their own affairs without interference, dictation from or alliance with any other person, firm, association, corporation or union whatsoever, and the association discountenances any tendency towards strikes or boycots or affiliation with any other union, labor organization or association.

Thus, to be eligible for membership six months' employment with the company is necessary. The dues are $1 for initiation and 50 cents per month.

The management of the affairs of the association is entrusted to a board of 15 trustees, the president and secretary being ex officio members. A very important provision in the by-laws is that all officers and trustees elected after Jan. 1, 1904, shall have been in the street railway service of the company for more than five years prior to this election or appointment.

No person not a member of the association is admitted to address meetings of the members except on invitation of the majority of the trustees.

The result of the second strike was the cause of dissension and derangement of several of the labor bodies of Seattle which had counseled the strike, promising assistance, etc.

OFFICERS OF THE ACCOUNTANTS' ASSOCIATION.

We consider that the Street Railway Accountants' Association, and the nominating committee which recommended to the Association the officers chosen for the ensuing year, should be heartily congratulated upon the selection of Mr. W. G. Ross for president. Mr. Ross is not only a street railway accountant who has been closely identified with the Association and active in its work ever since the organization in 1897, but being as managing director of the Montreal Street Railway Co., at the head of the operating department as well as of the accounting department, he is a most fitting representative of the Accountants' Association on the executive committee of the A. S. R. A. During the ensuing year, which is to be a period of reorganization of the electric railway associations, it will certainly be of great advantage for the Accountants' Association to be represented on the committee of general managers by a man who is himself the general manager of his company. Mr. Ross was chosen a member of the executive committee of the Accountants' Association at its organization meeting in 1897, and during the year 1899-1900 served as second vice-president.

The announcement by Mr. W. B. Brockway that he could not accept a re-election as secretary of the Accountants' Association came as a disappointment, and almost as a shock. He had been secretary and treasurer of the Association ever since its organization in 1897, and had served so efficiently that the membership in general had hoped that he would consent to continue indefinitely as the active executive officer. When Mr. Brockway, who for two years has accepted re-election under protest, finally decided that in justice to his other work he could not serve another year, the Association was at a complete loss to find a satisfactory successor, and the choice of a secretary and treasurer was confided to the incoming executive committee. In order that the Association might not be crippled in the interim Mr. Brockway kindly consented to fill the duties of the office until the end of the calendar year, and was appointed acting secretary and treasurer until a permanent successor shall be chosen. Mr. Brockway has had to give a great deal of his time during the last eight years to the work of the Association, and it has been almost entirely a labor of love on his part as the compensation allowed the secretary for his services is scarcely enough to pay for the stenographic and clerical help needed to carry on the work. No words are too strong to express the obligation of the Association for the time and energy devoted by Mr. Brockway to its successful upbuilding.

MR. C. B. FAIRCHILD, JR.

With this issue Mr. C. B. Fairchild, jr., who has so acceptably served as eastern editor of the "Review" for nearly four years, resigns that position to go into business for himself. Mr. Fairchild was educated at the College of the City of New York, leaving in his sophomore year to join the editorial staff of the Street Railway Journal. He was with the Journal for six years, devoting a considerable portion of his time to work on the "Red Book" of American Street Railway Investments, of which for one year he had entire charge. Mr. Fairchild resigned from the Journal in 1899 to become assistant editor of the "Street Railway Review," and in 1901 he assumed charge of our eastern editorial office with headquarters in New York.

Mr. Fairchild has been thoroughly successful in technical journalism, because of the ability, energy and unswerving loyalty he brought to his work. The "Review" regrets to have this connection severed and Mr. Fairchild takes with him our best wishes for equal success in his new work.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

The decisions which have been reported in the Legal Department of the "Street Railway Review" since 1893 have been published separately by the Windsor & Kenfield Publishing Co. under the title "Street Railway Law," four volumes of which have been printed. Vol. I covers the period from January, 1894, to January, 1897; Vol. II from January, 1897, to July, 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901, to April, 1903. Vol. V is now in press. Price: Bound in sheep: four volumes, $10.00; single volume, $3.00. Bound in buckram: four volumes, $6.50; single volume, $2.00.

INDIVIDUAL UNDER SAME OBLIGATION TO PROVIDE FOR SAFETY OF PASSENGERS AS CORPORATION—FAILURE TO TAKE HOLD OF HAND RAIL IN ALIGHTING NOT NECESSARILY NEGLIGENCE.

Crump vs. Davis (Ind. App.), 70 N. E. Rep. 886. Apr. 26, 1904.

The appellate court of Indiana, division No. 2, holds that there was no error in giving the jury an instruction that, although not a corporation, the defendant (Crump), being a common carrier, was under the same obligation to provide for the safety of passengers as a corporation carrier. It also holds that it is not negligence per se (by itself) for a passenger to fail to take hold of the hand rail in alighting from a street car.

ENTITLED TO USE MATERIAL TAKEN UP WHEN LAYING TRACK TO PUT STREET INTO REQUIRED CONDITION AGAIN—CITY LIABLE FOR REMOVAL OF MATERIAL.

City of Detroit vs. Detroit Railway (Mich.), 99 N. W. Rep. 411. Apr. 26, 1904.

The supreme court of Michigan holds that when the defendant was engaged in tearing up the pavement or surface of the street for the purpose of laying its track, it was entitled to use the material thus torn up in putting the street in the condition required by the ordinance, so far as the same was suitable to the purpose, and that the city was liable for such material removed by its authority while the replacing of the pavement was in progress. It says that it can see no good reason for saying that the ordinance referred to contemplated that the old material which was entirely suitable for use should be replaced with new. This was not the contract.

PRESUMPTION OF NEGLIGENCE FROM SPRINKLING CAR WITHOUT ANY ONE UPON IT COLLIDING WITH WAGON—MEANING OF MAXIM RES IPSA LOQUITUR—SUFFICIENCY OF DEFENSE THAT MOTORMAN WAS THROWN FROM CAR BY ELECTRIC SHOCK—LIABILITY WHERE MOTORMAN LOSES CONTROL OF CAR BY OWN CARELESSNESS.

Chicago City Railway Co. vs. Barker (Ill.), 70 N. E. Rep. 624. Apr. 20, 1904.

The supreme court of Illinois says that this was a case for the application of the doctrine res ipsa loquitur (the matter speaks for itself). While the party who brought the action was riding in his wagon, as he had a right to do, an electric motor car used for sprinkling purposes, with no motorman or any other person upon it or in control of it, ran up from the rear and struck the wagon, throwing the man out upon the ground, injuring him. This collision gave rise to a presumption of negligence on the part of the company, and the burden of proof was upon it to rebut that presumption. The meaning of the maximum res ipsa loquitur is that, while negligence is not, as a general rule, to be presumed, yet the injury itself may afford sufficient prima facie evidence of negligence, and the presumption of negligence may be created by the circumstances under which the injury occurred. The contention of the company was that, if it was necessary for it to rebut the prima facie presumption of negligence raised by the occurrence of the accident in the manner stated, it did so by showing that the motorman was thrown from the car by an electric shock which the company was unable to anticipate or prevent, and that therefore it should not be held responsible because the car was not in the control of any one when it struck the wagon. It was a question for the jury to determine whether the explanation of the accident sufficiently rebutted the presumption in question. The credibility of such rebutting evidence is held by the authorities to be a question for the jury. If the company placed the sprinkling car under the control of a motorman, who lost control of it by his own carelessness, then the sprinkling car was not properly run and managed by the company.

FAILURE OF REPAIR TO HOLD EVIDENCE OF ITS CHARACTER—CARE OWED TO PASSENGERS—AS TO CHARACTER OF ROLLING STOCK—INEFFICIENCY OF MOTORMAN IN EMERGENCY—PRESENCE OF MIND AN ESSENTIAL TO COMPETENCY.

Howell vs. Lansing City Electric Railway Co. (Mich.), 99 N. W. Rep. 406. Apr. 26, 1904.

Where it was found after an accident that a brake rod which had broken the day before and been repaired was useless for want of a bolt, the supreme court of Michigan holds that the failure of the repair to last more than 24 hours was some evidence of the character of such repair. The defendant owed to its passengers a high degree of diligence and care in transporting them, and that involved the character of the rolling stock. It was not necessarily a defense that the motorman was confronted by an imminent and unexpected danger, whereby he lost his usual ability to control the car. While proper allowance should be made for such conditions, it is the duty of those who run cars and trains to put them in charge of competent men, and a reasonable degree of presence of mind may be an essential to competency.

CONSTRUCTION OF FRANCHISE STATUTE AS TO MEANING OF WORDS "NEXT HIGHEST" BIDDER.

Pacific Electric Railway Co. vs. City of Los Angeles (U. S., Cal.), 42 Sup. Ct. Rep. 586. Apr. 11, 1904.

By the California act of March 11, 1901, the supreme court of the United States says, the notice of an application for a franchise is required to state that sealed bids will be received for the franchise "up to a certain hour and day named therein" (sec. 3), and also to state that the franchise "will be granted to the person, firm, or corporation who shall make the highest cash bid therefor;" and any bid may be raised not less than 10 per cent "above the highest sealed bid," and the franchise finally struck off, sold, and granted to the "highest bidder" (sec. 5). Section 5 also provides that the "successful bidder shall deposit with said governing body, or such person as it may direct, the full amount of his or its bid, within twenty-four hours thereafter; and in case he or it shall fail so to do, then the said franchise or privilege shall be granted to the next highest bidder therefor." To what do the words "next highest" refer? To bids already made, or to a bid or bids to be made? More obviously the former. They express the relation between bids in existence,—those already made and pending before the council in pursuance to its notice. It is only in comparison with the *next* highest of those that the words have significance. Again, the court says that it thinks section 5 is plain, and was intended to express as an alternative of a bid not fulfilled the acceptance of one already made, not one to be made, and that it is fortified in this view by section 7, which provides that the grantee of the franchise shall file a bond to fulfil the terms and conditions of such franchise, and also provides that if such bond be not filed "the award of such franchise shall be set aside and the same may be granted

to the next lowest bidder, or again offered for sale," in the discretion of the governing body. In other words, when there is to be further competition it is explicitly provided for.

CONTRIBUTORY NEGLIGENCE OF PERSON INJURED ATTEMPTING TO BOARD MOVING CAR GOING TO SHED AND NOT CARRYING PASSENGERS—REVERSED SIGN NOT NECESSARILY NOTICE—EMPLOYES NOT BOUND TO PREVENT PERSONS ATTEMPTING TO BOARD MOVING CARS.

Leu vs. St. Louis Transit Co. (Mo. App.), 80 S. W. Rep. 273. Apr. 12, 1904.

The fact that the car that the plaintiff was injured in attempting to board while in motion was proceeding to the shed, and was not carrying passengers, the St. Louis court of appeals says was not shown to be known to him, and the mere reversing of the street name on top of the forward end of the car ("so it would not read anything") did not necessarily import such knowledge to him; and it was left to the jury, under most liberal instruction, to determine whether he saw, or by the exercise of due care on his part could have seen, the indications, either by motorman or conductor, that the car was on its way to the sheds, and not carrying passengers, and, in event of such finding, that the plaintiff was debarred from recovering damages. Under the circumstances it was no error to decline an imperative instruction that the verdict must be for the defendant. At the same time it was beyond the legal duty of the latter's employes in charge of the car to avert the casualty by preventing the plaintiff from attempting to board the moving car if seen in time. while engaged in such effort.

STREET CAR NOT PROTECTED BY LONG-ENACTED STATUTE AGAINST DOING INJURY TO ANY LOCOMOTIVE, CAR, ETC.

State vs. Cain (Kan.), 76 Pac. Rep. 443. Apr. 9, 1904.

The wilful breaking of the window of a street car in use upon a street railway, the supreme court of Kansas holds, is not a violation of any of the provisions of section 2098 of the general statutes of 1901, which provides that "every person who shall willfully cut, break, burn, injure or destroy any locomotive, car, or other machinery which now is or which may hereafter be in use upon any railroad in this state, or any wood-house, car or water station erected for the accommodation and use of any railroad within this state, shall on conviction thereof be punished," etc. Without seeking to ascertain when this section was first enacted into the laws of the state, the court finds that it was in the general statutes of 1868, which was prior to the existence of street railways in Kansas, and it says that while this would not of itself be conclusive that street railway cars were not included in this section, it cannot presume that the legislature intended to protect a class of property which did not exist in the state.

RIGHT TO SHOW ABSENCE OF FENDER AND TO PREDICATE NEGLIGENCE ON OMISSION TO PROVIDE SAME OR OTHER SAFEGUARDS WHEN NOT REQUIRED BY STATUTE OR ORDINANCE.

Fritch vs. New York & Queens County Railway Co. (N. Y. Sup.), 87 N. Y. Supp. 942. Apr. 29, 1904.

The second appellate division of the supreme court of New York says that it cannot be regarded as yet definitely settled by authority in that state to what extent street railroad companies are obliged, in the absence of statute or ordinance on the subject, to adopt safeguards against injuring persons upon the highway likely to arise out of their want of care in the operation of their cars. But it thinks that there can be no doubt that it was proper to admit evidence of the fact that there was no fender on the particular car which ran down the plaintiff's son, a boy 7½ years of age. And it thinks that, on the whole, the correct view is, where a jury is satisfied from the evidence that the injury would have been prevented by the use of a safeguard, such as a fender, which is usually attached to cars of similar construction, operated in similar localities generally throughout the country, and which has proved ordinarily efficacious for the protection of persons upon the highway, they are entitled to predicate negligence upon the omission to provide cars with such safeguards.

MEASURE OF DAMAGES FOR BREACH OF CONTRACT TO ERECT DEPOT OR ESTABLISH STOPPING PLACES AS COMPENSATION FOR RIGHT OF WAY.

Louisville, Anchorage & Pewee Valley Electric Railway Co. (Ky.), 80 S. W. Rep. 507. May 4, 1904.

In an action to recover damages for a breach of contract to erect a depot or establish a stopping place at an agreed point in consideration of a grant of a right of way, the court of appeals of Kentucky holds that the true criterion of damages is such a sum as would represent the difference, if any, as shown by the evidence, in what would have been the fair market value of the residue of the plaintiff's land, after the conveyance of the right of way, if the depot or stopping place had been established at the point on such land agreed upon by the parties, and the fair market value of such residue of land without the depot or stopping place. And in so estimating the damages the jury should not consider the profits, if any, which might have been made by the plaintiff in any business the latter might have established at or near such depot or stopping place, but consider adaptation, if any, which the location of the depot or stopping place at the point mentioned would have given the plaintiff's land for business or other useful purposes, and thereby have enhanced its market value.

COMPANY NOT REQUIRED TO ACCOUNT TO ATTORNEYS AFTER SETTLEMENT WITH CLIENT.

Weller vs. Jersey City, Hoboken & Peterson Street Railway Co. (N. J. Ch.), 57 At. Rep. 730. Apr. 12, 1904.

A bill filed by complainants, attorneys of New Jersey, against a defendant, a street railway company, the court of chancery of New Jersey says, set forth that one John Meffert had been injured by the tort (wrongful act) of the defendant, and had a right of action against it for damages for his injuries; that he had retained complainants to settle with said company, or to prosecute an action for him for said damages; that in consideration of their services to be performed, he had assigned to complainants 50 per cent of whatever might be recovered by suit, settlement, or otherwise; that complainants gave notice to said company of such assignment, and thereafter commenced an action in behalf of John Meffert against it; that pending the action the company settled with Meffert for a sum of money, the amount of which complainants had not discovered, and paid the agreed-on amount, and received from Meffert a complete release of his claim. It thereupon prayed for discovery, for an accounting of the money so paid, and for a decree for the payment by defendant to complainants of 50 per cent thereof. On demurrer to the bill for want of equity, the court holds that the bill stated no grounds on which the relief prayed could be decreed.

LIABILITY FOR INJURY TO PASSENGER USING STILE ERECTED BY OWNER OF PLEASURE GROUNDS OVER FENCE SEPARATING ELECTRIC FROM STEAM RAILROAD RIGHT OF WAY—DUTY TO PROVIDE REASONABLY SAFE MEANS OF ACCESS AND EGRESS AT TERMINALS OR STATIONS.

Cotant vs. Boone Suburban Railway Co. (Ia.), 99 N. W. Rep. 115. Apr. 6, 1904.

At or near a terminal of an electric railway which for some distance ran parallel to, and immediately north of, the right of way of a steam railroad, the rights of way of the two roads being separated by a wire fence, an owner of a pleasure ground south of the steam railroad constructed a stile over the wire fence. This was made by placing two ladders, each 8 or 10 feet in length, and 14 or 16 inches in width, in such a position as that two ends met over and above the fence, while the other ends were set in the earth on either side thereof. The plaintiff, after riding out on the electric railway, seeing this stile, attempted to pass over it and was injured by having his foot caught in such a way as he started to

descend from the top that he was thrown to the ground. He sued the electric railway company for damages, and obtained a judgment, which the supreme court of Iowa affirms.

It will be noted that the accident occurred on that part of the stile which was over and upon the right of way of the steam railroad, and it was contended that the defendant electric railway company's responsibility ceased when the passenger passed upon the ground of another carrier; that, at most, it was under no other duty to the plaintiff than to warn him of danger of which it had notice or knowledge, and that its liability was not greater than if the stile had been erected jointly by the steam railroad company and the defendant. The jury found that the stile was a dangerous contrivance, but the defendant strenuously insisted that, as it had no right to enter upon the grounds of the other company to repair the device, it could not be held liable for any injury that may have resulted from the use thereof. The court says that ordinarily this proposition is true, but it must be remembered that this contrivance, while partly on or over the land of the steam railroad company, was a single, complete device, and formed a continuous passageway over the fence; and if the defendant invited its passengers to use it, either expressly or by implication, it was bound to at least ordinary care in seeing that it was fit for the purpose intended. That it had no right to go upon the grounds of the steam railroad company to make inspection or repairs was not controlling. Its passengers were not bound to ascertain at their peril what part of this stile was on the premises owned by another company, and what right the defendant had to use it. The defendant undoubtedly had the right to make arrangements with this other company for the construction of a stile, and for permission to its passengers to cross its right of way; and, having invited the traveling public to use the device, it would not be permitted to say that it had no right to erect part of the contrivance upon grounds of another company. It would not do to say that the traveling public must inquire in such cases as to the right the carrier had to pass upon the grounds of another company to make repairs. This contrivance was used by the defendant's passengers alone. It was not built to accommodate the steam railroads or its passengers. The use made of the railroad right of way was permissive only. The steam railroad company did not owe the plaintiff or the defendant company any duty whatever with reference to this stile. The use of the stile was for the joint benefit of the defendant company and the owner of the pleasure grounds. Had the contrivance been constructed by the defendant and the steam railroad company jointly for the use of the passengers of either line, both would undoubtedly have been liable for an injury received by a passenger. Here there was no liability on the part of the steam railroad company, but the situation was such as to make it natural for a person alighting from the defendant's train as the plaintiff did, intending to go to the pleasure grounds, to use the stile in passing over the fence. The defendant was bound to know that persons alighting from its trains would likely use this device in passing to their destination, and it was its duty to use at least ordinary care in seeing that it was properly constructed and in good repair.

On the theory that the stile, by reason of its narrowness, or for want of railings, or because it was constructed of light or defective materials, was not such means of egress as an ordinarily prudent person would provide, in which event the defendant might be found guilty of negligence, the court holds that it was liable for the defective condition of the stile, although it was erected by a stranger. The defendant had full knowledge of the construction of the stile, and impliedly invited its passengers to use it. Under such circumstances, its liability was the same as if it had itself set and maintained the device. This rule is bottomed on the proposition that the duty of a carrier of passengers does not end when the passenger has alighted from its cars. It must also provide reasonably safe means of access to and from its stations or terminals for the use of its passengers, and the passengers have a right to assume that the means of egress provided are reasonably safe. This duty it cannot delegate to another so as to relieve itself from responsibility. The defendant's contention that it was not liable because the stile was erected by a stranger was unsound in principle, and not sustained by authority. When it invited its passengers to use the stile, it, in effect, represented that it was reasonably safe for the purposes intended; and, when injury occurred by reason of its unsafe or faulty construction, it should not be allowed to shield itself behind another, and to say that it did not know of its defective construction

CONTRIBUTORY NEGLIGENCE OF PEDESTRIAN INJURED ATTEMPTING TO PASS IN FRONT OF STATIONARY CAR FOR JURY—NEGLIGENCE DEFINED—KNOWLEDGE IMPUTED TO AND CARE REQUIRED OF MOTORMAN IN HEART OF CITY—COMPANY ENTITLED TO CLEAR INSTRUCTION ON NOT BEING LIABLE FOR RESULT OF CONCURRENT AND MUTUAL NEGLIGENCE.

McLeland vs. St. Louis Transit Co. (Mo. App.), 80 S. W. Rep. 30. Mar. 15, 1904.

From the plaintiff's testimony it was disclosed that the car by which she was injured had stopped, and, while passengers were alighting, she sought to pass in front of the stationary car, which was started without any signal to her that it was about to move. The St. Louis court of appeals says that it is no unfair deduction that the motorman saw, or should have seen, the plantiff's effort to get by the car; nor is the court prepared to declare that, in the most crowded portion of the city of St. Louis, a pedestrian who seeks to pass in front of a nonmoving car, in plain sight of the attendant in charge, is attributable with such contributory negligence as to debar recovery. Negligence has been concisely defined to be the absence of care according to the circumstances. At the intersection of Broadway and Washington avenue, the junction of two of the most prominent thoroughfares in the city of St. Louis, in frequent and constant use by pedestrians and vehicles of every sort, the defendant's motorman should have exercised a degree of care commensurate with the conditions attending the passage over Broadway by his car; being imputed the knowledge that the vigilance that might have sufficed in the less populous and traveled parts of the city would fall far short of constituting ordinary care in such thronged portions, frequented by the public, about the retail stores of the city, and where, indeed, the watchfulness exacted would vary at different hours of the day, and even on different days of the week. Under such state of facts, where reasonable men might fairly differ in their conclusions, the question of due care or negligence on the plaintiff's part was properly relegated to the jury. At the same time, the defendant, as a matter of lawful right, was entitled to have the jury informed by a sharply defined and concise instruction, without qualification or obscurity, that, if her injuries resulted from the concurrent and mutual negligence of both herself and the corporation defendant, the latter was not responsible to her therefor.

DUTY TO RECEIVE MONEY TENDERED FOR FARE AND TO RETURN CHANGE—DAMAGES FOR REFUSAL OF CONDUCTOR TO RETURN CHANGE, ACCOMPANIED WITH INSULTING AND ABUSIVE LANGUAGE.

Gillespie vs. Brooklyn Heights Railroad Co. (N. Y.), 70 N. E. Rep. 857. Apr. 26, 1904.

The plaintiff, confessedly a passenger on the defendant's car, gave the conductor a quarter of a dollar from which to take her fare. He received it, but did not return her the 20 cents change to which she was entitled. She subsequently asked him for it, when he, in an abusive and impudent manner, not only refused to pay it, but also grossly insulted her by calling her a deadbeat and a swindler, and by the use of other insulting and improper language, even after a fellow passenger had informed him that she had given him the amount she claimed.

The court of appeals of New York says that in this case there was obviously a breach of the defendant's contract and of its duty to its passenger. It was its duty to receive any coin or bill not in excess of amount permitted to be tendered for fare on its car under its rules and regulations, and to make the change, and return it to the plaintiff, or person tendering the money for the fare. That certainly must have been a part of the contract entered into by the defendant, and the refusal of the conductor to return her change was a tortious (wrongful) act upon his part, performed by him while acting in the line of his duty as the defendant's servant. To that extent, at least, the contract between the parties was broken, and as an incident to and accompanying that breach the language and tortious acts complained of were employed and performed by the defendant's conductor.

And the court holds that, in an action to recover damages for the

breach of that contract and for the tortious acts of the conductor in relation thereto, the conduct of such employe and his treatment of the plaintiff at the time might be considered upon the question of damages, and in aggravation thereof. It says that the authorities which it cites render it manifest that the defendant was not only liable to the plaintiff for the money wrongfully retained by its conductor, but also for any injury she suffered from the insulting and abusive language and treatment received at his hands. And again it says that after the somewhat extended review which it made of the authorities bearing upon the subject, it is led irresistibly to the conclusion that the defendant was liable for the insulting and abusive treatment the plaintiff received at the hands of its servant; that she was entitled to recover compensatory damages for the humiliation and injury to her feelings occasioned thereby, and that the trial court erred in directing a verdict for the plaintiff for 20 cents only, and in refusing to submit the case to the jury.

DUTY OF COMPANY ACCEPTING FRANCHISE TO OPERATE CARS ON TRACKS MAKING TRAP—COMPLIANCE WITH STATUTES OR ORDINANCES NOT ALL—CONDUCTORS AND MOTORMEN BOUND TO KNOW DANGEROUS SITUATION AND TO DO WHAT CONDITION LEGALLY DEMANDS WITHOUT DIRECTIONS—PUBLIC NOT REQUIRED TO KNOW NARROWNESS OF SPACE BETWEEN TRACKS OR LENGTH OR WIDTH OF CARS —WHAT MAY BE ASSUMED.

Eichorn vs. New Orleans & Carrollton Railroad, Light & Power Co. (La.), 36 So. Rep. 335. Feb. 29; Apr. 11, 1904.

Here a pedestrian attempting to cross the street was fatally injured by being caught between two cars at a place where the tracks curved to connect with those on an intersecting street. It appeared that the tracks on the street he was attempting to cross, even when they were parallel to each other, were too close together to enable a person to stand safely upon the space between the two, and, should a person be standing at the point where the curves upon the crossings commenced at the time when two moving cars passed each other there, he would meet with almost certain death, as, in passing, on account of the way the tracks were located, the ends of the moving cars swung towards each other, and blocked the way up upon the upper side. The tracks, when they were laid, were, even with the cars then in use, traps, to all persons not having knowledge of the exact situation, and the danger had been made much greater for several years past than it was before, as wider and longer cars had been substituted for those formerly used.

The supreme court of Louisiana holds that a street railway company accepting a franchise to operate cars upon tracks so dangerously laid at points very menacing to human life was bound to know of the risks it was assuming, and the duties and burdens it was taking upon itself. It was no answer for it to say that it could not control the city officers and authorities in its placing of the tracks. There was no obligation on its part to engage in the business at all, and, if it thought proper so to do, in view of and in spite of the attendant responsibilities, it could not avoid the legal consequences of a failure on its part to meet the requirements resulting from the exact situation. Not only was the company itself held to a knowledge of the dangerous situation of affairs, but the conductors and motormen upon the cars were also bound to know this. It required no notice to them from the officers of the company of this fact, for this matter was constantly and directly before their eyes. If the company was of the opinion that its duties to the public went no further than compliance with positive existing statutes or ordinances, it was mistaken. It is also error to suppose that trainmen operating cars have no duties to perform, other than those as to which they have received specific directions. They are required to do whatever the necessities of a particular situation or condition legally demands, whether they have received instructions or not. The cars unquestionably met and passed each other on the foot crossing. This could not have been done without culpable negligence.

The general public is not called upon to know or take in at a glance that the space between parallel tracks in a city is not wide enough to afford protection to persons standing on that space, or to know the length and width of the cars used upon the road. A person has the right to assume that the width is sufficient, and to assume that it was not likely that two cars would pass each other, moving, while he was in that position.

FAMILIARITY WITH TRACKS NOT CONCLUSIVE EVIDENCE OF KNOWLEDGE OF DANGER ON PART OF PASSENGER GOING ON INSIDE FOOTBOARD TO GET SEAT—DUTY TO PROVIDE AGAINST USE OF INSIDE FOOTBOARD WHEN DANGEROUS—PASSENGER USING INSIDE FOOTBOARD NOT BOUND AS MATTER OF LAW TO LOOK FOR CAR ON OTHER TRACK—CARE REQUIRED.

Kreimelmann vs. Jourdan (Mo. App.), 80 S. W. Rep. 323. Mar. 1, 1904. Rehearing denied Apr. 26, 1904.

The plaintiff having boarded an open summer car with a continuous step or footboard along each side, and finding no vacant seat on the side of the car that he got on, passed around the rear bench to the other side of the car to reach an unoccupied seat, and was hit by a car on the other track, the two tracks being so near each other that the upright stanchions or grab rails, which projected from the sides of the two cars, were only 10 or 12 inches apart as the cars passed. That the plaintiff was familiar with the tracks, the St. Louis court of appeals holds, was to be taken into account in determining whether his declared ignorance of the danger incurred in getting on the footboard was true. But, it says, a man might use street cars running on parallel tracks a long time, and might know the tracks were about the distance apart those in question were, without realizing that it was dangerous to use the running board of an open car if that side was left open for use, unless his attention was drawn to the danger by some accident. Men are not apt to make nice calculations about such things, but are rather inclined to trust to the carrier's system and management.

The operation of cars of the pattern which caused this accident, with no restraint or guard against the use of the footboards on both sides, and on tracks so close that passengers are in peril of a collision when using the inside footboard, cannot be regarded as other than inconsiderate management. If it desired to operate such cars on such tracks, the company should have taken some precaution to prevent passengers from using the inside footboard; and leaving that side as accessible as the other was an invitation to step on the footboard when it was necessary to do so in boarding or alighting from a car or to find a seat.

Nor does the court agree with the proposition, which was greatly insisted on, that it was error to refuse to instruct the jury that the plaintiff could not recover damages if he stepped on the footboard without first looking for a car on the other track. It says that the footboard on which he stepped was intended, among other things, for passengers to walk to a seat on. In itself, it gave no warning that a person using it was likely to be hit by a car on the near track, but tended to produce an impression that he would be safe on the board, for it was not to be supposed the defendant would invite its patrons to expose themselves to great peril. Nor was the other track a warning to him, for he might believe, with reason, that a passing car would miss him; and, if he told the truth, that was his belief. The court does not feel justified in prescribing as the measure or quantum of care to be used by a passenger in such a situation that he must look for approaching cars before stepping on a footboard. The more satisfactory test of right conduct under the circumstances that surrounded the plaintiff is the one which prevails universally, namely, did he exercise ordinary care to insure his own safety? The facts did not call for a charge to the jury that the plaintiff was bound to look for another car before he stepped on the board, though failure to take that precaution would defeat his action if the jury thought it was an essential element of due care.

The Rockford & Interurban Railway Co. has recently published a very neat folder, which is illustrated with views on its lines, both in the city and on the interurban roads. Among the views are the Rockford & Freeport sub-stations, a view at Harlem Park, Washington Park, and several views on the Pecatonica River, which is reached by the Freeport branch. On the back cover is a map of northern Illinois and southern Wisconsin, showing the network of interurban lines which cover this section. Time tables and a very interesting article descriptive of Rockford and its vicinity are also included.

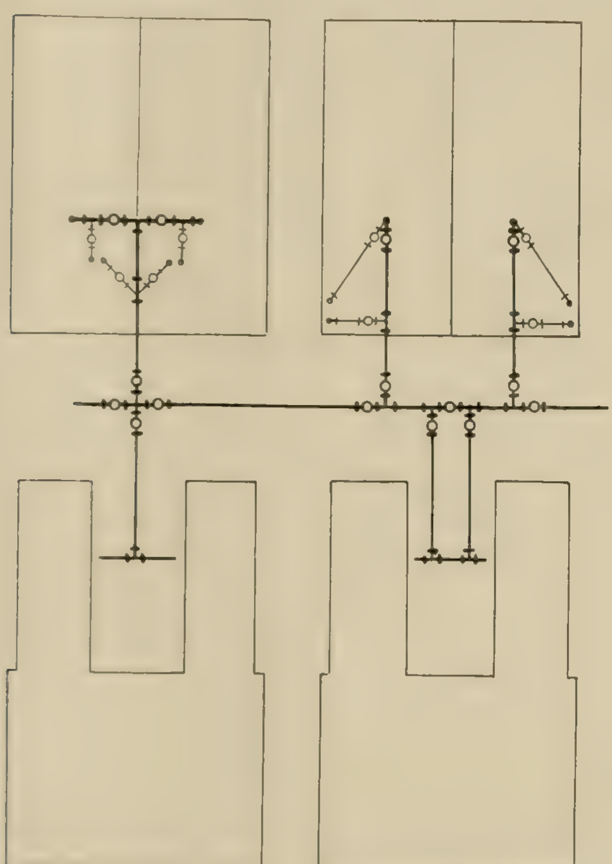
High Pressure Steam Pipe Systems.*

Being a Review and a Comparison of Late Practice on the Continent of Europe and in America.

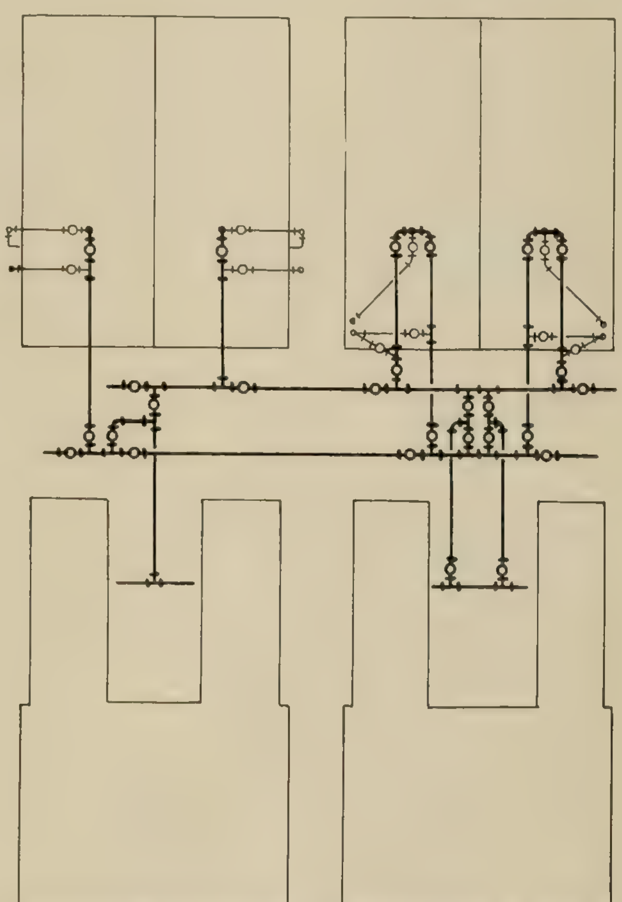
BY FRANZ KOESTER.

Among the most radical changes in power plant installation in recent years has been the adoption of higher pressure and high degrees of superheat in the steam furnished to the prime movers. The use of pressures ranging from 200 to 300 lb., accompanied by temperatures of from 500° to 700° F. has made necessary the design and use of solidly constructed pipe lines, fittings and flanges.

By the use of superheated steam it is possible to increase the steam temperature and at the same time keep the pressure constant; the practice of today, however, tends towards increasing the pressure, and the time is not far distant when pressures up to 150 lb. will not be considered high. There are in operation today, particularly in Germany, a number of plants where pressures higher than 200 lb. are carried by the pipe lines, for example the Technische Hochschule (University) in Darmstadt, where the plant is equipped with the most modern boilers, engines and turbines, the steam being furnished at a pressure of 300 lb. and superheated to 750° F. The steam in this instance is used not only for operating the power plant, but also for heating the power house and principal buildings of the college, the pressure being reduced in the heating system. The recently completed power plants for the city of Vienna, there being one plant for lighting purposes and the other for power, the two plants furnishing an aggregate of 3,400 h. p., use steam at a pressure of 205 lb. and a temperature of 572° F. In the operation of these latter plants a steam consumption of 9.41 lb. per i. h. p. is obtained, this economical operation being largely due to the carefully designed and well constructed piping system. In addition to the plants already mentioned the 3,000-h. p. engines at the Berliner Elektricitaetswerke showed as the result of tests made in 1900 a steam consumption of 9.39 lb. per i. h. p., using steam at 190 lb. pressure and superheated to 600° F. Another modern plant constructed within the past few years is that at Frankfort-on-the-Main, where the 4,000-h. p. Brown Boveri-Parsons turbine shows a steam consumption of 9.1 lb. per i. h. p., the steam having a pressure of 176 lb. at the throttle and being superheated to 572° F.



FIGS. 1 AND 2.

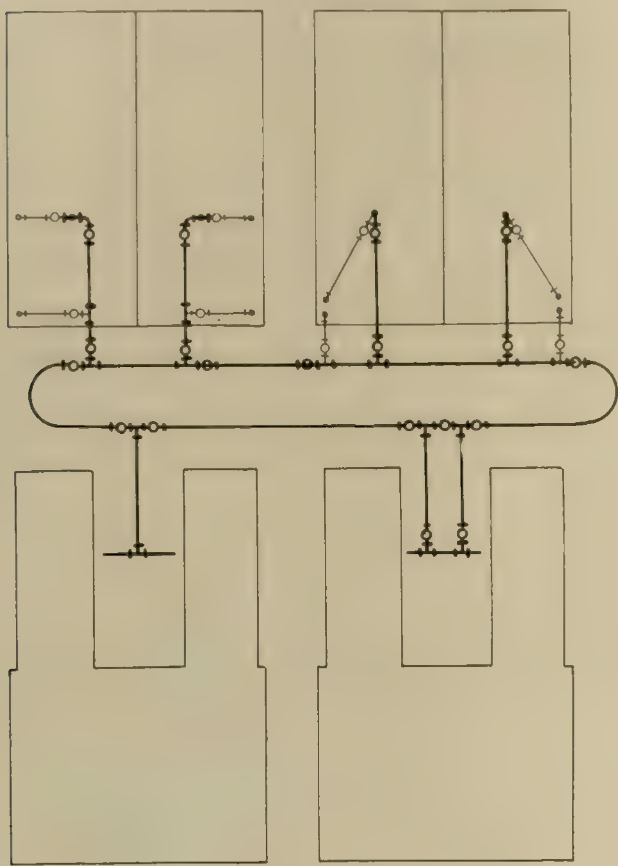


FIGS. 3 AND 4.

Unfortunately the exhibit of engines and boilers at the St. Louis Exposition does not show much advance in the use of high pressure and superheated steam. The boilers and engines, with the exception of a few of Continental manufacture, furnish and use steam at pressures ranging from 160 to 170 lb. and none of the boilers is equipped with superheaters. The Curtis and Parsons turbines at the Exposition are running with saturated steam, and it is difficult to obtain any figures regarding their steam consumption. The industrial exhibition at Duesseldorf a few years ago furnishes a striking comparison with the present Exposition at St. Louis. Of the 16 boilers with their 35,000 sq. ft. of heating surface at the Duesseldorf exhibition there were few that were not equipped with

* Copyright 1904 by Franz Koester.

superheaters, and the entire main piping system, which was of considerable length, the distance between boilers and engines being in some instances as great as 500 ft., was of unit construction, as regards pipes, flanges and fittings, the most modern materials being



FIGS. 5 AND 6.

used and special effort being made to render the piping system pleasing to the eye of the visitor.

As previously mentioned, the only boilers at the St. Louis Expotion which furnish superheated steam are those of Continental manufacture, and of these the most interesting are the Delaunay

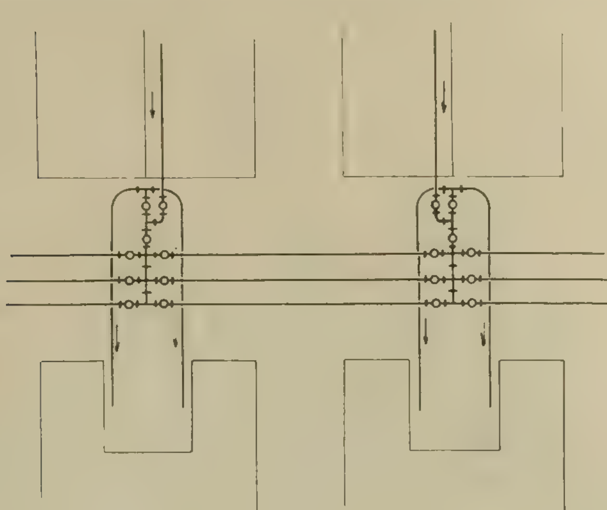


FIG. 8.

Belleville boiler, which furnishes steam at a pressure varying from 294 to 308 lb., superheated to a temperature ranging from 570° to 750° F. These boilers furnish steam through a 7-in. pipe to a 1,500-h. p. engine of the same make, the engine being of the vertical type quadruple expansion and having six cylinders. It has been the experience on the continent, where the use of high pressures and high degrees of superheat have been used to such an extent that it is difficult to find a plant constructed within the past few years where these features are lacking, that the higher the temperature of the steam the greater will be the resulting economy of the engine or turbine.

The use of steam at high temperatures naturally means an increase in the expansion of the pipe lines and in the strains brought upon them, and the use of high pressures demands solid and substantial construction. There are a number of important conditions which must be met successfully by the piping system in a power plant, and the value of a given system is dependent upon the man-

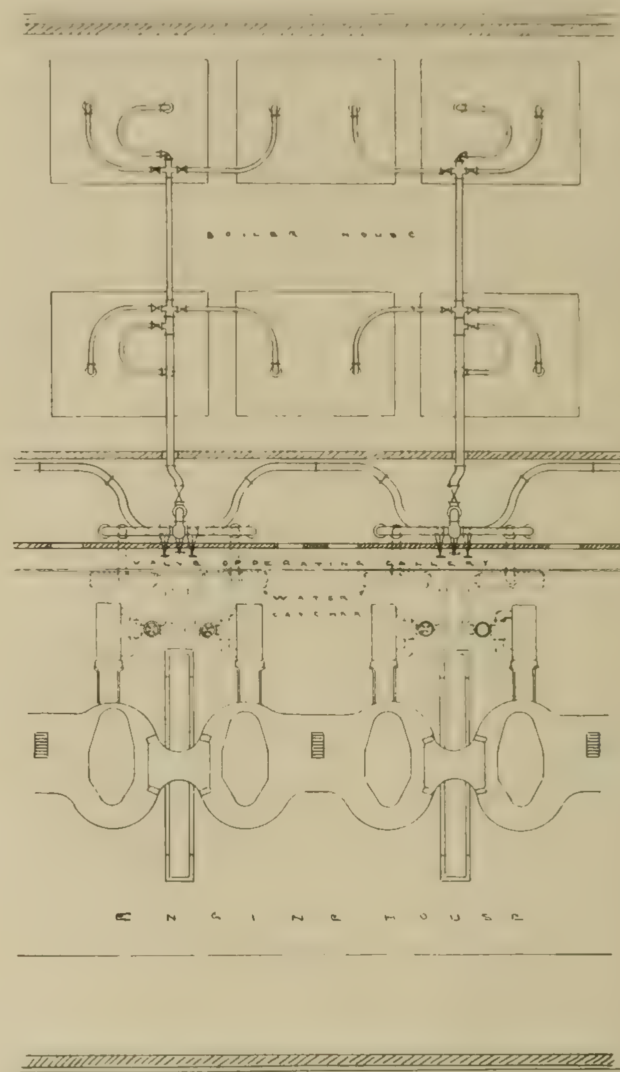


FIG. 7

ner in which these various conditions are met. As the steam line is in reality the main artery of the plant, it is of the utmost importance that it be so designed that an accident to a portion of the line will not result in the shutting down of the plant. Flexibility and simplicity in operation are of the greatest importance, as well as the absence of all connected lines whose services can be dispensed with. The line should be designed to accomplish the desired result, and at the same time to be made up with the minimum number of fittings and valves. The line should be made as short as possible and the pipe of as small a diameter as can be used in order to avoid condensation losses and to insure the economical operation of the plant. In connection with the size of pipe to be used in a given case a very marked difference may be noticed between the practice in this country and the general practice on the continent. It is customary in this country to design the pipe line for a steam velocity of 4,000 to 6,000 ft. per minute, while the prac-

tice on the continent in plants using saturated steam shows a velocity of from 30 to 40 meters per second, or 5,900 to 7,900 ft. per minute, and where a high degree of superheated steam is used the velocity is sometimes made as high as 100 meters per second, or 19,680 ft. per minute. It will, of course, be readily apparent that the use of these high steam velocities enables the continental engineers to use steam pipes much smaller than those which would be used in this country for a similar purpose. As an example of the marked difference in pipe sizes as used in this country and on the continent, it may be interesting to consider the new plant of the Interborough Rapid Transit Co. and the plant of the Manhattan Elevated R. R. Co. The 7,500-h. p. engines in these plants are each served by two 14-in. steam pipes, and in the former plant the 400-h. p. exciter engines are each served by an 8-in. pipe. On the other hand, the [illegible]-h. p. engines in the Municipal plant at Vienna, already cited, be disconnected from the header at will. The steam lines to the engines or turbines are taken from this main header, usually from the top, and are thence led to the prime mover. The disposition of valves, both in the main line and in the branches, should be of a character to insure flexibility in operating and to enable the steam to be drawn from any or all of the boilers, as may be necessary, and also to enable the line to any engine to be disconnected at will. The general character of this system is well shown in Figs. 1 and 2, and on account of the extreme simplicity of this method it is very largely used. The multiple header system consists of two or more headers to which the connecting pipe lines from the boilers are joined and from which branches are led to the engines. The general arrangement of this system is shown in Figs. 3 and 4, and from these diagrams it will be seen that the arrangement of connections is a remarkably flexible one, and that the method pro-

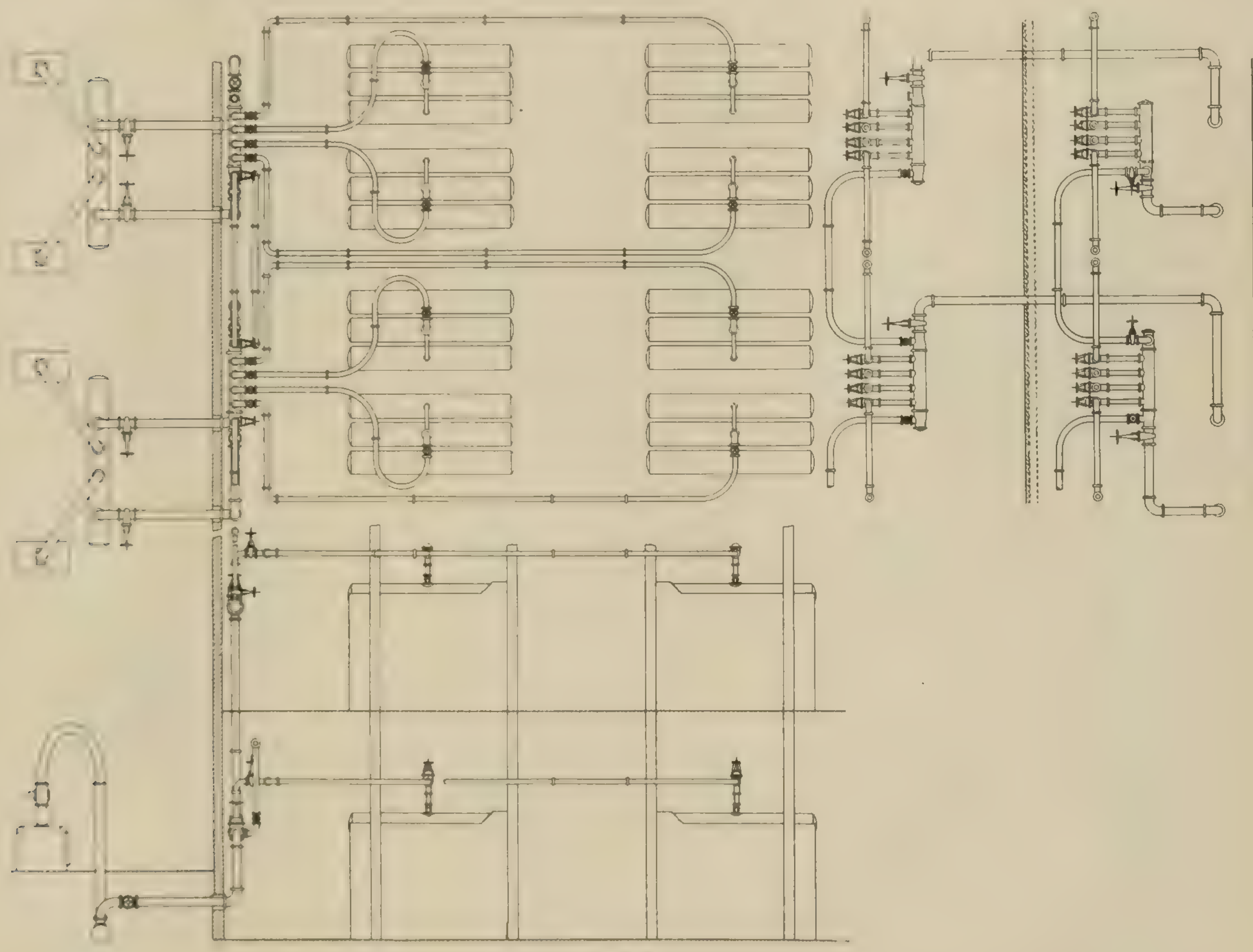
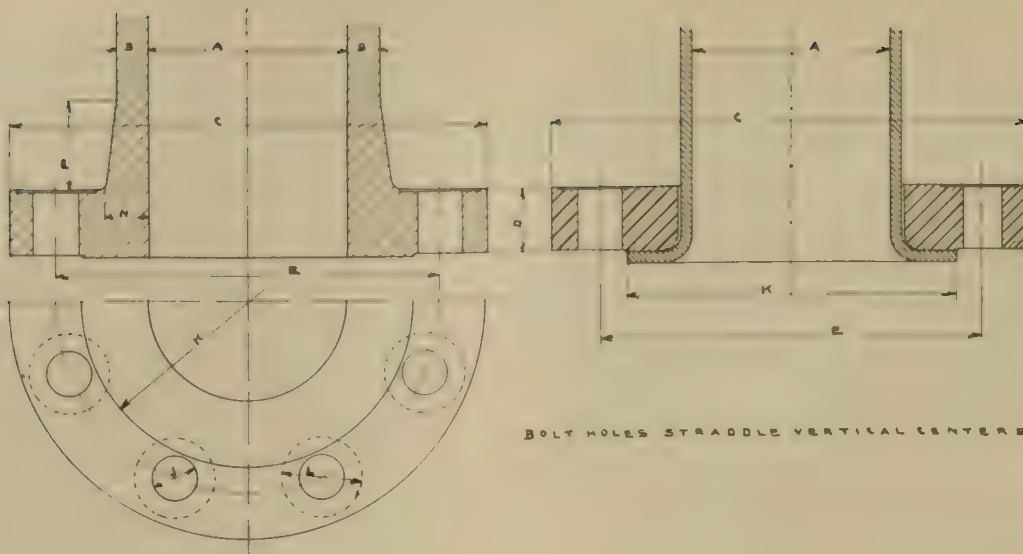


FIG. 9.

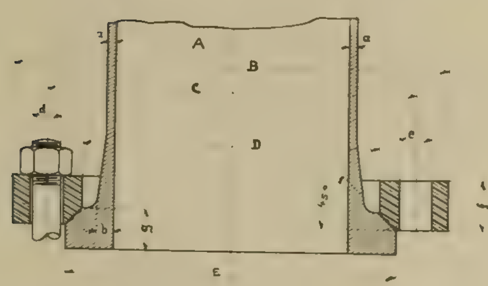
are each served by one 7¾-in. steam pipe, and the economical steam consumption of these engines seems to be ample justification of the methods employed. There are three main types of power plants which are in general use, one in which the engine and boiler rooms lie parallel to each other, another where the engine room is built adjacent to one end of the boiler room, and a third class where the boiler room is located directly above the engine room. This latter type of plant is more general in this country than abroad, as on the continent the question of available ground does not present the serious difficulty that it often does here. There are three methods of piping the steam from lines which due to usage have come to be regarded as standard, namely, the single header, the multiple header and the ring system. The single header system usually consists of a pipe which is run at the back or above the boilers, and to this are connected the lines from the boilers, the connection either entering at the side or dropping from above the main header. The arrangement of valves in the boiler lines is such that any boiler may

vides as far as possible against accident to any part of the pipe line. Two possible methods of cross connecting are shown in these illustrations, and it will be seen that in the right-hand method flexibility is purchased at the cost of numerous valves and fittings. It is, of course, apparent that there are almost an infinite number of ways in which the multiple headers may be cross connected, but in any event the object of this system is to provide an extra header to carry the load in case of an emergency, and the best method of cross connecting is that which utilizes the minimum number of valves and fittings and at the same time is the most flexible. The general arrangement of the ring system is shown in Figs. 5 and 6, the main steam header being in the form of a closed ring which may be split up into sections by means of suitably placed valves. There are numerous variations possible with this arrangement, as where the header runs around both sides of the boiler room the two sides may be cross connected at desirable points, or where the two sides of the ring are close together and on account of the



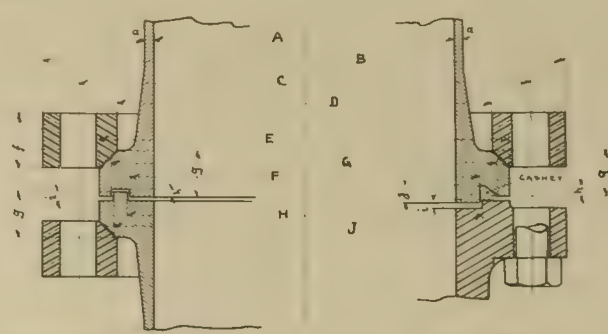
DIAM PIPE (INSIDE).	A.	1 1/2	2.	2 1/2.	3	4.	5.	6.	7.	8.	9.	10.	12.	14.	16.	17.
THICKNESS OF SHELL.	B.	7/16.	1/2.	9/16.	5/8.	3/4	13/16	15/16.	1.	1 1/16.	1 1/8.	1 3/16.	1 1/4.	1 3/8.	1 1/2.	1 5/8.
DIAM FLANGE.	C.	6.	6 1/2.	8.	9.	10 3/4.	12.	13 3/8	14 3/4.	16 1/4.	17 1/2.	19 1/4.	21 1/2.	23 3/4.	26.	27 1/2.
THICKNESS OF FLANGE.	D.	7/8.	1.	1 1/4.	1 3/8.	1 1/2	1 5/8	1 3/4.	1 7/8.	2.	2 1/16.	2 1/8.	2 1/4.	2 3/8.	2 1/2.	2 5/8.
DIAM BOLT CIRCLE	E.	4 1/2.	5.	6 1/4.	6 7/8.	8 1/8.	9 5/8.	11.	12 1/4.	13 1/2.	14 3/4.	16 1/4.	18 1/2.	20 3/4.	23.	24 1/2.
NO. OF BOLTS.	F.	4.	6.	6.	8.	8.	8.	8.	12.	12.	12.	12.	16.	16.	20.	20.
SIZE OF BOLTS.		3/4.	3/4.	3/4	7/8.	7/8.	1.	1.	1.	1 1/8.	1 1/8.	1 1/4.	1 1/4.	1 1/4.	1 1/4.	1 1/4.
DIAM BOLT HOLES	J.	7/8.	7/8.	7/8.	1.	1.	1 1/8.	1 1/8.	1 1/8.	1 1/4.	1 1/4.	1 3/8.	1 3/8.	1 3/8.	1 3/8.	1 3/8.
DIAM RAISED SEAT	K.	3 5/8.	4 1/4	5 1/4.	5 3/4.	7.	8 3/8	9 3/4.	11.	12 1/8.	13 3/8.	14 3/4.	17.	19 1/4.	21 1/2.	23.
DIAM. SPOT BORE.	L.	1 5/8.	1 5/8.	1 5/8.	1 7/8.	1 7/8.	2 1/8.	2 1/8.	2 1/8.	2 3/8.	2 3/8.	2 5/8.	2 5/8.	2 5/8.	2 5/8.	2 5/8.
THICKNESS OF SHOULDER	N.	1/2.	9/16.	7/8.	7/8.	1.	1 1/16	1 1/4.	1 3/8.	1 7/16.	1 1/2.	1 5/8.	1 11/16.	1 7/8.	2.	2 1/4.
LENGTH OF SHOULDER	P.	2 1/16.	2 1/8.	2 3/16	2 1/4.	2 3/8.	2 1/2.	2 3/4.	2 7/8.	3.	3 1/8.	3 1/4.	3 3/8.	3 1/2.	3 5/8.	3 11/16.

FIG. 10



PIPES TO BE OF WROUGHT IRON OR STEEL

LOOSE FLANGES OF W. I., CAST OR FORGED STEEL



TONGUE AND GROOVE JOINT

LENS JOINT

SIZE	A	1	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	6	7	8	9	10	11	12	13	14	15	16
THICKNESS OF SHELL	a	3/32	1/8	1/8	1/8	5/32	5/32	3/16	3/16	7/32	1/4	1/4	9/32	9/32	5/16	5/16	11/32	11/32	3/8	3/8	3/8
THICKNESS OF SHOULDER	b											1/2	9/16	9/16	5/8	6/8	11/16	11/16	3/4	3/4	3/4
OUTSIDE DIA. OF LOOSE FLANGE	B	4 7/8	5 7/8	6 1/4	7	7 3/4	8 3/4	9 1/2	10	10 5/8	11 3/4	13	14 1/4	15 5/8	16 3/4	18	19 1/8	20 1/2	22	23 1/8	24 1/4
DIA. OF BOLT CIRCLE	C	3 3/4	4 3/8	5	5 1/2	6 1/4	7	7 1/2	8	8 5/8	9 3/4	11	12 1/4	13 1/2	14 5/8	15 3/4	11	18 3/8	19 5/8	20 1/4	21 3/4
NO. OF BOLTS		4	6	6	6	6	6	6	8	8	8	10	12	12	12	14	16	16	16	18	20
SIZE OF BOLTS	d	1/2	1/2	5/8	5/8	3/4	3/4	3/4	3/4	3/4	7/8	7/8	7/8	1	1	1	1	1 1/8	1 1/8	1 1/8	1 1/8
DIA. OF BOLT HOLES	e	5/8	5/8	3/4	3/4	7/8	7/8	7/8	7/8	7/8	1	1	1	1 1/8	1 1/8	1 1/8	1 1/8	1 1/4	1 1/4	1 1/4	1 1/4
INSIDE DIA. OF LOOSE FLANGE	D	2 3/8	3	3 3/8	3 3/4	4 1/2	4 7/8	5 1/2	6	6 1/2	7 3/4	8 7/8	10	11 1/4	12 3/4	13 3/8	14 1/2	16	17 1/8	18 1/4	19 1/4
THICKNESS OF LOOSE FLANGE	f	5/8	3/4	3/4	7/8	7/8	1	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 5/8	1 3/4	1 7/8	2	2 1/8	2 1/4	2 3/8	2 1/2
DIA. OF PIPE FLANGE	E	3	3 5/8	4	4 1/2	5 1/4	6	6 1/2	7	7 1/2	8 5/8	9 3/8	11 1/8	12 1/4	13 3/8	14 1/2	15 3/4	17	18 1/4	19 3/8	21 3/4
THICKNESS OF PIPE FLANGE	g	5/8	3/4	3/4	7/8	7/8	1	1	1 1/8	1 1/4	1 1/4	1 1/4	1 1/4	1 3/8	1 1/2	1 1/2	1 1/2	1 5/8	1 5/8	1 5/8	1 3/4
INSIDE DIA. OF GROOVE	F	1 7/8	2 3/8	2 7/8	3 3/8	4	4 1/2	5	5 1/2	6	7 1/4	8 1/4	9 1/2	10 1/2	11 3/4	12 3/4	13 3/4	15	16 1/4	17 1/4	18 1/4
OUTSIDE DIA. OF GROOVE	G	2 5/8	3 1/8	3 5/8	4 1/8	4 3/4	5 3/8	5 7/8	6 3/8	6 7/8	8 1/8	9 1/4	10 1/2	11 1/2	12 3/4	13 3/4	15	16 1/4	17 1/2	18 1/2	19 1/2
DEPTH OF GROOVE	h	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16
INSIDE DIA. OF TONGUE	H	1 13/16	2 5/16	2 13/16	3 5/16	3 13/16	4 7/16	4 15/16	5 7/16	5 15/16	7 3/16	8 3/16	9 3/16	10 3/16	11 11/16	12 11/16	13 11/16	14 15/16	16 3/16	17 3/16	18 3/16
OUTSIDE DIA. OF TONGUE	J	2 9/16	3 1/16	3 9/16	4 1/16	4 11/16	5 5/16	5 13/16	6 5/16	6 13/16	8 1/16	9 3/16	10 7/16	11 7/16	12 11/16	13 11/16	14 15/16	16 3/16	17 7/16	18 7/16	19 7/16
HEIGHT OF TONGUE	i	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4
HEIGHT OF TONGUE IN LENS JOINT	j	9/32	9/32	9/32	9/32	9/32	9/32	9/32	9/32	9/32	9/32	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
DIA. OF GASKET IN LENS JOINT		7/32	7/32	7/32	7/32	7/32	1/4	1/4	1/4	1/4	1/4	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16

FIG. 11

effect of expansion in a short cross connection the two lines are only joined at the ends by short bends.

An interesting variation in the multiple header system may be [illegible] [illegible] of the steam piping for the new [illegible] plant of the [illegible] Power [illegible] Co. for operating the new [illegible] The arrangement of this piping is clearly shown in Fig. 7, the connections between two engines and two boiler groups being shown. A group of six boilers is provided for each engine, and the connections from the boilers terminate in a common pipe which leads to the engine. This pipe is provided with a by-pass by means of which it is connected to a manifold, to which are also connected three headers which run the entire length of the building

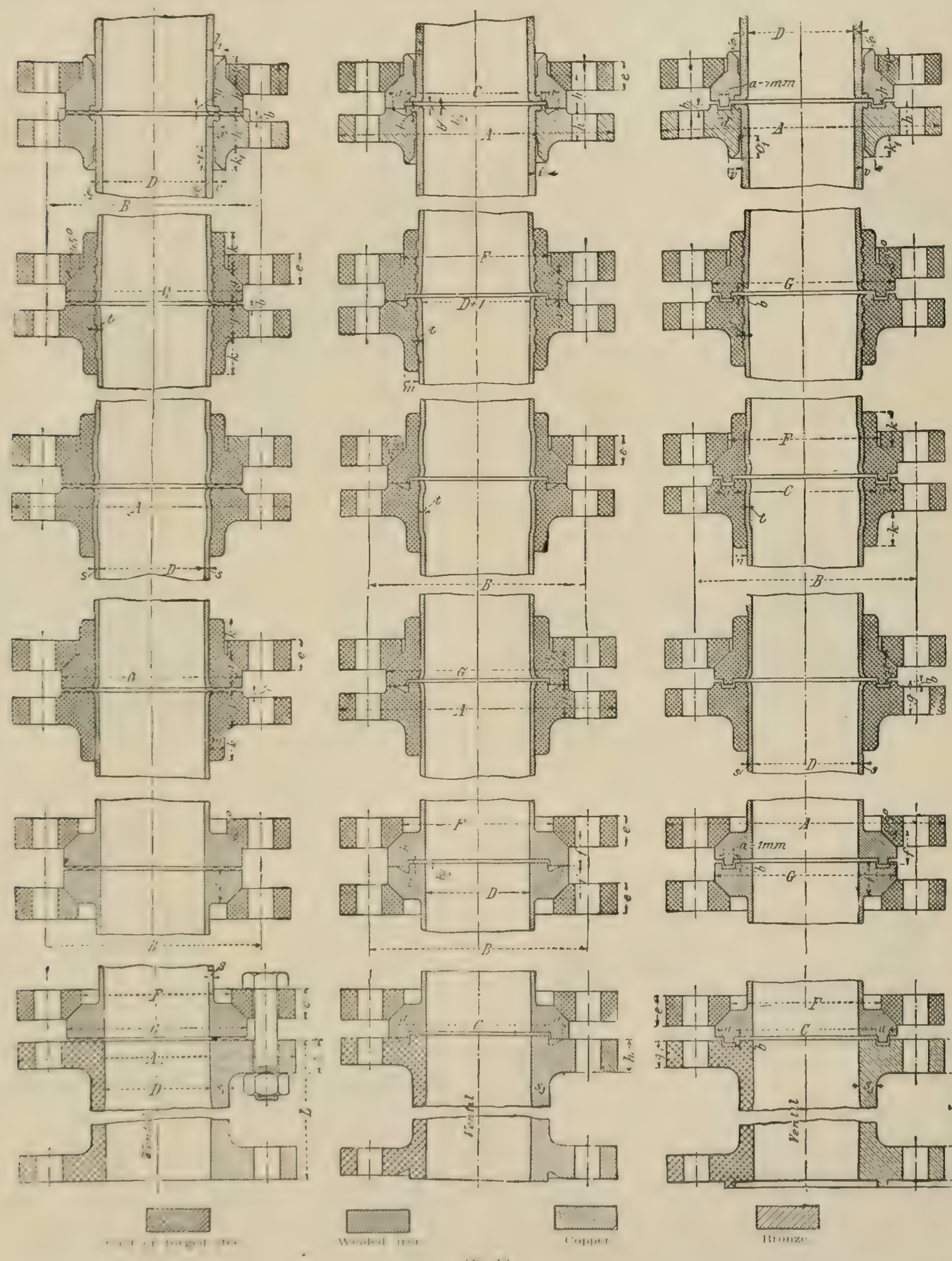


FIG. 12.

The arrangement of valves in this system is such that any group of boilers may be connected to its manifold and also any of the three headers may be connected to the manifold. With this design it is possible to run any engine from any group of boilers, and the three headers provide security from interruption to the service

of the header and pipe connection to the manifold is shown in Fig. 8. As is clearly shown in Fig. 7, the headers and manifold are contained in a special pipe area way, and the valves, which are the quick-closing type, are operated from a gallery in the engine room.

The arrangement of the main steam piping in the Manhattan

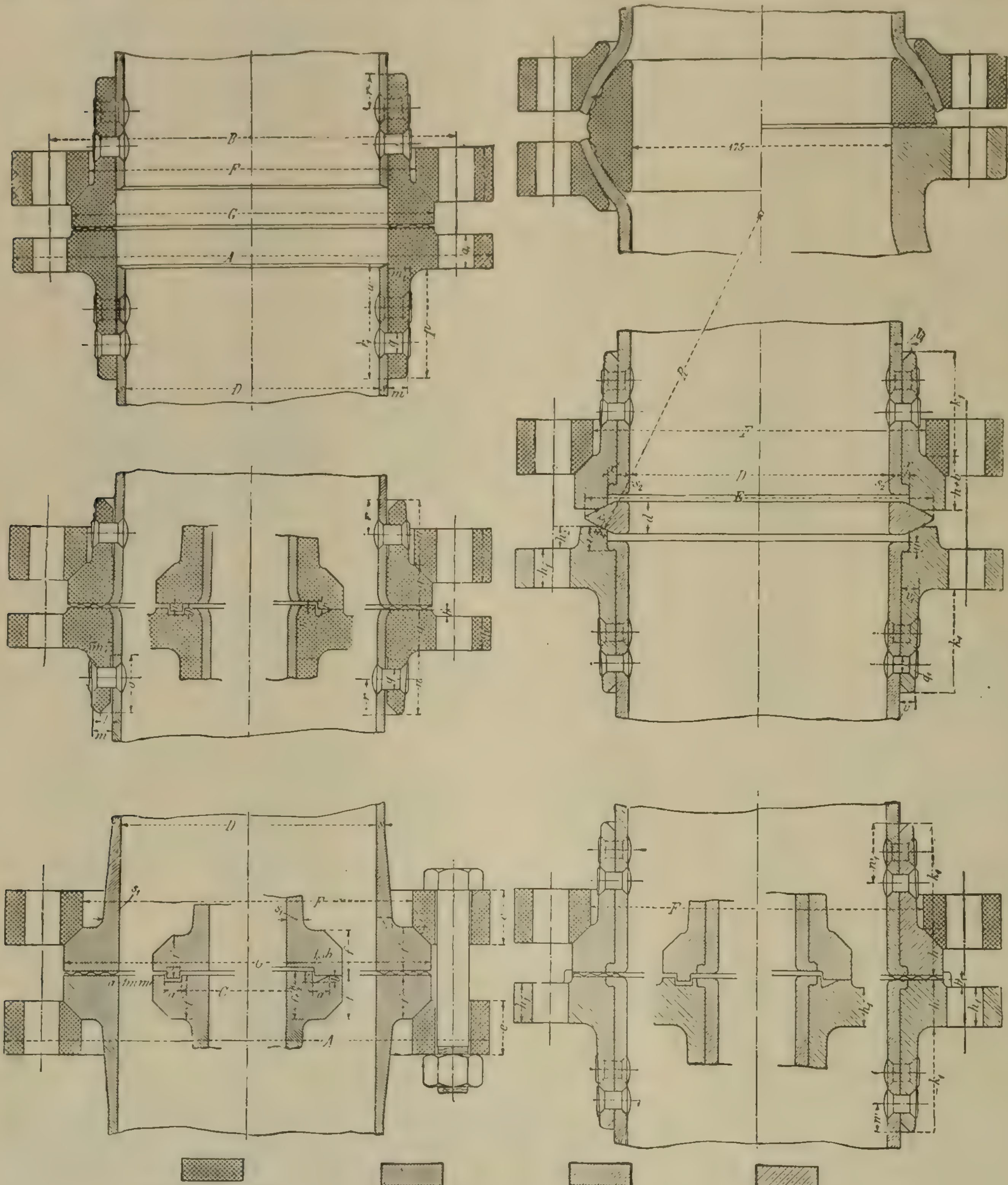


FIG. 13.

due to an accident to a portion of the pipe line. A point that is specially noticeable about this piping is the provision made for taking care of the expansion in the lines, both in the case of the boiler connections and in the three headers, the numerous long-radius bends being well adapted for this work. A diagrammatic scheme

plant is clearly shown in Fig. 9, which is presented here by the courtesy of Mr. W. N. Stevens, who had charge of this work. In connection with this it is understood that the same general arrangement is to be adopted in a large plant in Chicago. As the drawing shows, the boilers in this plant are located on two floors, there

being rows of boilers on each floor, with an aisle between them. With the increase in the pressure and at the same time the added temperature of superheat it has become necessary to remodel and to design new types of pipes and fittings, and at the present time pipe line design and construction occupies a field of its own in power plant engineering, and in a large plant the services of an expert are almost absolutely necessary to insure the correct and economical distribution of the steam.

It often happens that the standard high pressure fittings cannot

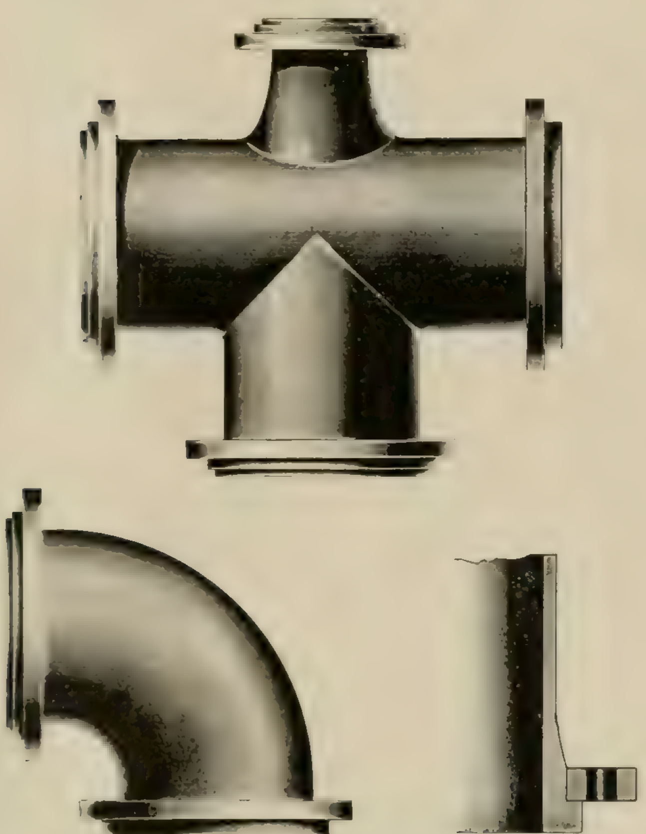


FIG. 14

be made to apply satisfactorily to the construction of modern high pressure lines for superheated steam, and for this reason there are numerous sets of standard fittings made to be standard for a particular installation and to suit the conditions to be met in the individual plant. Among the changes that have been caused by these new conditions have been the adoption of steel pipes, and changes in the shape and form of the connecting flanges. The design of the fittings and pipes for the new Interborough Rapid Transit Co's. power plant was due to Mr. John Van Vleck, the mechanical engineer in charge.

Fig. 10 and the accompanying table show the type of pipes and

FIG. 15

fittings used in the above work, the figure on the right representing the steel pipe and the loose movable flange, while that on the left shows the design of the special cast iron fittings and valves. By referring to the table it will be seen that the fittings and flanges used are considerably heavier than those of the standard high pressure pipe. These flanges are of forged steel and are bolted without gaskets, the joints being ground true. In the left-hand figure the thickening of the casting as it nears the flange and the thickness of the casting itself is especially noticeable.

In Fig. 11 are given the necessary data for determining the design of the types of pipe joints illustrated in Figs. 12 and 13. These types have been adopted as standard by the Verein Deutsche Ingenieure in 1900, and are adopted for pressures up to 300 lb. It will be readily apparent that the expense of some of these types would render their use almost prohibitive in this country, although at the present time special constructions are being very largely used. Among the types shown in Figs. 12 and 13, there will be doubtless a number which appear to be limited in their sphere of usefulness, but during the past four years these standards have held their place in continental power plant practice and have successfully met the demands imposed by high pressures and a high degree of superheat. As will be noticed from the sections in Figs. 12 and 13, the copper pipe which in continental practice is much in use and is today used exclusively in the boiler feed line, is equipped with bronze flanges. The upper right-hand section in Fig. 13 shows a particularly interesting construction employed by the Sulzer Engine Co., where it becomes necessary to cut the pipe length in the field and make up the joint; this type of construction is often used as a filling-in piece or distance piece between the engine and cylinders.

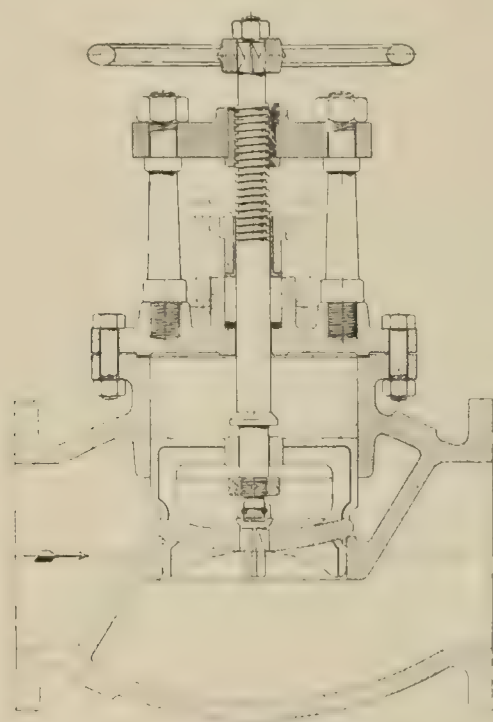


FIG. 16

In order to illustrate the difference which exists between the designs as laid down in tables 10 and 11, and the A. S. M. E. standard for high pressure steam, it may be interesting to consider, as an example, the flange diameter and thickness for an 8-in. pipe, as given below:

	Pressure, lb.	Pipe Size, in.	Flange diam., in.	Thickness, in.
Interborough Rapid Transit Co.	250	8	16¼	2
Verein Deutcher Ingenieure	300	8	14¼	1 5/8
A. S. M. E.	250	8	15	1 5/8

The types of joints shown in Fig. 11 are those which are most commonly used, the tongue and groove joint and lens joint being, as a rule, used with gaskets. This table is abridged from tables of standard high pressure pipe fittings in which all the dimensions were originally given in the metric system, and in the subsequent reduction to inches and fractions of an inch, the resulting figures have been slightly increased. There are numerous types of gaskets in use in high pressure steam lines, those which experience has proved to be the most satisfactory being made up, as a rule, of copper in some form; the copper wire gasket, made up of small wires, closely interwoven in the form of a flat ring, or when used with the lens joint, in the form of a ring which is circular in cross section; the

corrugated copper gasket, and a gasket of asbestos and copper are the types which are found in most common use in continental plants. Pure asbestos has been found to be unable to stand the high pressures of modern practice. Ground joints are used to a much larger extent in this country than on the continent, and in the Duane St. plant of the New York Edison Co., and in the Interborough Rapid

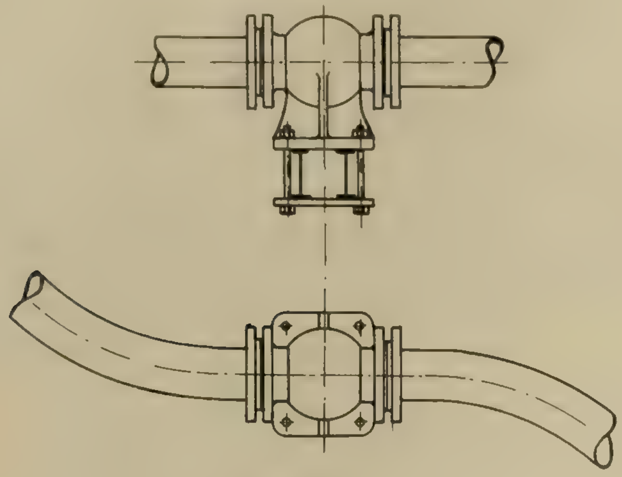


FIG. 17.

Transit Co's. new plant, ground joints are used entirely in the high pressure line, and in the former case an experience of several years without any sign of leakage in the steam line has proved this joint to be satisfactory.

In the construction of fittings on the continent the use of cast iron is avoided so far as it is possible to do so, and wrought iron and steel are used to a large extent, and fittings of these materials are often made, as shown in Figs. 14 and 15, the method of applying the loose flanges being clearly shown in the lower right-hand corner of Fig. 14. Fig. 15 shows a welded iron manifold, which may be applied to a number of uses, and this construction is applied to a great variety of forms. In order to decrease the number of joints in the line and to avoid the objectionable features which attend them, and at the same time decrease the expense, the pipes are made in lengths up to about 15 meters (50 ft.), which is somewhat more than twice as long as the available lengths in this country.

Fig. 16 shows a section through a cast iron high pressure valve which is interesting on account of being designed for a steam pres-

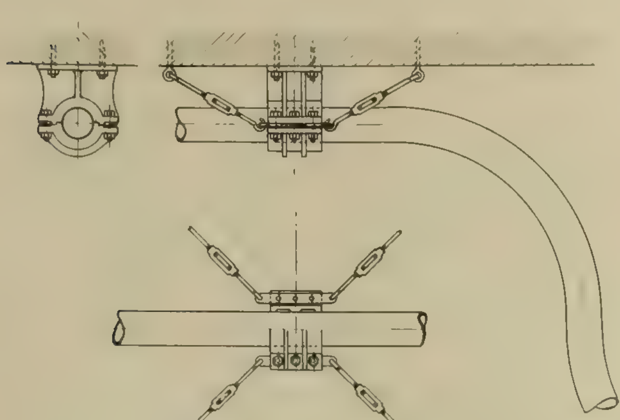


FIG. 18.

sure of 300 lb. and a temperature of 750°. The most interesting feature of this valve, which is fully protected by patents, lies in the internal by-pass arrangement, which is operated by the valve spindle before the valve is opened. As will be seen from the illustration, the disk is solidly constructed of cast iron, as well as the valve seat.

Cast iron is used in this case on account of the effects of the superheated steam on the bronze. Owing to the high temperatures of superheated steam, the limiting temperatures which the pipe line is subjected to, and consequently the resulting expansion and contraction in the line, is largely increased. The usual method for taking care of the expansion in a high pressure line consists in anchoring the line firmly at several points and inserting in the line between the anchorages, long radius bends, which are capable of being deformed by the resultant stresses of the expansion.

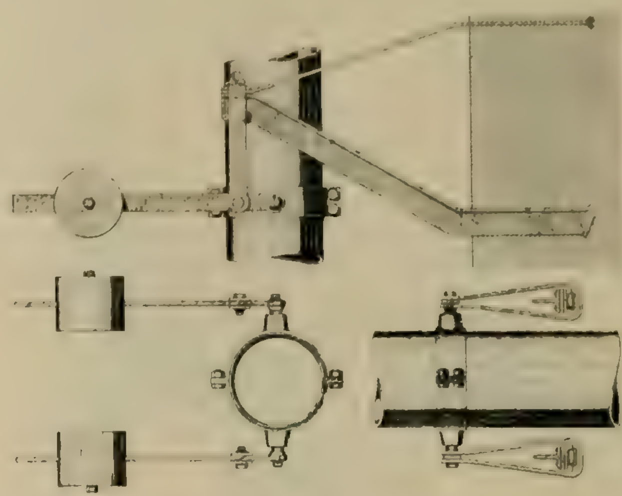


FIG. 19.

Figs. 17 and 18 show two types of anchors for holding the pipe line. The method shown in Fig. 17 consists of carrying the pipe in a casting which grips it firmly, and which is itself bolted and anchored to the wall. Fig. 18 shows a somewhat different kind of anchor in which the casting comprising the anchor forms a part of the pipe line and is bolted either to a column or to beams, as the construction may dictate. In Fig. 19 is shown a detail of a pipe hanger for large vertical risers which is constructed by Gebrueder Reuling, of Manheim, who also makes the previously described cast iron valve. Both of these appliances are in use in the university

FIG. 20.

plant at Darmstadt. It will be seen from the design of this hanger that its movement both in a vertical and a horizontal direction is provided for, the horizontal movement being taken care of by the knife edges which rest on roller bearings.

Fig. 20 shows the application of the long radius bends which are placed in the steam line in order to take care of the expansion, this illustration showing bends in the long distance high pressure municipal heating line in the city of Dresden.

In using small steam pipes it has been found necessary to enlarge the steam pipes near the engine to about double the size; this will prevent vibration of the steam line. As drip pipes are more or less unsatisfactorily it is well to avoid using them if possible.

It is considered today on the continent that the use of water catchers in the pipe line is never entirely satisfactory and that the only way in which they can be dispensed with is to use highly superheated steam and locate a small water catcher in the pipe line near the engine.

The importance of covering the pipe lines and flanges with the best non-conductor of heat that can be obtained and the resultant effect of this proceeding upon the loss of heat and condensation in the pipe, has long been realized. In this country magnesium, asbestos and various mineral wools are used for pipe coverings, the thickness varying from 2 to 3 in. The material which is used to the largest extent for pipe covering in Europe is kieselguhr. This material is an earthy substance which is ground and mixed with water to form a paste which is placed around the pipe and in some cases being first mixed with organic matter which is eventually burned out, leaving air cells in the covering which add to its efficiency. In other instances this substance is mixed with felt or is placed on the pipe and wrapped with a covering of silk which is an excellent non-conductor. Another interesting method of covering, which is used on the long distance heating line in Dresden, consists in covering the pipe first with a cylinder of perforated sheet iron which is separated from the pipe by a distance piece. The cylinder is then wrapped with raw silk and a second cylinder is placed over the first, separated from it by a distance piece and covered by a layer of silk. The effect of this treatment is to divide the space between the pipe and the covering into a number of air cells, and the result of this method has given entire satisfaction.

The object of this article has been to point out some of the advantages that may accrue from a carefully and well designed piping system, and it may be confidently stated that the remarkably low steam consumption of the engines in continental plants is due in a large extent to the care that is exercised in the design of the connecting link between the boiler and the engine, namely: the pipe line.

Radiant, a New Fuel.

U. S. Consul-General H. Clay Evans, London, England, transmits the following extract from the London Daily Mail of Aug. 10, 1904:

"A new fuel called radiant, to be used in connection with gas and other fires, has been invented by two young engineers of Southend, and if it be proved that it can do all that is claimed for it, it will cause as great a revolution in the present system of gas heating as did the introduction of the Welsbach mantle in gas lighting.

"The inventors claim for radiant—that it gives treble the heat with the same gas consumption as an ordinary gas fire; that it takes up the carbonic oxide from the air and purifies the atmosphere; that it does away with the unpleasant smell given off by gas fires; that it burns brightly like a coal fire; that it is as cheap as fire clay and is inexhaustible.

"The two young inventors are connected with one of the largest firms of gas engineers in the country, and have been experimenting for years with a view to producing a fuel such as radiant.

"Radiant will take the place of the asbestos or fire-clay balls, and will, it is said, give out an intense heat. It is made from materials that are now waste products of chemical works.

"The new fuel captures the blue flame, which at present is lost, and converts it into intense heat. Radiant is also said to possess the power of retaining heat to a very great extent."

A Convenient Book.

Messrs. Stone & Webster, of Boston, have issued a book containing interesting facts regarding the electric railway and lighting properties managed by them. The book is of a convenient size and it contains exhaustive data regarding the bonds, stocks, and franchises of 25 corporations, their financial statement for 1903, and maps showing the territories served by them. Appended to this are suggestions for guidance in transferring stock.

Railway Lectures at Iowa State College.

The Iowa State College has arranged a series of ten lectures to be delivered during the present college year by officials of the various railway systems operating in Iowa. The first lecture was delivered September 14th by Judge J. C. Davis, chief attorney for Iowa of the Chicago & Northwestern Ry., upon the subject, "The Relations of the Railways as Common Carriers to the State and Federal Governments." Other dates and subjects for the course of lectures are as follows:

October 5th—"Railway Accounting."

October 26th—"Tie and Timber Preservation."

November 16th—"Motive Power."

January 4th and February 1st—"Relation of the Railways to the Producers."

February 22d—"Signal Engineering."

April 12th—"Maintenance of Way."

The arrangements for this course of lectures have been made largely through the kindness of Mr. W. H. Whalen, superintendent of the Chicago & Northwestern Ry., at Boone, Iowa. The course has received much attention and approbation throughout the state and should be found of interest and value, not only to the students of the college but also to the general public.

Glory and Reward for the "Trolley Song."

Arrangements having been fully completed, the Detroit United Weekly is now prepared to announce in detail the competition with which it hopes to arouse interest in musical and lyrical composition not only in Detroit, but in all parts of the country. The Detroit United Weekly offers a prize of $200 for the words and music of a "trolley song." This composition need have no reference whatever to the Detroit United Railway. It is to symbolize the great field of electric transportation. It may be general in character, applicable to any city or interurban system. It may be humorous or serious. The author is to retain the copyright of his composition. It is, however, to be dedicated to the Detroit United Railway, which company also retains the privilege of reproducing words and music in any publication and of using same in any advertising literature. The Detroit United Railway will sell no copies. Words and music may be the joint effort of two authors, but words must fit music. No unattached verses or music will be considered. Every contribution must be complete in this respect.

The task of judging the merit of the compositions and awarding the prize will be left to a committee of three of the most prominent musical authorities and artists in the state. They are Prof. Francis L. York, Director of the Detroit Conservatory of Music; Mr. Harold Jarvis, Detroit's famous tenor; and Prof. E. R. Schremser, Director of Schremser's Military Band and Orchestra. These gentlemen have agreed to serve as the tribunal of last resort.

The competition is open to all, residents of any state or natives of any country. In view of the enormous number of contributions that will be received, several conditions must be observed.

No names or addresses must appear upon any manuscript. A separate letter must accompany each contribution, which in the competition will be designated by a number. The music must not be too pretentious or the verses too voluminous. The competition will be open for several months, the precise time limit to be stated subsequently. All contributions must be mailed or delivered to Mr. John H. Fry, Detroit United Railway, 12 Woodward avenue. It is needless to point out what the winning of this prize means to the successful composer. Aside from the premium, his composition will be enormously advertised and he will retain full possession of all privileges. The contest is on!—Detroit United Weekly.

Applicants for the position of conductor and motorman on the Aurora, Elgin & Chicago electric lines are obliged to have a thorough test of the eyes for color blindness.

Contracts have been let by the Orban & Syracuse Electric Railway Co., whereby a telephone system will be installed which will enable cars at any point on the line to communicate directly with head quarters at Orban or Syracuse or any station along the line.

Report of the Thirteenth Convention of the International Tramway & Light Railway Union, Vienna, Sept. 8, 1904.

This year's congress is made noteworthy by an abundance of valuable working results, and a short account of the proceedings is given in the following article. In order to enable the congress to obtain concise opinions upon the various subjects under discussion, communications in the form of questions were submitted to the various railway companies of the continent. The answers were laid before a specially chosen committee of judges by whom synopses were made.

The subject of the "Control of Electric Tramway Installations and Maintenance of the Feeders" was dealt with by Herr M. G. Pedriali, chief engineer of the Brussels tramways. He reported that the companies were unanimous in advocating a regular three to six monthly examination of the insulation of the separate sections of the line. A distinction must be drawn between the maintenance of the system of feeders or parts thereof and that the equipment of the line. For the examination of the system of feeders some companies employ the method of putting a voltmeter, of known resistance "r," in series between the positive pole of the dynamos and that part of the line whose resistance to earth it is required to be measured. The required resistance to earth is given in the formula:

$$R = \frac{V - V_o}{V_o}\, r$$

Where V = the pressure between the positive pole of the dynamos and earth, V_o = the reading on the series connected voltmeter and r = the known resistance of the voltmeter.

For the determining of faults in insulated cables by this principle a delicate galvanometer and calibrated resistance must be employed. A quick method, though one of no great accuracy, consists in noting the indication of the ammeter of the first dynamo switched on in the morning when no cars are on the lines. The current indicated must be due to faulty insulation. It is strongly recommended to examine daily the combined resistance of the whole network or of the separately fed sections.

A matter of great importance is the maintenance of the conductivity of the rails, with the object of avoiding stray currents. The various data given upon this point are not in agreement and therefore definite results cannot be given. Experience seems to show that at those places where metal pipes cross the line most thickly a difference between the rails and pipes of not more than one volt should be allowed.

In the matter of testing the insulating material, some companies satisfy themselves with examination of the insulators; this they accomplish by connecting a voltmeter between the span wire and earth. Amongst a large number of methods of testing the Gerard method deserves special mention. A number of railways test their wires for mechanical strength. For this purpose the Winterhalter apparatus is specially well adapted. In the matter of the wearing out of the trolley wire, it is noticed that breakage generally takes place at the points of suspension; in the case of soldered suspension in the middle and of riveted suspension near the end, of the trolley ear. Too short ears produce breakage in consequence of the sagging of the wire. Other causes of breakage are to be sought in sidings, crossings, section insulators, etc. These should be fixed from elastic span wires of as great length as possible and of diminishing section. The tension of the wire at a temperature of 0° C. must be between 450 and 500 kg. for a wire of 25.5 sq. mm. cross section. The pressure of the trolley should be 5.5 kg. in the case of axial wires. The life of an 8-mm. wire varies between 500,000 and 1,500,000 passings of the trolley.

"The Prevention of the Disturbance of Electrical Measuring Instruments Through the Influence of Electric Tramways," was treated by Herr Björkegren, of the Grosse Berliner Strassenbahn. He distinguishes between disturbances which take place through the action at a distance of the feeder circuits and of the stray fields of the motors; influences which are extremely small at distances exceeding 200 meters, and disturbances caused by the fact that the different tramline sections, fed from the central station, have different voltage drops, and that this difference of drop sets up balancing earth currents. Various instruments are mentioned which possess the advantage that they employ the earth's magnetic field only in a secondary manner.

Herr E. A. Ziffer, civil engineer, Vienna, dealt with "Automobile Traffic Upon Local and Light Railways." He describes the different steam, benzene, alcohol and accumulator cars which are in use and arrives at the conclusion that up to the present the steam motor is the most widely used. Steam motor cars (passenger car and locomotive combined) are the most reliable for regular service and are capable of developing large power, but they have the disadvantage that they cannot instantly get up steam and cannot be quickly stopped and started; in addition their machinery is very delicate and demands much repair. Benzene cars have also very delicate machinery, their cogged gearing causes much loss of energy, they are noisy, and throb and produce a bad odor. The advantages are that the driver need pay little attention to the machinery during the journey but can give his whole attention to the road and the speed. Alcohol motors are odorless and clean, but have not yet progressed beyond the experimental stage. Accumulator cars are not greatly used; they possess a very small power limit and are therefore impracticable for high speeds and for grades, and possess comparatively very great weight.

Herr Chief Engineer H. Luthler dealt with "The Advantages and Disadvantages of Electricity for Light Railways." The advantages are: The public is provided with a frequent service of trains; time is saved upon short journeys by means of employing a very great starting acceleration. In consequence of the ready distribution of the units the service can be easily adapted to the varying traffic demands of the day. The absence of smoke makes it practicable to carry the traffic into the heart of the towns. Centralization of the power provides that the power installation need not have a capacity equal to the sum of the maximum demands of the cars, but can have a smaller output. This results in a smaller expenditure in copper, smaller first cost and maintenance, longer life of the power units and smaller cost of maintenance of the same, and saving in dead weight. The disadvantages are: It is practically impossible to accommodate any exceptionally heavy traffic; the power is, in regard to steam supply, limited; disturbances in the supply station affect the whole system; disturbances in the traffic may cause a number of trains to become assembled upon a short section of the line and the power demand made at this point will exceed the capacity of the conducting system and of the power station.

One of the most important subjects was that treated by Chief Engineer Phillip Pforr, "The Nature of the Supply, and the Tension Best suited for Electric Light and Local Railways." An installation of conductors costs less, the smaller the currents that it has to carry. If the local railways are to compare favorably in the matter of cost with the tramways they must adopt high tension transmission. The most suitable motor is the one that has the fewest leads. The future railway motor is the single-phase motor, in comparison with which the three-phase motor possesses the disadvantage of an extra lead. The disadvantages of a collector do not come into consideration because on the one hand the new single-phase motors work just as sparkless as the direct current machines, and on the other hand many local railways demand that the motor shall be capable of being used upon the already installed direct current system; that is to say, the motor must be suited for use with direct current. This is only possible if the motor has a collector. With single-phase machines the energy demand does not increase on gradients to the same extent as in three-phase working, and the demand upon the supply station is more regular; or, in other words, a smaller power installation is required when single-phase motors are employed. The regulation on starting up three-phase motors is effected by resistances, and this method incurs great loss of energy, whereas with single-phase motors the employment of transformers avoids such loss. The single-phase motor allows of considerable fall of voltage without much diminution in power whereas a comparatively small fall of voltage will bring a three-phase motor to rest. Three-phase systems will, therefore, only come into consideration under special conditions when, for example, it is required to employ an existing three-phase system. Single-phase installations are not more costly than direct current machines and the working is far cheaper on account of the absence of rotary converter stations and the service and maintenance of the same.

Herr G. Pavie, of Paris, discussed the subject of "Allowability and Efficiency of Trailers on City Tramways." He considered the use of trailers to be the best means for dealing with temporary increase of traffic. Trailers are especially adapted to single track lines for cases in which the lack of sidings makes a quick succession of cars impossible. The use of trailers is further to be recommended upon double track lines when it is not allowable to have a succession of cars at short distances apart and when, under these conditions, the percentage of the seat space occupied reaches 75 per cent. The use of at least one trailer is universal and three may be taken as the maximum limit. The nature of the line (single or double track) has no influence in determining the number of trailers allowable. Trailers require only one motorman, and if need be the conductor of the motor car can also take care of the trailers. Further advantages of trailers are: Smaller power demand or economy in current, economy in first cost and maintenance (three times less than for motor cars), fuller use of rolling stock, and the possibility of dealing with temporarily heavy traffic. Disadvantages of trailers are: Loss of time in starting, slower braking, longer stops at the stations, greater demands upon the motors and other electric equipment, and diminution of the average speed

The inquiry into the subject of "Current Economy Upon Tramways" led to no decisive results. It appeared to Director W. Klitzing that a continual mechanical supervision of the motormen, as for instance by the provision of wattmeters, and the encouraging of a personal interest in the matter on the part of the men by means of a system of premiums, were far more efficient in the keeping down of current expenditure than the issuing of instructions and the employment of inspectors.

The study of "Brake Systems for Electric Tramways" was dealt with by Herr Director Phillip Scholtes. The following are the main points: Each of the three brake systems—hand, electric or air—has its advantages, and the choice is controlled by special conditions. The brakes must work without jerk. Two independent brakes must be provided. The brake must not demand much exertion on the part of the driver. If the hand break is insufficient on account of the weight of trailers or other working conditions, recourse must be had to an electric brake. If the use of the latter be prevented by special circumstances, for instance, limited motor power or insufficient subdivision of the controller, air brakes can be used. These are absolutely indispensable in the case of excessive loads and high speeds, and also where more than two trailers are employed.

Other subjects dealt with were: "Maintenance Charges," "Booking Systems," and "State Provision for Employes."

HERZOG.

Second Electric Railroad in Peru.

BY UNITED STATES CONSUL GOTTSCHALK, CALLAO, PERU

The electric railroad between Lima and Callao, the second enterprise of its kind in Peru, is in operation. Like its predecessor, that between Lima, Chorillos, and other near-by seaside resorts, the Lima-Callao road is equipped with American power machinery and handsome American cars, both open and closed. The roadbed and track were laid by an American firm.

The new road, which is run by the overhead trolley system, covers the 8.6 miles between Lima and Callao in a little over 20 minutes. It runs cars every 15 minutes and has lowered by one-half the fares formerly existing on the steam railroad. The new railroad has thus far been unable to obtain permission to run through the principal streets of Lima, and therefore stops at Union St. (the chief commercial artery), where it connects with the city horse cars, but it is believed that the obstacles to electric traction through the streets of Lima will soon be removed. The road runs through the main streets of Callao, and has besides a prolongation of some mile and a half to La Punta, a seaside resort a short distance farther down the coast.

The new road is considered a popular one and is so much traveled as to make the acquisition of additional rolling stock a necessity. It fills a long-felt want of frequent and cheap communication between the capital city and its port which, although a separate municipality, has for many years been a commercial suburb of Lima.

Suburban Transportation in Boston.

The general features of the transportation system of Boston and its suburbs are well known to engineers and operating officials in many other parts of the country, but unless one is a resident of the New England metropolis it is often easy to overlook the frequent minor changes in operating methods which are of peculiar interest because of their influence upon the service as a whole. In every large city the transportation companies barely solve one problem before another presents itself; and as long as rapid growth in population continues, it is to be expected that variety will constantly be found in the operating questions that engage the attention of managers of railways, both steam and electric.

An indication of the widespread public interest which attaches to Boston transportation problems is readily found in the frequent articles and editorials which appear in the daily press upon railway subjects, and it is a satisfaction to record many instances of able discussion of such questions on the part of laymen. At the same time there is a strong tendency among irresponsible citizens of the Hub to rush into print on every possible occasion that arises in the transportation field, and it is to be regretted that some of the effusions of these inexperienced critics betray little or no knowledge of the business which they attempt to illuminate. At times the most well-meaning of the daily papers fall into serious error, and thereby spread broadcast ideas, opinions and conclusions which are decidedly harmful to the development of improved methods of construction or operation. It is safe to say that nowhere in this country is public opinion more powerful than in New England, and hence it is of great importance that events should be given correct perspective.

A case in point, which ought not to pass unchallenged, is that of a prominent evening paper which printed a long story a few days ago to the effect that a certain curtailment of electric service on the system of the New York, New Haven and Hartford Railroad boded ill for the application of electricity in suburban transportation. Quoting from the article in question:

"Electrical equipment and operation of the suburban service of steam railroads is not to be a thing of the immediate future. It must wait on the invention of new electrical appliances or the perfection of existing appliances in their application to transportation problems. At present, while the third rail system may be practical on elevated structures, in tunnels and on surface lines where the right of way is owned by the operating company and used for this means of transit alone, and while the trolley is satisfactory for comparatively low speed traffic in highways and streets—neither system in its present stage of development can be safely, economically and satisfactorily applied to transportation lines which must be utilized for the ordinary steam locomotive. This is not good news for the growing hosts of suburbanites, who have hoped for rapid transit in the electrification of existing steam roads; but it is the latest word of the students of transportation problems. * * * While electricity may be the ultimate solution of suburban transit, the details of that solution have not been worked out as yet * * * and here is the most promising field of study. * * * An object lesson of the truth of these conclusions has been furnished within the present month by the N. Y., N. H. & H. R. R. Some years ago when the Nantasket branch of this road was equipped with the third rail system, it was confidently predicted that here was a beginning in electrical suburban operation which would be so successful that other roads must follow. With this idea as a basis the South Station was built with complete facilities for handling an electrical suburban service in its basement. This basement has never been so used, and such use of it is no nearer, seemingly, than when the terminal station existed only on blue prints. Instead of electric tranction being installed today the road has just completed the removal of a considerable part of the electrical equipment from which so much was expected. For two years or more the electric installation between Nantasket Junction and Braintree has not been used, and now the third rail, poles, trolley and feed wires have been taken out, and the idea of operating this section of the line by electricity has been definitely abandoned until such time as new and workable devices shall be available. The line from Nantasket Junction to Pemberton will continue to be electrically operated, but only because this line is not used at all by steam locomotives. * * * the trolley and third rail have been

found impractical on the New Haven system * * * and the basement of the South Station will remain unoccupied for some time to come."

In considering the foregoing statements after a trip over the Nantasket branch of the New Haven system the most striking feature of the situation is the fact that local rather than suburban service has been given by the electric cars of the steam road. Braintree is 10.1 miles from the South Station in Boston, and Nantasket Junction is 8.1 miles beyond Braintree; Cohasset is 3.4 miles beyond the latter point, and marks the limit of the old third rail system, while the Pemberton branch extends about 7 miles around the coast as a spur from Nantasket Junction. As far as is known, no electric car operated between any of these points has ever entered Boston in the course of its business, and it is difficult to see wherein the operation of these branch cars by any kind of power from electricity to a draught horse either proves or disproves the ability of electricity to displace steam in suburban service. It is not the purpose of these comments to discuss the pros and cons of the local service of the New Haven road; the point is, that the Nantasket branch presents a special case of a feeder to the main steam operated line, and as such has no power whatever to determine the final economy and flexibility of electricity in handling the traffic between Boston and the suburbs covered by the system.

No one who is acquainted with the latest developments in high speed electric railway work needs to be told that the apparatus for handling the most difficult and complex suburban traffic is already designed and about to make its triumphant entry—at least in the near future—in New York City over the track of a steam road which today handles the Boston trains of the New Haven system, speaking in a broad sense. The progressive policy of both the New York Central and the Pennsylvania lines will make its mark in time upon the more conservative lines which enter Boston. It is flying far from exactness to condemn the third rail as a failure with its adoption in the Park Avenue Tunnel confronting us, or to anathematize the trolley as good for nothing when roads like the Boston and Worcester and the Schenectady-Ballston line illustrate that rapid transit and an overhead wire are not impossible together. Doubtless there is, and always will be, room for the improvement of electric and steam railway equipment, but it is ridiculous to claim that the success or failure of electric traction financially on a branch line is any indication of its value in a broad, comprehensive suburban system.

To the electric railway engineer the territory around Boston offers an almost unparalleled field for the realization of the advantages of electric suburban service. For years the Newton-Brookline circuit of the Boston & Albany division of the New York Central has been regarded by progressive engineers as a piece of railroad property fairly made to order for the purposes of electric traction. There is little doubt that the results in New York will hasten the equipment of this line. Similarly the Boston & Maine, and the New Haven system, present the traffic density and geographical layout of lines and stations which invite electric propulsion of suburban trains. It is possible that if the South Station loop had been placed in electrical operation within the past five years, none of these questions of compatibility would have arisen between the electric and the steam locomotive for the reason that the latter would have been exterminated from the suburban passenger lines entering Boston. It has been stated that the smoke nuisance cannot be eliminated by the New Haven road for less than $3,000,000 a year, on account of the excessive cost of burning anthracite coal in the locomotive furnaces, but here is a condition that would vanish with the introduction of electrically propelled trains. It is certain that many serious problems confront the steam roads of the United States in the direction of properly handling suburban traffic, and it would be careless of the best interests of the electric railway world to fail to recognize the gravity of the questions of safe and expeditious terminal movements. The fact remains, however, that two of the leading systems of the country have taken a bold step forward, and although the steam locomotive disappears slowly from its city pathways, its days are numbered inside the business districts of great centers of population. In the advance of the electrically propelled train, the economics of some country branch line has no more influence upon the success of the suburban system as a whole than the breaking of a single twig has upon the life of a massive tree.

An Exhibit of Exceptional Merit.

The exhibit of the G. M. Gest, electrical subway contractor, which occupies a commanding location in the court of the Electricity Building at the World's Fair, deserves more than the passing mention which was given it in "The Daily Street Railway Review" for Wednesday, October 12th, it being a display of exceptional merit. As will be seen by the illustrations shown herewith, the exhibit in the main consists of a manhole divided by a concrete wall, virtually making two holes out of one, the front being open.

Here are shown the following: Gest patent enamel terminal brick, with rounded face, which protects the cable from injury; Gest patent frame and adjustable cable brackets, single, double and triple, by means of which the cable can be adjusted and held at any height; Gest patent sewer trap and strainer, operated from above by means of a chain; Gest burlap machine, in which a roll of burlap the right width can be pitched and cut off as wanted, and Gest's improved mandrels. On the walls of the manhole are displayed interesting photographs of work done by the Gest forces in Springfield, Cincinnati and Louisville.

WORLD'S FAIR EXHIBIT OF GEST'S CONDUIT SYSTEM.

The Gest exhibit also includes, by utilizing two life-size wax figures of workmen, demonstrations of how tile should be laid in the trench and also how cables are spliced.

It is believed that Mr. Gest, whose principal offices are in Cincinnati and New York, is the only purely electrical subway contractor in the world having an exhibit at the World's Fair. The exhibit is in charge of Mr. W. T. Jackson, of the Cincinnati office.

The Indianapolis & Northwestern Traction Co. has recently issued a very attractive timetable with map of its road, views along its line and general information regarding its service.

In a recent publication compiled by a committee of the Board of Trade, of Oxford, Pa., under the head of "Transportation Facilities," it is noted that franchises have been granted to insure the construction of the following lines: The extension of a branch of the Wilmington & Kennet Square line; a line from Newark, Del., partially built; a line from Elkton, Md.; a line from Parkersburg, and a line from Christiana.

Flue Gas Testing.

[illegible] RESIDENT ENGINEER MANCHESTER (ENG.) COR[illegible] ELECTRICITY WORKS.

Of what use is flue gas testing? Of no use at all unless it leads to better combustion. With the "snap test," that is to say, a test of one individual and separate sample of gas, it is possible to ascertain whether the smokeless chimney is due to good combustion or excess air, and one can safely say that there are more smokeless chimneys from the latter cause than the first.

When the cause is found, remedy is generally easy of application. [illegible] have had air leaks, you can look for them and stop them.

Excess air, although the most common source of loss, is not the only thing of value that accurate analysis of flue gas gives to the engineer in charge of works. When he has stopped his air leaks he can commence experiments with his furnaces, and by working as his experience directs in various ways he can quickly find out which of these ways is the most economical, which is the best type of furnace, the best way of stoking the coal, etc.

In the writer's experience men have been known to be satisfied with 6 per cent carbon dioxide, and even less, at the boiler, and after regularly testing and observing the composition of the flue gases for some weeks have been able to maintain a much higher average, and reach quite often 13 to 15 per cent CO_2; this under ordinary working conditions, and at electric power stations, with a load factor sometimes as low as 12 per cent.

[illegible] necessary for testing a sample of flue gas is a burette graduated in cubic centimeters from 0 to 100, a few connecting tubes, and one reagent bottle containing caustic potash solution. This will enable the operator to find the percentage of CO_2 and is really all that is necessary in practice. By the addition of two more reagent bottles containing potassium pyrogallate and acid cuprous chloride, respectively, oxygen and carbon monoxide can be also determined. For further information in connection with this, I cannot do better than give particulars of these solutions. They are as follows:

Potassium hydrate. (Caustic Potash.) (a) For carbon dioxide determination 500 grams of the commercial hydrate is dissolved in 1 liter of water. Absorption capacity, 1 c. c. absorbs 40 c. c. carbon dioxide. (b) For the preparation of potassium pyrogallate, 120 grams of the commercial hydrate is dissolved in 100 c. c. of water.

Potassium pyrogallate. For oxygen determination this solution should be prepared only when wanted. The most convenient method is to weigh out five grams of the solid acid upon a paper, pour it into a funnel inserted into the reagent bottle and pour upon it 100 c. c. of potassium hydrate (a) or (b). The acid dissolves at once, and the solution is ready for use. Absorption capacity, 1 c. c. absorbs 2 c. c. oxygen.

Acid cuprous chloride. For carbon monoxide determination cover the bottom of a two-liter bottle with a layer of copper oxide or "scale" ⅛ in. deep, place in the bottle a number of pieces of rather stout copper wire reaching from top to bottom, sufficient to make a bundle an inch in diameter, and fill the bottle with common hydro-[illegible] sp. gr. The bottle is occasionally shaken, and when the solution is colorless, or nearly so, it is poured into the half-liter reagent bottles containing copper wire, ready for use. The space left in the stock bottle should be immediately filled with [illegible] sp. gr.)

By thus adding acid or copper wire and copper dioxide when either is exhausted, a constant supply of this reagent may be kept on hand. The absorption capacity of the reagent per c.c. is 1 c.c. CO.

Care should be taken that the copper wire does not become entirely dissolved and that it extends from the top to the bottom of the bottle; furthermore, the stopper should be kept thoroughly greased the more effectually to keep out the air, which turns the [illegible]

A simple form of snap test apparatus is illustrated in Fig. 3, description and directions for working which are as follows:

The measuring burette A, Fig. 3, contains from the zero mark at the bottom of the upper capillary end exactly 100 c. c., and is graduated to 1-5 c. c. In order to shield the gas contained in this burette from the influence of changes of external temperature, the [illegible] water jacket closed at the top and bottom by stoppers. This jacket is provided with a white background of opaque glass upon which the black divisions of the burette are plainly visible. The bottom of the burette is connected by an elastic tube with the level bottle d, filled two-thirds with water. The top end is connected with a closed capillary tube bent out at a right angle and provided with a three-way cock, b. This tube is supported in a wooden frame, and in addition to the three-way tap, carries two glass taps, g g, each of them possessing capillary tubes, and connected with two U-shaped absorption vessels, f f, filled with bundles of glass tubes. The first of these being closed, the burette is filled with a solution of caustic potash (potassium hydrate), and the second with an alkaline solution of pyrogallate. The above mentioned liquids serve for absorbing carbon dioxide and the oxygen respectively. Before making an analysis the reagents in the vessels are set to their zero marks on the capillary tubes below the taps, g g. When in use, the level bottle must be raised to the top of the wooden frame and the three-way tap to the pump connection opened to allow the burette to fill with water up

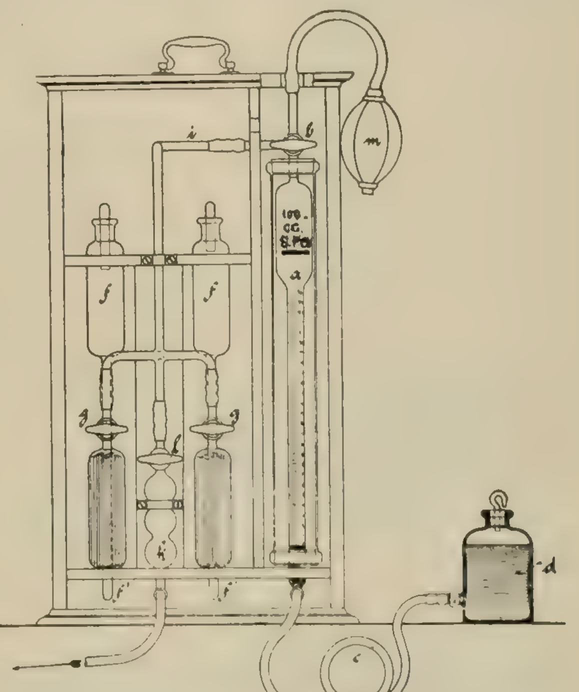


FIG. 3.

to the capillary part. The gas must then be connected and aspirated by lowering the level bottle after turning the three-way tap through 90°. The water must then be run off in the burette a little below the zero mark, the three-way tap closed, and the gas compressed by raising the level bottle until the water rises above zero. Then the level bottle must be lowered to allow the excess water to run out to zero. Last of all, the three way tap is opened to pump for an instant in order to produce a pressure equal to that of the atmosphere, whereupon exactly 100 c. c. of gas will be found within the burette. Now, to absorb the CO_2 and O respectively; first the carbon dioxide, by conveying the gas into the near U-shaped tube. This is done by raising the level bottle, and at the same time opening tap g. The absorption is hastened by causing the gas to travel several times from the U tube to the burette and back, alternately lowering and raising the level bottle, and leaving the tap open all the time. At last the level of the liquid in the U-tube is changed to the mark on its own capillary tube and the tap is closed. The reading in the burette can now be taken by raising the level bottle until its contents are at the same level as the water within the burette, to ensure the gas being again at atmospheric pressure. The decrease in volume shown indicates directly the volume of carbon dioxide. In exactly the same way the oxygen is absorbed, the absorptions being carried out in the order detailed. It is advisable to grease the glass taps occasionally to prevent them becoming fastened. Carbon monoxide may be determined if desired by substituting cuprous chloride for the pyrogallate.

Fig. 1 illustrates a mercury sampler, by means of which a sample can be obtained and taken to any distance to be tested in a laboratory. Fig. 2 represents an aspirator, which can be used as follows:

The collector and aspirating tank having been placed in a convenient position adjacent to the hole made in the flue from whence it is intended to draw the gas, the collector, Fig. 1, must be connected

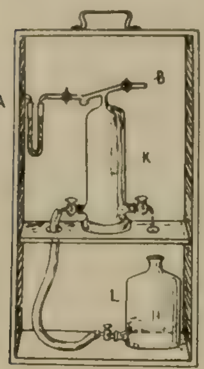


FIG. 1.

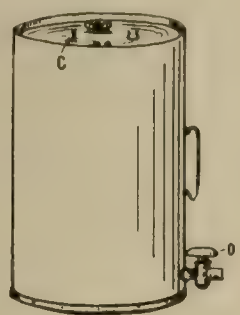


FIG. 2.

to a pipe at A by means of a rubber tube and the pipe inserted through the hole in the flue previously mentioned. The collector must be connected at B by means of a rubber tube to the aspirating tank, Fig. 2, at C, the tank itself and the sunk portion having been previously completely filled with water, so as to allow the water to seal the brass plug with the end of the rubber tube. The water must now be run off by the tap D, thus drawing a stream of gas from the flue. The mercury in the collector, K, is now drawn off at any desired rate in the mercury bottle, L. It is advisable, in order to obtain a reliable sample, to regulate the flow of mercury so that its level falls from near the neck at the top of the collector down to the level of the bottom taps in from 10 to 15 minutes. The sample having been taken, all four taps should be closed and the rubber tubes disconnected.

Results prove beyond doubt the advantage of testing samples of flue gas, and it is now remarkably easy to do this, the chemists having given the matter special attention, and supplied us with apparatus just like that described, and it behooves all up-to-date engineers to employ this means of improving the economy of the works in their charge. It soon occurred to someone that an apparatus which would continuously record the percentage of CO_2 in flue gas would be a great boon and help to engineers. It has been a most difficult problem, and engineers have been humbugged and disheartened by the ingenious but unreliable apparatus first designed by chemists for the purpose. Now we have on the market apparatus of the clockwork and mechanical variety, and the clockwork and photographic instrument depending on the specific gravity of the gas for its record of CO_2, and to the writer the latter type of instrument seems most reliable and less troublesome.

Illustrations and a diagram of an apparatus of this description will be seen in Figs. 4 and 5.

This particular form is called the Krell CO_2 recorder and is a German invention, the agent being the Smoke Preventer Co., Ltd., Blackburn, England, to which I am indebted for the diagrams mentioned.

The apparatus consists of two principal parts, namely, the system of tubes and the pressure gage. The description of these parts and their connection with one another will be clear on referring to Fig. 4, from which the method of operation of the apparatus will be readily understood.

The system of tubes consists of two brass tubes, a and b, about 1¼ in. in diameter, surrounded by a metal casing. These tubes are about 5 ft. 9 in. high and are joined together at the top at x, at which point a ½-in. tube is connected, which is bent downwards and leads to the ejector. This tube is provided with a small gage, j, and the shut-off cock, h. The former serves for adjusting the suction and the latter for shutting off the gas. The tubes a and b have at their lower ends the cocks f, l, v, and e, k, w, respectively. The cocks l and k are coupled together by a rod so that they can be worked simultaneously. When the ejector is set to work the flue gases are drawn from the boilers through the tube d and cock f into the vertical tube a, and at the same time air is drawn through the cock e into the tube b. Both the gas and the air, which have different specific gravities, are drawn upwards and pass out at x through the tube g. By this means we get two columns, one of flue gas and the other of air, of equal area and equal height, H, whose difference in weight varies according to the quantity of CO_2 in the column of flue gas. Since the weight of b remains the same and that of a depends upon the proportion of CO_2, the difference in weight at any time may be used for directly determining the percentage of CO_2 in the furnace gases. For this purpose the two columns of gas and air are put in connection with a differential pressure gage. The pressure gage consists of a plate o with the box q cast in one with it. Securely fixed in the side of this box is the glass tube r, the other end of which rests in and is supported by a small bracket. By means of the set screws p p and the two levels s and t, the pressure gage and its graduated tube r are set in the correct position. An indicating fluid consisting of deep colored alcohol is put into the box q through i until it reaches the zero point of the scale alongside the graduated tube. This scale is graduated to show percentages of CO_2. If the rod connecting the three-way cocks l and k, shown in the figure to the left, is put over to the right the two columns of gas a and b will be connected with the upper and lower compartments of the pressure gage, thereby causing the measuring fluid to be forced along the graduated tube. The extent of the movement corresponds with a certain percentage of CO_2 in the column of gas a, which percentage may be directly read off. Since the flue gases are continually passing through the apparatus the ever-changing percentage of CO_2 may be noted by the corresponding position of the measuring fluid and

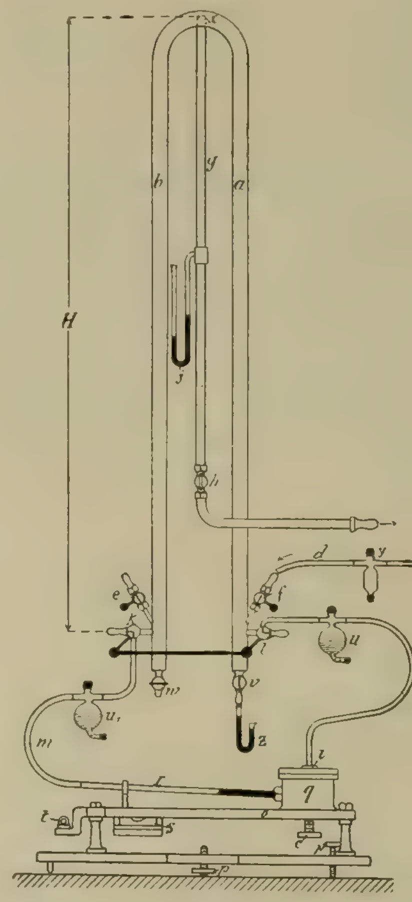


FIG. 4.

consequently the percentage of CO_2 may be ascertained at any moment.

The connecting tubes m and n are provided with little glass vessels, u_1 and u, containing pure alcohol, provided with rubber stoppers. This alcohol by its own evaporation prevents the alcohol in the graduated tube evaporating. The cocks v and w are draw-off cocks; the former is always left open and is connected by a rubber

sleeve to a little water syphon z hanging beneath, which serves for the purpose of collecting the water of condensation from the flue gases and discharging it.

FIG. 5

The pressure gage, Fig. 4, as previously mentioned, consists of a narrow horizontal plate with a closed box (containing a sensitive

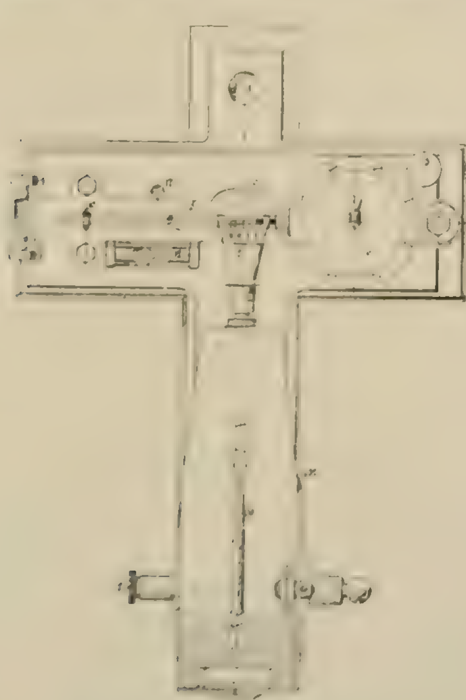
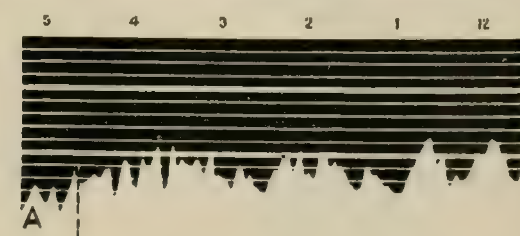


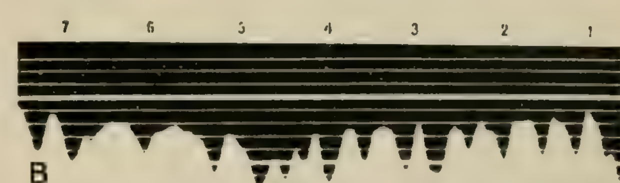
FIG. 6

[illegible] on the top which is covered with felt to protect against [illegible] variations of temperature. The top of the closed box is connected with the tube a containing the flue gas and the bottom (through the graduated tube r which contains the registering fluid) with the tube b containing the air. Into the left-hand side of the box q, Fig. 6, is fixed the glass graduated tube 9 supported at the other end in the small bracket 10. At the left hand and in front of the plate 5 levels 11 and 12 are fixed. The graduated tube is divided by black lines, with the zero point to the right, and is graduated up to 18 towards the left; each division indicates 1 per cent of CO_2. The lamp carrier, Fig. 5, is secured to the upper plate and carries a cylindrical glow lamp. Below this lamp is a small asbestos screen with a slit through which the rays of light fall upon a mirror 20, Fig. 6, fixed at an inclination of 45° behind the graduated tube 9, which reflects them horizontally through the graduated tube and into the recording camera.

The side of the camera, Fig. 6, is provided with a door (hinged at the bottom and secured by a catch at the top) and with a groove on the inside which entirely prevents entrance of light to the camera. At the opposite side of the camera is a hole to receive the axle of the clockwork which is firmly secured by means of the milled head 27. This clockwork rotates a brass drum inside the camera once in 24 hours. Fig. 5 shows a side view of the camera with a timing ring about 20 mm. wide, with divisions from 1 to 12 hours by quarter hours. At the side of the opening in the camera and at the right-hand side of the timing ring there is an index mark upon a hinged plate by means of which the revolving cylinder can be set to any desired starting time. The clockwork is wound up by opening the door which will be seen in Fig. 5 hinged down, and rotating the cylinder inside the camera in the clockwise direction. The camera is provided with a handle on top by means of which it can be removed.

Diagrams A and B represent portions of actual records, showing the benefit of the knowledge gained by the use of this recording





instrument. In diagram A it will be noticed that the percentage of CO_2 seldom rises above 10 per cent, and is often as low as 5 per cent. In the diagram B, where the fireman was aware that the instrument was connected, it rises considerably above the other average. The sensitiveness of the instrument is amply proved by the fluctuations of these records.

It is generally recognized that complete insight into the conditions in which the boiler furnace installation is at any time working can only be provided from a knowledge of the CO_2 obtained in the products of combustion. It is on this account that efforts have been made to produce instruments for the former, which would themselves automatically and continuously show the percentage of CO_2. The writer is glad to be able to state that there is now no longer any reason for ignorance on such matters. Tramway engineers should not fail to avail themselves of this means, or any other for that matter, which points so distinctly to an increased economy in the working of their power houses.

Plans for the organization of an athletic and social club of the Oakland Traction Co. are well under way. General Manager W. F. Kelly, who is the originator of the idea, has offered, on behalf of the company, to fit up all the spare space in the general office building for the benefit of the car men.

The Machinery of the Employment Bureau.

BY ALBERT EASTMAN, SUPERINTENDENT OF EMPLOYMENT, PUBLIC SERVICE CORPORATION OF NEW JERSEY.

The employment bureau of the Public Service Corporation has been organized to hire all the conductors and motormen required to carry on the electric railway service upon the entire mileage controlled by the corporation. Since its inception, on Jan. 1, 1904, it has turned over to the operating department an average of 300 men a month who it is believed will rank favorably in general qualifications with the men employed during the same period on any other electric railway system in the country. To secure these men it has been necessary to examine over 1,200 applications a month so that the ratio of men actually employed to the total number of applications received is about as one to four. Owing to the proximity to New York and Brooklyn, the bureau has been confronted with a difficult problem in securing a desirable class of applicants inasmuch as the nearby larger cities naturally attract the newcomers first. When the bureau was first started, the Public Service system was greatly in need of men owing to the recent establishment of better schedules on nearly all the lines, but in spite of this fact, during the first few months of working the class of men applying did not warrant a better ratio than one in ten of men actually employed to the total number of applications received. The reduction in the ratio of rejected applicants is due almost wholly to the fact that the conditions of service on the property have been made more attractive in all phases and the bureau now has a very much better class of applicants to draw from. The situation is also due in part to the fact that the machinery of the employment bureau has been established with the sole object of dealing justice to every individual applicant and appointments are made solely on the grounds of personal qualifications. Every applicant knows that he will stand on his own merits, irrespective of any other consideration, and so long as the company needs men, every applicant who is able to measure up to the standards established by the company will be put to work ultimately in a good position at a good wage.

The Public Service system covers so much territory that it has been found necessary to receive applicants six days in the week, and certain days in each week are set aside for receiving applications at different centers of population touched by the company's lines. Applications are received at Hoboken on Mondays and Wednesdays; at Newark, Tuesdays; at Paterson, Thursdays; at Elizabeth, Fridays; and at New Brunswick, Saturdays.

Applications are taken from men between the ages of 21 and 40. For conductors, the men must be at least 5 ft. 6 in. in height and motormen must be 5 ft. 6 in. in height and must weigh 150 lb. or over. Before applicants are given the necessary blanks to fill out, they are looked over, measured, and weighed, and are asked a few general questions.

If their general appearance is satisfactory, they are given a blank to fill out.

Form P. S. 31.

Public Service Corporation of New Jersey

STREET RAILWAY DEPARTMENT

HOBOKEN, N. J., ... **190**

M ....

Dear Sir:
In applying to this Company for a position as .... **Mr.** ....
claims to have been in your employ ....
as .... **Badge No.** ....
from .... **to** ....
and ....

Please advise me as to the veracity of the above and your record of this party. The information that you give us will be thankfully received and CONSIDERED CONFIDENTIAL.

....
Sup't of Employment.

REMARKS ....

DESCRIPTION	
Age	
Height	
Weight	
Color Eyes	
Color Hair	
Mustache	
Beard	
Complexion	

(Signed)

FIG. 1—INQUIRY OF RAILROAD COMPANY (5½x8½ IN.)

Form P. S. 32.

Public Service Corporation of New Jersey

STREET-RAILWAY DEPARTMENT

HOBOKEN, N. J., ... **190**

M ....

Dear Sir:
In applying to this Company for a position as .... **Mr.** ....
refers us to you. Will you favor us with your opinion of his honesty, character, habits and ability, etc. Please state definitely as to honesty and habits. Has he ever to your knowledge been employed by any Railroad or Railway Company? The information that you give us will be thankfully received, and CONSIDERED CONFIDENTIAL.

Yours truly,

....
Superintendent of Employment.

N. B.—In your employ from .... **to** ....

Remarks: ....

(Signed)

....

FIG. 2—INQUIRY OF OTHER EMPLOYER (5½x8½ IN.)

FORM P S 30

Name .... Age { ....

Present Address { .... Length of Residence { ....

Previous Address { .... Length of Residence { ....

Married or Single { .... Boarding or House-keeping { ....

Last Emp. ....

Address ....

From .... to ....

....

....

Previous Emp. ....

Address ....

From .... to ....

FIG. 3—INVESTIGATION BLANK ($4\frac{1}{4}$x$9\frac{1}{4}$ IN.)

There are three "Employer" and three "Reference" Spaces; also one for "Remarks."

FORM P S 29

Public Service Corporation of New Jersey

STREET RAILWAY DEPARTMENT

I herewith report on investigation of .... who is an applicant for position as ....

Is he known by name given? .... but as ....

Does he reside at address given? .... How long has he resided there? ....

Did he reside at previous address given? .... How long did he reside there? ....

Married or Single .... Boarding or Housekeeping ....

Previous Employer .... advises ....

" " .... advises ....

" " .... advises ....

" " .... advises ....

Reference .... advises ....

" .... advises ....

" .... advises ....

" .... advises ....

I would recommend that applicant be .... for the following reasons ....

....

Investigator

.... 190 . .

(OVER)

FIG. 4—REPORT OF INVESTIGATOR ($8\frac{1}{2}$x11 IN.)

The application blank used is modelled after the usual form employed by other companies for this purpose. It is made out in the form of a contract, the introduction constituting an agreement whereby the applicant in the event of his securing employment binds himself to abide by the rules and regulations of the company and to loyally and faithfully serve the company's interests. The body of the blank includes about 24 essential question aimed to reveal the general desirability of the man from the company's standpoint. The main idea is to obtain a statement of the man's name, present and previous address, general physical condition and previous employment during the past five years. Stress is laid on questions as to whether the man has ever been employed by a railway or railroad company. In addition to the names and addresses of his employers for the past five years, the applicant is required to give the names, addresses and occupations of four persons to whom the company can refer for information as to the man's general character. The blank includes a paragraph by which the applicant agrees to furnish two photographs of himself provided the Public Service Corporation ever demands them.

A point is made of compelling the applicants to fill out the blanks on the company's property and rooms fitted up with desks and writing material are provided for this purpose at all places where applications are received. Under no condition is a man permitted to take a copy of the blank from the company's property, and after the blanks are filled out they are never returned to the men.

After a man has written answers to all the questions, the superintendent of employment receives him in a private room and questions him closely with the idea of forming an opinion of his qualifications. The man is then told he will be notified by postal if the company can use him.

The application blank then goes to the application clerk. If a man happens to have been employed previously by a steam or electric road, a blank form similar to Fig. 1 is sent to the company which employed him. This blank calls for a detailed description of the man, as it is assumed that the electric or steam railroad company will have a detailed record of the man, if he has been in its employ. If the applicant has not been in the transportation business, a blank shown in Fig. 2 is sent to his former employer.

If the applicant represents himself as a resident of any town or city in or near any part of the Public Service system, the case is turned over to a special investigator, of whom the company has several in its employ. The investigator calls at all the addresses given, makes careful inquiry about the man and also calls on all the persons named as references.

To expedite the work of the investigators, two blanks, Figs. 3 and 4, are used. Fig. 3 is filled out by the investigator from the original application and is used by him in jotting down the information he secured. The arrangement of the blank is such that much of the information can be noted with very little writing, as the investigator simply puts an O K or an N G at each line. Fig. 3 is of convenient size for the pocket so that the investigator can start out with a bunch of cases all arranged by routes. When the investigator returns from a day's work, he makes a report of each case on Fig. 4, taking the information from Fig. 3. It should be noted that the questions asked on the original application line up in regular order with the information called for on Figs. 3 and 4, and this facilitates the transcribing from one blank to another.

If the investigator finds nothing that would disqualify the man, the reports are approved by the superintendent of employment and a postal card is sent to the applicant notifying him to report on a certain day and time at the employment office. When the applicant reports, if he is to be a conductor, he pays $1.50, which is the first year's premium on his bond. This amount, together with the man's application for a bond (which is filled out at the time of making the original application) are forwarded to the bond company. The bond company makes a special investigation of the man on its own account, but unless notified to the contrary the railway company assumes that the bond has been accepted.

Applicants for the position of motorman pay $1.00 as a deposit on badge and buttons. Motormen are not bonded.

Accepted applicants are given their outfit, consisting of badge, rule book, buttons, and in the case of conductors, a punch. They are then assigned to some division and instructed to report for duty.

It becomes of the utmost importance to make sure that the man employed is the one who reports for duty, and that no substitution take place between the employment office and the division depot. It is believed that the precautions employed by this company to prevent such substitutions are original and unique. At the time the accepted applicant is given his outfit, he is handed the blank reproduced in Fig. 5. This is virtually a letter of authority to the division superintendent to put the man to work and constitutes the man's credentials. At the bottom of the blank is a perforated slip and the blank and slip bear the same consecutive number. When the blank is handed to the man, the perforation is torn off and kept on file in the employment bureau. The man takes the blank to the division superintendent, who immediately starts breaking the man in by letting him ride on the cars with a regular employee until the new man is thoroughly familiar with his duties. The division superintendent fills in the lines left on the blank for that purpose, giving the names and badge number of the older employees who have instructed the

1251

PUBLIC SERVICE CORPORATION OF NEW JERSEY.

STREET RAILWAY DEPARTMENT

HOBOKEN, 19

Mr. *Div. Supt.*

Place bearer *Badge No.*

at *Carhouse to learn the duties of*

Supt of Employment

Instructed by — *Badge* / *Badge* / *Badge* / *Badge* / *Badge*

This is to certify that I have received the necessary instructions and thoroughly understand the duties of the position of ______ *as required by the rules of the Company, and have also received the following supplies, all of which I agree to return to an authorized officer of this Company or forfeit amount shown opposite each article.*

MARK

Punch,	*valued at* $2.25
Rule Book, No.	" " .50
Buttons, Small,	" " 1.00
" *Large,*	" " .50
Badge, No.	" " 3.00

Name,

Date,

Examined and found familiar with instructions and Book of Rules.

By *Division Supt.*

Date, 19

TO BE RETURNED PROMPTLY TO OFFICE OF SUPT. OF EMPLOYMENT.

1251 *Date,* 19

Name, *Badge*

Carhouse

Reported at Carhouse for instructions 19

Reported for duty and card returned 19

Failed to report in specified time. Outfit returned to Employment Department 19

FIG. 5—LETTER TO ACCEPTED EMPLOYE (4¼x11 IN.)

No. 1251 **Public Service Corporation of New Jersey.** File No. Badge No.

STREET RAILWAY DEPARTMENT.

190 **Carhouse.**

Mr. ***, Div. Supt.***

I have assigned to your Division Mr.

to learn the duties of

Gives as present address St. City or Town. Length of Res.

Gives as previous address St. City or Town. Length of Res.

DESCRIPTION OF APPLICANT.

Age Height Weight Color Eyes Color Hair Mustache Beard Complexion CHARACTERISTIC MARKS:	PHOTO

Applicant claims to have previous street railway experience as follows:

As on for

As on for

As on for

If above-mentioned applicant does not report to you in a reasonable time notify Employment Office.

When the applicant with above-numbered badge reports, and does not answer description or you are satisfied that above statements are incorrect, you will notify Employment Office, giving File No. on all correspondence relating to this applicant. Hold this Assignment Sheet until applicant commences work when you will fill in blank lines on back and place in your carhouse files. All duplicate discipline forms, papers, etc., pertaining to above-mentioned employee, should be kept in this cover—the original sent to Employment Office.

When employee leaves service place this cover and contents in carhouse ex-Employes' file for future reference, and forward notice of discharge or resignation, with outfit, to Employment Office immediately

Give File and Badge No. on all correspondence and discipline blanks.

SUPT. EMPLOYMENT.

No. **1251**

Mr. *has this date reported for the necessary instructions for*

Date, 190

DIV. SUPT.

FIG. 6—BLANK FOR CHECKING APPLICANT (8½x13½ IN.)

new man. When the division superintendent is satisfied that the new man is ready to go into regular service, he signs the blank at the bottom and returns the form by mail to the employment bureau.

At the same time that the employment bureau assigns a man to a division, the superintendent of employment forwards by mail to the division superintendent a copy of the blank shown in Fig. 6. This blank gives a complete description of the accepted applicant and division superintendents are careful to see that the description fits in every particular the man who presents himself as the accepted applicant. For additional checking, Fig. 6 bears the same consecutive number as Fig. 5. Fig. 6 bears a perforated slip at the bottom which is torn off by the division superintendent and returned to the employment bureau as soon as the accepted applicant reports for duty. It will be remembered that all this time, the perforated slip from Fig. 5 has been on file at the employment bureau and the information called for on that slip is filled in as soon as the blanks are returned from the division superintendent. The body of Fig. 6 is retained at the division depot and becomes a folder in which are placed duplicates of all papers relating to the man, including discipline blanks, etc., each division depot being provided with a filing case constructed for holding these folders.

Date Appointed		CONDUCTOR	File Number	Date Leaving Service		Date Appointed		MOTORMAN	File Number	Date Leaving Service	
		4995						4996			

FIG. 10—HEADINGS OF BADGE RECORD (8x13¼ IN. FOUR TO EACH PAGE.

Form P. S. 12

PUBLIC SERVICE CORPORATION OF NEW JERSEY

STREET RAILWAY DEPARTMENT

Car House .... Line ....

Conductor / Motorman .... Badge No. ....

Warned for running into an open point
" " feeding motors improperly
" " not running car on time
" " allowing passengers to ride on front platform.
" " not stopping to take on passengers
" " missing car too often
" " excessive drinking.
" " not reporting in a neat and tidy condition.
" " talking to motorman while on duty.
" " not registering fares.
" " making errors in day cards and envelopes
" " making errors in punching transfers.
" " errors in accepting transfers.
" " not having sufficient money to operate car.
" " not holding trolley rope while passing under special work, etc.
" " not collecting fares promptly
" " being slow signalling motorman.
" " not calling streets and trolley stations
" " not ventilating car properly.
" " reading while on duty
" " incivility to passengers.
" " not obtaining sufficient number of witnesses to accident
" " not carrying proper dash sign.
" " starting car without proper signal
" " passing standing car too rapidly
" " ....
" " ....

Div. Supt.

Date 190

FIG. 7—WARNING BLANK (5½x8½ IN.)

When form, Fig. 6, is being filled out, the clerk inserts in the space provided for that purpose a file number by which number the case is thereafter known. Large folders of heavy manila paper are provided in the employment office for keeping the originals of all papers relating to each man. The folders measure 15 in. long, one leaf being 9 in. wide and the other 9½ in. wide. The half-inch margin of one leaf projects above the edge of the other, and on this margin is printed the file number. The file numbers run consecutively and no number is used twice. The folders are kept in large cases and as soon as a man leaves the service, the folder with all the papers is put into the "dead case." The "dead case" is always increasing in size, but the "live case" remains about the same, as the total number of men in the service does not change materially from year to year.

These filing cases are doubly indexed by the card system, one set of cards giving the men's names and the others the badge numbers. When a man's record is desired, the file number is determined by referring to either set of cards, depending on whether the man's name or badge number is given. The index cards in addition to the file number, badge number and name also bear the date when man was appointed, division to which assigned, date resigned or discharged, and date if transferred from one division to another.

Contained in each folder is a large sheet upon which is entered the man's complete record, including accidents, reprimands, secret service reports, register record, etc. The headings for these record cards are shown in Figs. 8 and 9. If the operating department requires the record of any particular man, the entries of these cards are copied and forwarded to the general superintendent.

The men's records come from one of two sources, either from secret service reports, all of which are handled by the employment bureau direct or from discipline and warning blanks which are handled by the division superintendents. The warning blank is shown in Fig. 7. If a man's register record is receiving too many undesirable entries, it becomes the duty of the superintendent to notify the division superintendent, who warns the man. Warnings for any other offenses named on the blanks are handled by the division superintendents themselves without instigation from the employment bureau, but copies of the warning are sent to the employment bureau and become part of the man's record in the folders. Records of discipline administered, resignations, discharges, etc., are made in the same way.

A very careful record is kept of each badge issued. For this purpose, a "Badge Record Book" is used, ruled as shown in Fig. 10. There is space on each page for four badge records. The man's name to whom badge is assigned is entered, together with man's file number, date appointed and date of leaving. When the badge is turned in, notation is made of the date, and when the badge is re-issued, the new man's name to whom it is given is entered on the next line.

The employment bureau makes daily reports to general superintendent of number of men required and appointed at each division depot; and weekly reports of suspensions, reprimands, discharges, resignations and appointments at each division depot. The employment bureau also makes daily report of the name of all conductors and motormen who have entered or left the service during the week.

Motorman .... File No. .... Badge No. ....

Employed .... Assigned to ....

Discharged .... Resigned .... Reappointed ....

DATE	REPORTS	Demerit	Credit	Record	Examined

FIG. 8—MOTORMAN'S RECORD CARD (9x12 IN.)

Conductor .... File No. .... Badge No. ....

Employed .... Assigned to ....

Discharged .... Resigned .... Reappointed ....

DATE	[illegible]	[illegible]	TIME A.M.	TIME P.M.	No. Pass	No. Reg	Reg. by	DATE	REPORTS	Demerit	Credit	Record	Examined

FIG. 9—CONDUCTOR'S RECORD CARD (9x12 IN.)

Eighth Annual Meeting, Accountants' Association, St. Louis, Oct. 13-15, 1904.

FRIDAY, OCT. 14, 1904

Friday's session of the Accountants' Association was devoted to a joint meeting of the American Railway Mechanical and Electrical Association and the Street Railway Accountants' Association. The business considered at the meeting was the report of the Joint Committee on "Blanks for Shop Records and Accounts." The report was presented by Mr. H. M. Pease, auditor of the International Traction Co., Buffalo, a member of the committee, and will be found on page 842. Is the very extended and comprehensive discussion which ensued the following named gentlemen took part: P. S. Young, Jersey City; W. O. Mundy, Pittsburg; H. C. Mackay, Milwaukee; C. N. Duffy, Chicago; J. S. Smith, Kansas City; W. E. Harrington, Camden; F. E. Smith, Chicago; W. G. Ross, Montreal; H. H. Adams, Baltimore; E. W. Olds, Milwaukee; C. L. S. Tingley, Philadelphia; John Lorenz, Jackson, Miss.; Frank R. Henry, St. Louis; W. H. McAloney, Denver; W. B. Brockway, New York; J. L. Green, Dayton; D. A. Faut, Chicago.

On motion the report of the committee was approved, and the members recommended to adopt the systems of shop records presented by the committee as far as practicable in their various companies. A vote of thanks was passed to the committee, and the committee was continued.

On motion of Mr. Olds, of Milwaukee, a vote of thanks was tendered to the Accountants' Association for the hearty co-operation its members had given in the work of the joint committee.

Mr. Robert McCulloch, of St. Louis, was present during a portion of the meeting, and being called upon for remarks, expressed his approval of the work done by the Accountants' Association.

SATURDAY, OCT. 15, 1904.

At Saturday's session the first business was the report of the Executive Committee. This was followed by the report of the Committee on "A Standard System of Street Railway Accounting," Mr. C. N. Duffy, of Chicago, chairman, which will be found on page 840. The "Question Box" was then read.

The foregoing report and the question box was discussed fully by the following named members: W. G. McDole, Cleveland; C. N. Duffy, Chicago; C. L. S. Tingley, Philadelphia; Elmer M. White, Hartford; H. C. Mackay, Milwaukee; Irwin Fullerton, Detroit; W. G. Ross, Montreal; W. E. Harrington, Camden; F. J. Duffy, Beaumont, Texas; B. A. Conelly, Lima, O.; D. S. Carll, Washington; P. V. Burington, Columbus; A. S. Kibbe, Philadelphia; G. H. Clifford, Ft. Worth, Texas; Frank R. Henry, St. Louis; F. E. Smith, Chicago.

Mr. W. Caryl Ely, president of the American Street Railway Association, visited the meeting and in brief remarks commended the work of the Association, and complimented it upon the progress it had made, especially in having secured recognition by the National Association of Railroad Commissioners, to which body it is entitled to send delegates at annual meetings.

Mr. A. L. Judson, accountant of the New York State Board of Railroad Commissioners, was also present and took an active part in the discussion of the questions before the meeting.

The following officers and committeemen were elected for the ensuing year:

President, W. G. Ross, Montreal, Canada.

First Vice-President, Frank R. Henry, St. Louis, Mo.

Second Vice-President, Isaac McQuilkin, Anderson, Ind.

Third Vice-President, J. W. Lester, Worcester, Mass.

Executive Committee: The Officers and—

F. E. Smith, Chicago, Ill.

G. B. Willcutt, San Francisco, Cal.

Arthur L. Linn, Jr., Utica, N. Y.

P. S. Young, Newark, N. J.

W. B. Brockway, the secretary and treasurer, was renominated, but declined election. He was appointed acting secretary and treasurer, to serve till January 1, 1905, at which time his successor is to be appointed by the executive committee.

REPORT OF STANDING COMMITTEE ON A "STANDARD SYSTEM OF STREET RAILWAY ACCOUNTING."

SUBMITTED BY C. N. DUFFY, CHAIRMAN

We recommend that no change be made in the classification of construction and equipment accounts or the classification of operating expense accounts, as revised by the association at its sixth annual convention, held in Detroit, Mich., Oct. 8, 9, and 10, 1902.

From time to time, as far back as the year 1898, your committee has answered certain questions asked by different members, with respect to the disposition and charge of various items in connection with the use of the Standard System of Street Railway Accounting. Your committee, deeming this information instructive and valuable to all the members of the association, thought it advisable to submit the questions asked and the answers given to this convention, with the idea of continuing the presentation of such information annually in future reports of the committee to the association.

The questions follow; (unless otherwise indicated the answer is by Mr. C. N. Duffy):

1. To what account should the salary of the master mechanic be charged?

Account No. 9—Miscellaneous Shop Expenses. Sept. 21, 1898.

2. To what account would you charge premiums on a bond given to the city to guarantee the operation of the railroad?

Operating Expense Account No. 32—Miscellaneous General Expenses. Sept. 9, 1900.

3. To what account would you charge premium paid on bond given to the city to comply with city ordinance regarding the running of cars on the street?

Operating Expense Account No. 32—Miscellaneous General Expenses. Sept. 9, 1900.

4. To what account would you charge the rent of the general office while the road is being constructed? Also salary of general manager?

Construction and Equipment Account "O"—Miscellaneous. Sept. 9, 1900.

5. To what account would you charge damage to construction locomotive, and to John Smith's property, which was caused by some unknown person starting the locomotive at night, causing same to run off the track, and running into John Smith's property, damaging locomotive and J. S.'s property?

Construction and Equipment Account "O"—Miscellaneous. Sept. 9, 1900.

6. To what account would you charge a Wells light, which cost \$100, and is used at the gravel pit out in the country, so that the men can see to dig gravel at night? This gravel is used to fill up roadbed on which tracks are being laid.

Construction and Equipment Account "D"—Track and Roadway Sept. 9, 1900.

7. To what account would you charge rent that is paid every six months, for a strip of land on which the tracks are laid?

Operating Expense Account No. 36—Rent of Land and Buildings. Sept. 9, 1900.

8. Are all expenses of whatever nature to be charged to Construction and Equipment Account until the road is completed?

Yes. Sept. 9, 1900.

9. What account should be charged with hose jumpers when they are purchased to take the place of other hose jumpers, and are used on the streets for the purpose of cars going over the hose of a fire engine, in case of fire?

Account No. 22—Miscellaneous Car Service Expenses, under the instruction: "Cost of getting derailed cars on track and removing obstructions and wreckage." July 29, 1901.

10. What account should be charged with the construction and laying down of temporary tracks and bending rails for same for the storage of cars for temporary and special occasions; also putting in temporary cross-overs from one track to another?

Account No. 22—Miscellaneous Car Service Expenses, under the

instruction: "And all other car service expenses not otherwise provided for." July 20, 1901.

11. Under the standard system of accounting which this company follows, we are directed to show under Miscellaneous Income the income from sale of power in excess of the actual cost of producing the same. We are also directed to deduct from the cost of the operation of our power plant the cost of producing the power sold so that the cost of the operation of our power plant as shown by our books will be what it actually costs us to provide power for our railway service only.

As you are aware, there are six accounts under the heading "Operation of Power Plant" and two accounts under the heading "Maintenance," which are all affected, more or less, by production of power. The writer does not quite understand how we are to deduct the cost of producing the power sold from the total cost of our power. We presume, however, that we will deduct from each one of the six accounts under the heading "Operation of Power Plant" that proportion of the cost of producing the power sold which that particular account bears to the total. Is this the correct way to treat this matter or not? If it is not the correct way, would you kindly write to us explaining how we are to deal with the matter? We would ask you to favor us with an early reply, as we expect in a very short time to be selling power on a very large scale. We are not selling it at present, and therefore the question has not come up, but we are about to make contracts to furnish power for two other roads in our vicinity. We have a very large hydraulic power plant, and it is our intention to sell power on a very extensive scale. In all probability our income from the sale of power will more than exceed what it would cost to produce power for this company for railroad purposes alone.

We are very anxious to follow out the system of the Accountants' Association, as we know it is a good one, but as it is not perfectly clear to the writer's mind, we would ask that you send us some further explanation.

In order to determine the cost of producing power exclusive of fixed charges and depreciation, the total of Accounts 10, 11, 12, 13, and 14, classified under "Operation of Power Plant," and the total of Accounts 4 and 5, classified under "Maintenance of Equipment," and the cost of maintenance of power plant buildings carried in Account No. 3, classified under "Maintenance of Way and Structures," should be taken. This total represents the cost of producing power. The power used in the operating of your railroad and the power sold can be proportioned according to the meter readings at the power plant. This will enable you to show the cost of producing power used and the cost of producing power sold by apportioning the cost of producing the power between what is used on the railroad as shown by the meter readings and what is sold as shown by the meter readings.

The income from the sale of power should be distributed between the accounts that make up the cost of producing the power, to the extent of the cost, and the profit of selling the power, to "Miscellaneous Income."

The distribution over the accounts that make up the cost of producing power should be in the proportion that each account bears to the total cost. Jan. 15, 1902.

12. We have in connection with our property some air compressors. Some are situated at car houses, and a pump for same is operated by a small motor in the car house. In other cases they are adjacent to our power stations, and the pump is operated by power furnished direct from the station. These compressors are used for filling the tanks on our cars for operating the air brakes.

I am somewhat at a loss to know to what account I should charge the maintenance of the air compressors and the motors for operating the same.

Answered by Mr. H. J. Davies, May 20, 1903.—I should regard your air compressors, pumps, and the motors that operate them as miscellaneous tools, and should charge the expense of maintaining them to Account No. 9. Of course, the expense of maintaining the tanks and air brakes on the cars should be charged to No. 6—Maintenance of Cars, and I think the cost of the air, which would include the current for operating the compressors and the labor of getting the air into the tanks, should go to Account No. 21—Car Service Supplies.

13. What operating expense account is chargeable with fire hose and fittings when for repairs and renewals of such articles in car houses?

Account No. 22—Miscellaneous Car Service Expenses. Dec. 24, 1903.

14. What operating expense account is chargeable with fire hose and fittings when for repairs and renewals of such articles for power plant?

Account No. 14—Miscellaneous Supplies and Expenses of Power Plant. Dec. 24, 1903.

15. What operating expense account is chargeable with the cost of sulphuric acid used in storage batteries and labor and other expenses of cleaning storage batteries?

Account No. 14—Miscellaneous Supplies and Expenses of Power Plant. Dec. 24, 1903.

16. What operating expense account is chargeable with the expense of care of vines planted close to and running up the sides of car houses, including cost of fertilizer, tools, etc., used in connection therewith?

Account No. 22—Miscellaneous Car Service Expenses. Dec. 24, 1903.

17. What is the correct charge for the maintenance of a compressed air pump for blowing dust out of motors which is a permanent machine in one of the car houses?

When this machine was originally bought, undoubtedly it was, or should have been, charged to Construction and Equipment Account "J," Shop Tools and Machinery.

The instructions with reference to such a charge being as follows: "Charge to this account all expenditures for shop tools and machinery for general repair shops, car houses, etc., including foundations and installation."

As the question deals with the maintenance of this machine, the proper charge would be Account No. 9—Miscellaneous Shop Expenses, which provides for all expenditures for repairs and renewals of shop tools, machinery and appliances, for the reason that the machine is a fixed tool, and not a hand tool, and because the expenditure incurred is a "Maintenance" charge; the fact that the machine is placed in the car house, which is practically a part of or a branch of the general repair shops, or that it is used for blowing dust out of motors, does not warrant the charge to any other account than to Account No. 9.—Jan. 27, 1904.

18. To what operating expense account should be charged premium on bonds of general office employes when paid by the company? Does not seem to be specially covered by the classification.

Account No. 32—Miscellaneous General Expenses.

The gentleman who put this question objected to the answer, in the following letter:

"I note you state that premium on bonds of general office employes, when paid by the company, should be charged to Account No. 32—Miscellaneous General Expenses. I wish to call your attention to the fact that according to the Interstate Commerce Classification of Operating Expenses for Steam Lines 'Premium on Bonds of agents and other station employes when paid by the company should be charged to Station Supplies.' On account of this rule, it has been my custom to charge premium on bonds of general office employes of steam lines to 'General Office Expenses and Supplies,' which, as you know, is a similar account covering the general office to the station supplies account covering local stations.

"In street railway accounting, if we follow the general idea covering steam lines classification, it would appear to me that premium on bonds of general office employes of street railways when paid by the company would be chargeable to Miscellaneous Office Expenses.

"Will you kindly refer this communication to the Standardization Committee and advise me of their views in the matter?"

The chairman of this committee does not agree with the gentleman that Account No. 28—Miscellaneous Office Expenses, should be charged with premium on bonds of general office employes when paid by the company, as the expense is certainly one of the general expenses of conducting railway business.

The chairman promised the gentleman that this matter would be presented to the convention.—June 17, 1904.

19. To what account should we charge the maintenance of a derrick hoist and stone crusher—two pieces of machinery situated in our yard?

Assuming the derrick hoist and stone crusher referred to are a part of your track tools and appliances, the proper account to charge the maintenance of same would be account No. 1—Maintenance of Track and Roadway. July 18, 1904.

Blanks for Shop Records and Accounts.

REPORT OF THE JOINT COMMITTEE OF THE A. R. M. AND E. A. AND THE S. R. A. A. OF A.

By mutual agreement, the American Railway Mechanical and Electrical Association and the Street Railway Accountants' Association of America, appointed a joint committee to prepare a report on "Blanks for Shop Records and Accounts," to be presented at one of the sessions of the eighth annual convention of the Street Railway Accountants' Association to be held in St. Louis, Oct. 13, 14, and 15, 1904; the members of the American Railway Mechanical and Electrical Association attending.

The necessity and importance of a system of shop records and accounts for carefully recording work of repairs and mechanical changes, is recognized by all master mechanics, and as the accountant's duties bring him in close touch with all departments he is naturally interested in the adoption and installation of a system in the mechanical department by which he can report the relative usefulness of changes or improvements over previous methods.

Your committee, in preparing this paper, thoroughly realize local conditions control to a degree, the operation of street railway properties, and that it would be difficult to submit a set of blanks which would meet the needs of all companies, and in preparing the accompanying blanks they were prompted and governed by the desire to cover in a general way a system which could be adapted with slight changes to the requirements of small companies having somewhat limited office facilities, as well as the larger with a more complete organization.

The report, for convenience, is arranged in three sections.

The first section contains the forms pertaining to reporting the condition of equipments while in service and under repairs, viz.:

Form 1. Trainmen's Report of Condition of Cars.
Form 1-A. Summary of Trainmen's Report of Condition of Cars.
Form 1-B. Trainmen's Report of Condition of Car.
Form 1-C. Summary of Trainmen's Report of Condition of Cars.
Form 2. Car Inspector's Daily Report.
Form. 3. Car Tag.

The second section contains the forms pertaining to the accounting for work done by the mechanical department, viz.:

Form 4. Shop Order.
Form 5. Inter-department Order.
Form 6. Master Mechanic's Order.
Form 7. Individual Time Card.
Form 7-A. Daily Report of Time.
Form 8. Application for Change in Pay Roll.
Form 9. Requisition on Storekeeper for Material and Supplies.

The third section contains the forms pertaining to shop records, viz.:

Form 10. Record of Car Repairs.
Form 11. Wheel Report.
Form 12. Wheel Record.
Form 13. Armature Report.
Form 14. Individual Armature Record.
Form 15. Individual Car Record.

SECTION ONE.

It is a well known fact that most, if not all, troubles and defects in cars and equipments are first noticed in the operating department. Proper reports as to the condition of the cars should therefore be made daily, by the trainmen, to enable the mechanical department to trace and take care of the troubles with a greater degree of accuracy and promptness; having this in mind we submit herewith Form Number 1.

Trainmen's Report of Condition of Cars.

When a car is turned into the car house a report as to its condition is made by the trainmen on this form, which is arranged to include information regarding the "Time In," "Car Number," and the "Defects" found to exist in the operation of the car. When no defects are noticed, the cars are reported "O. K." The trainmen then sign in the proper place as a certification that the cars are in the condition stated. When the cars are inspected the car house foreman notes in the column provided the "Action Taken," and affixes his signature. It is then carefully checked by the man in charge of the car house and a report made there from, daily (on Form 1-A.) to the master mechanic. The report is then forwarded to the superintendent of transportation, who after approving, passes it on to the claim department for permanent file. This report is followed by Form 1-A.

Summary of Trainmen's Report of Condition of Cars.

This summary is practically a recapitulation of defects reported by the trainmen. It is made in duplicate by the man in charge of the car house, and indicates the disposition of the troubles reported. The original is sent to the master mechanic daily and the duplicate remains at the car house for future reference.

Some companies may prefer to have the trainmen make a separate report for each car. To meet this requirement we present herewith another style of report blank, Form 1-B.

Trainmen's Report of Condition of Car.

This form is suggested as a possible substitute for Number 1, and has the advantage of requiring but very little writing as it contains the classification of troubles most likely to occur. As a rule a check mark only is needed opposite the defect reported. It may, however, be necessary in some cases in order to more fully describe the trouble to add a word or two before the check mark. The trainmen report in space provided the "Length of Detention," "Place of Trouble" and give other detailed information regarding the troubles encountered.

The report is made in duplicate and both copies sent to the dispatcher, who immediately forwards the original to the shop foreman. When the defects are not sufficient to render the car unfit for service, the report is handed in by the trainmen upon arrival at the car house.

It will be noted that no provision is made on this form for the action taken by the car house foreman; neither is it intended to form any report of the records in the claim department. The original should be filed, however, in the master mechanic's office where it may be obtained by the claim department, if desired. The size and shape of the blank can be altered to meet the demands, and the trouble classification can be made more in detail. It is recommended that this form be made in manifold paper, with a carbon back to the original. In filing the original it should be folded in the center, and the carbon side of the sheet folded on itself to prevent its coming in contact with other sheets.

It is necessary to follow up this report with a summary of troubles, which is provided for in Form 1-C.

Summary of Trainmen's Report of Condition of Cars.

This blank needs no lengthy explanation; as the note thereon indicates, it is made in duplicate by the man in charge of the car house, and contains a recapitulation of the troubles reported by the trainmen on Form 1-B. The original is sent to the master mechanic and the duplicate forwarded to the superintendent of transportation.

The two systems for the reporting of defects by the operating department, have been traced to their destination, and we pass on to Form 2.

Car Inspector's Daily Report.

This form is divided into two sections, one for "Cars in Good Condition" and the other for "Cars Needing Repairs." It also contains, on the back, a classification of most of the troubles pertaining to cars and their equipment. In reporting a car in good condition, the inspector places the car number in the column provided. If he desires to report a defective car, the number pertaining to the particular defect is obtained from the back of the blank, and inserted in the proper column.

The various troubles enumerated on the back of this form, illustrate the principle, and are not offered as definite terms or numbers.

The column headed "Foreman's Column, Action Taken" is used by the foreman in noting whether the "Repairs were made," "Car held in," "Car sent to shop," or whatever action was taken in the matter. Provision is also made for reporting cars lubricated. When defective cars are sent to the shops for repairs, a notice or report should be forwarded to the mechanical department. A tag is suggested for this purpose, Form 3.

Car Tag.

The man in charge of the car house fills out one of these tags for each defective car sent to the repair shops. It is attached to the car, and contains the "Car Number," "Line," "Date," "Time," "Trouble Numbers," and remains with the car until the repairs are made, when it is detached, and on the reverse side full information given regarding the "Repairs Made," "Date Completed" and "Names of Repairmen." It is then examined and signed by the shop foreman who turns it over to the master mechanic for his record.

SECTION TWO.

The mechanical department is frequently called upon to manufacture material and make repairs of an extraordinary nature, and, as it is essential to know the exact cost and have a record of the work, it is important that a system be installed so that the cost and other data can be readily obtained. The first blank suggested for this system is Form 4.

Shop Order.

This order is made in triplicate; the first sheet stating what is required, is forwarded to the master mechanic with instructions to have all labor performed and material furnished in connection with the order charged to Shop Order Number..., and notify the auditor when the work is completed. The second and third sheets, which are carbon copies of the first in so far as the description of the order is concerned, are sent to the auditor and contain columns in which to note the cost of labor and material. In case the order is to manufacture material, the third sheet is forwarded to the storekeeper who inserts in the proper columns the "Date" and "Quantity Received." If the stock ledger is kept at the storeroom, the storekeeper can obtain the cost of labor and material from the auditing department.

The master mechanic can also obtain the total labor and material cost from the auditing department, and if desired, the first sheet can be made the same size as the second and third, and columns provided thereon in which to insert the labor and material cost.

We have also prepared a form of order for use between departments, Form 5.

Inter-department Order.

When a department desires labor or material from another department, this form is suggested. The names of the departments are listed, and it is only necessary to underline the one desired to fill the order. The account to be charged is inserted and a full description, of what is required, given. It may be made in duplicate if desired.

The next blank to be considered is the master mechanic's order to his shop foremen, Form 6.

Master Mechanic's Order.

When the master mechanic receives a shop order (Form 4), he fills out one of these blanks for each foreman interested. All of these orders bear numbers identical with the shop order. The foreman after completing the order makes a full report, in the space provided, to the master mechanic. This form is made in duplicate, and the report filed by the master mechanic as his record. If desired, back of the blank can be arranged for labor and material cost.

In taking up the subject of time cards two forms are suggested, the first being Form 7.

Individual Time Card.

This card has printed thereon the "Account Names" and "Numbers" most likely to be used in distributing the time. Blank spaces are left, for miscellaneous work or account not printed on the card and the employe's name.

The master mechanic, by referring to the time card, can note the total time worked by employes, and the exact time charged to each account. These cards are turned over by the foreman to the timekeeper. If a time clock is employed these slips can be readily checked against the clock record.

The second form of time card is provided with spaces in which to report the time of a crew, and is covered by Form 7-A.

Daily Report of Time.

As stated above, this blank is intended for use in recording the time of a crew. It contains spaces for the "Names of the Employes," "Hours Worked," "Rate," "Total Amount Due" and the "Account Number" to which the time is charged.

Space is left to the right of the blank for miscellaneous charges. The next blank to be considered is Form 8.

Application for Change in Pay-Roll.

It often becomes necessary to change the rate of employes or to increase the working force. When this is done the auditing department should be notified to enable them to check the pay-roll. The above blank is intended for such notice, and is provided with lines for "Date," "Officer to Whom Addressed, "Name of Department Requesting the Change," "Date when the Change becomes Effective" and additional lines for full explanation as to why the change is desired. It is signed by the head of the department requesting the change, approved by the proper officer, and forwarded to the auditing department.

We now come to the request for material and supplies, Form 9.

Requisition for Material and Supplies.

In preparing this blank reference was made to the "Report of the Committee on Standard Blanks and Accounting for Material and Supplies," approved at the Detroit Convention of the Accountants' Association in October, 1902, but no blank was submitted to cover this requirement. The committee, therefore, recommends this form for use in drawing material and supplies from the storeroom as and when required by the shop department. It is made in duplicate by the foreman, and approved by the master mechanic. The original is sent to the storekeeper, and the duplicate retained by the master mechanic.

SECTION THREE.

The blanks submitted in this section illustrate the method the committee has to suggest for keeping the records of various parts of the equipment, with the report forms necessary for making the record.

The first blank in order is Form 10.

Record of Car Repairs.

This form is prepared for the purpose of recording the repairs made to each car. It will be noted that the blank has printed thereon the principal parts of a car. The repairs made are indicated by placing an "X" in the proper column opposite the date; whenever possible, the number of repairs made should be recorded, omitting the "X." This blank can be enlarged or reduced to meet any requirements.

The next blank in order is Form 11.

Wheel Report.

As the name implies, this form is used in connection with placing and replacing wheels, and is arranged to indicate the "Car Number," "Date," "The Numbers and Circumference of the Wheels Taken Out and Put In" and the cause of removal together with other information needed to make a complete report. It is filled out by the foreman, turned over to the master mechanic and recorded on Form 12.

Wheel Record.

This blank may be in book or card form. It is provided with spaces in which to record the "Wheel Number," "Car Number," "Date In," "Circumference," "Date Out," "Circumference," "Cause of Removal," and "Mileage." Provision is also made for several removals and replacements. Mileage is quite an essential feature of the report, especially to the companies purchasing wheels under a guaranteed mileage. The committee recommends that the master mechanic be given a statement of the mileage made by the individual cars under his care. It should be kept in a mileage book and used in connection with the various records. This blank is followed by Form 13

Armature Report.

This report is in the form of a tag and is attached to each armature, when removed from the car, where it remains in its entirety and the repairs recorded thereon, as made. After the repairs are completed, and as the armature is sent from the shop, the lower portion of the tag is detached from the stub and passed to the master mechanic's office. The stub remains with the armature until placed in the car, when it is filled out, signed and turned into the master mechanic's office by the foreman. As the tag is liable to become soiled it will be more legible if

FORM 1B COMPANY SIZE 6 9/16" X 7 9/16"

TRAINMEN'S REPORT OF CONDITION OF CAR.

CAR NO. .... DATE .... 190 .... LINE ....

LENGTH OF DETENTION, ... MINUTES .... A.M. P.M.

MOTORMAN .... NO. .... CONDUCTOR ....

State trouble opposite what is presented; if the defect cannot be found, ... which will assist in locating trouble. Report to be made out in duplicate and both copies sent to ... original to Shop Foreman. In case the ... such as to allow the car to remain in Service this report ... upon arrival at station.

Car Body Trouble	Truck Trouble
End Door	Brake Chain
Broken Glass	Wheel Guard
Ventilator	Brakes
Platform Gate	Flat Wheel
Chain	Hot Box
Brush Box	Spring
Coupling Link	Journal
Car Seats	Electric Equipment Trouble
Car Dirty	Armature
Signal Bell	Motor Flashed
Bell Cord	Brushes
Electric Bell	Leads
Gong	Controller
Brake Staff or Handle	Fuse Box
Fender	Hood Switch
Dash	Trolley Base
Signs	Pole
Hand Straps	Wheel
Register	Rope
Rod or Handle	Gear
Curtains	Case
Grab Handles	Light Circuit
Guard Rails	Headlight
Signal Lamp	Resistance

Remarks ....

Sign .... Motorman.

If Car is in Good Condition, Sign in full here ....

FORM 1

.... COMPANY

Trainmen's Report of Condition of Cars

.... STATION .... 190..

TIME IN A M	TIME IN P M	CAR NO	NOTE HERE ANY DEFECT FOUND TO EXIST IN OPERATION OF CAR	I CERTIFY TO MY CAR BEING IN CONDITION AS NOTED HEREON TRAINMEN'S SIGNATURES	FOREMAN'S COLUMN ACTION TAKEN
			SIZE 11½" X 17"		

NOTE:-

Trainmen should note on this report daily the condition of all cars used in passenger service and sign in the column provided. When no defects exist, cars should be reported "OK". Proper notation showing that crippled cars have been "REPAIRED", "HELD IN", or sent "TO SHOPS" should be noted hereon by Barn Foreman whose signature must then be affixed. The report should then be checked by man in charge of Carhouse and a report to the Master Mechanic made therefrom on form 1A. This report should then be forwarded to the Superintendent of Transportation who, after approving, will pass to claim department for permanent file.

FORM 1-A

.... COMPANY SIZE 8½" X 11⅜"

SUMMARY OF TRAINMENS REPORT OF CONDITION OF CARS

Condition of Cars at .... Station 190

CAR NO	REPORTED CONDITION	ACTION TAKEN

Station Master

Note:-

This report is a recapitulation of bad order Cars taken from "Trainmen's Report of Condition of Cars" Form 1. It must be made in duplicate by the man in charge of carhouse. Indicate in column provided the action taken, and forward the original to Master Mechanic by first mail.

BACK OF FORM 2

SIZE 8⅛" X 10¾"

	MOTORS		ELEC EQUIPMENT CONTINUED		CAR BODIES
1	Armature Grounded	38	Blowing Fuses	65	Sand Boxes out of Order
2	" Open Circuit			66	Sash Broken
3	" Rolled		TROLLEYS	67	Windows "
4	" Bands	39	Trolley Rope Broken	68	Curtains out of Order
5	" Bucking	40	" Wheel	69	Dashes Bent
6	" Bearing Hot	41	" Pole Bent or Broken	70	Vestibules out of Order
7	" Shaft Bent	42	" Base Broken	71	Panels Broken
8	" Shaft Broken			72	Ventilators Broken
9	" Collar Loose		WHEELS & AXLES	73	Hoods "
10	" Head Torn	43	Flat Wheels	74	Truss Rods Bent
11	Commutator Worn Out	44	Broken Wheel	75	Illuminated Signs out of Order
12	" Rough	45	Worn out Wheels	76	Bell Ropes " " "
13	Axle Bearing Hot	46	Loose Wheels	77	Signal Bells " " "
14	Fields Burned Out	47	Broken Axles	78	Foot Gongs " " "
15	Field Wire Burned Off	48	Bent "	79	Gates " " "
16	Brush Holders out of Order	49	Hot Journals	80	Doors " " "
17	Brush Holders Wire Burned Off	50	Broken "	81	Gear Handle Damaged
18	Gear Wheel Loose	51	Axle Collar Loose	82	Signal Lamps out of Order
19	Gear Wheel Broken			83	Seats " " "
20	Gear Case Loose		FENDERS	84	Guard Rail Broken
21	Gear Case Broken	52	Fenders Broken	85	Steps "
22	Motor Dropped	53	Wheel Guards "	86	Coupler "
23	Motor Susp. Bolts Broken			87	Registers out of Order
24	Motor Frame Broken		BRAKES		
25	Ground Wire Burned Off	54	Brakes out of Order		
		55	Brakehangers Broken		
	ELEC EQUIPMENT	56	Brake Rods Stripped		
26	Lamp Circuit Burned Out	57	" " Broken		
27	Fuse Boxes Burned Out	58	Brake Shoes "		
28	Lightning Arresters Bd. Out	59	" " Worn Out		
29	Controllers out of Order	60	Brake Handles out of Order		
30	Hood Switches out of Order	61	Ratchet Wheel & Dog " "		
31	Cables Burned Out				
32	Resistances Burned Out		TRUCKS		
33	" Wire " Off	62	Journal Boxes Broken		
34	Heaters out of Order	63	Pilot Boards "		
35	Headlight Glass Broken	64	Truck Springs "		
36	" Out of Order				
37	Electric Bells				

Form 1 C Size 5⅜" X 14¾"

................................COMPANY.

Line.................................. Date..........................

SUMMARY OF TRAINMEN'S REPORT OF CONDITION OF CARS

CAR BODY TROUBLE

	Car No	Car No	Car No	Car No	Car No	Car No	Car No	Car No	Car No
Heater									
[illegible]									
[illegible]									
Platform Gate									
Platform Chain									
Draw Bar									
Couplings									
Car Seats									
Car Dirty									
[illegible]									
[illegible]									
[illegible]									
[illegible]									
Brake Shaft & Handle									
Fender									
Doors									
Signs									
Hand straps									
Register									
[illegible]									
[illegible]									
[illegible]									
[illegible]									
Signal Lamp									

TRUCK TROUBLE

	Car No	Car No	Car No	Car No	Car No	Car No	Car No	Car No	Car No
Brake Chain									
Wheel Guard									
Brakes									
Flat Wheel									
Hot Box									
Spring									
Pedestal									

ELECTRIC EQUIPMENT TROUBLE

	Car No	Car No	Car No	Car No	Car No	Car No	Car No	Car No	Car No
[illegible]									
Motor [illegible]									
Burned									
Leads									
Controller									
Fuse Box									
Head Switch									
Trolley Base									
Pole									
Wheel									
Rope									
Gear									
Case									
[illegible]									
Headlight									
Resistance									

The [illegible] to form a duplicate from the "Trainmen's Report of Condition of Cars" [illegible] in by the Trainmen, placing opposite each trouble the number of car or cars reported. The original to be forwarded to the Supt. of Transportation and the duplicate to the Master Mechanic each day.

Signed.................. ....In charge

Form 2 Size 8" X 10⅞"

................................COMPANY

Car Inspector's Daily Report

.......................Station Date..........................

In good condition.				Needing repairs					
				Repaired		Formen's Column	Reported		Foremans Column
Car No.	Car No.	Car No.	Car No.	Car No.	No. of Trouble	Action taken	Car No.	No. of Trouble	Action taken

Note: – Car Inspector will fill out this form in duplicate each day, one copy to be forwarded to Master Mechanic, the other to remain with the Repair Foreman. Obtain numbers of Troubles on back of this sheet.

Mark cars that have been lubricated with an X in column to right of Car number

..................Inspector

..................Foreman

Form 3

COMPANY.

CAR TAG

REPAIRS MADE

....

....

....

....

Size 5⅛" X 6⅛"

Job Completed..................190

Repair men..................

....

....

..................FOREMAN

This tag with trouble numbers noted thereon should be attached by man in charge of Carhouse to each car sent to the shop for repairs. Repairs made should also be noted hereon and tag signed by shop foreman and turned over to Master Mechanic.

Form 3

COMPANY.

CAR TAG.

Car No..................LINE..................

TIME..................DATE..................190

TROUBLE NOS..................

REMARKS..................

....

....

Signed..................In charge

Form 7 Size 4" X 6"

................................Company

INDIVIDUAL TIME CARD

		Hrs.	Min.
Track & Roadway..........	1		
Electric Line..........	2		
Buildings & Fixtures..........	3		
Steam Plant..........	4		
Cars..........	6		
Electric Equip. of Cars..........	7		
Miscellaneous Equip..........	8		
Misc. Shop Expenses..........	9		
Car Service Supplies..........	21		
Misc. Car Service Expenses	22		
Cleaning & Sanding Tracks..........	23		
Misc. Office Expenses..........	28		
Store's Expenses	29		
....			
....			
....			
Date..................190....			
Name.................. Total			

Form 4

....COMPANY

SHOP ORDER

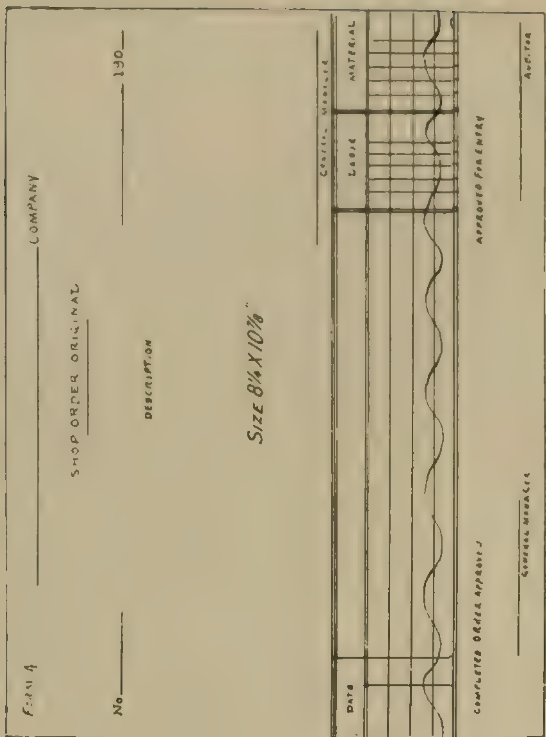
No.................. ....190....

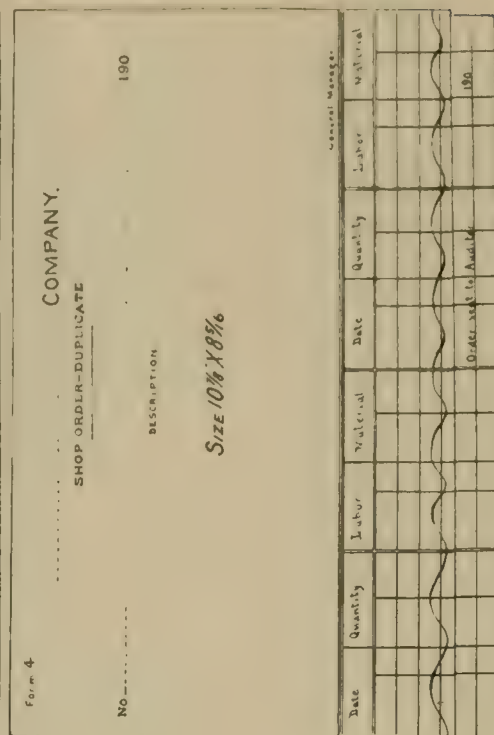
PLEASE FURNISH FOLLOWING MATERIALS

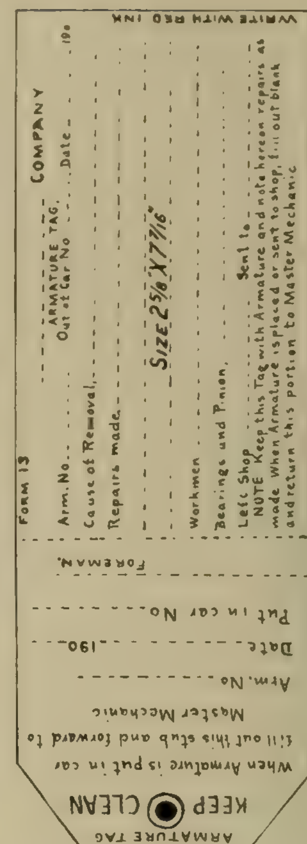
Size 4⅛" X 8⅜"

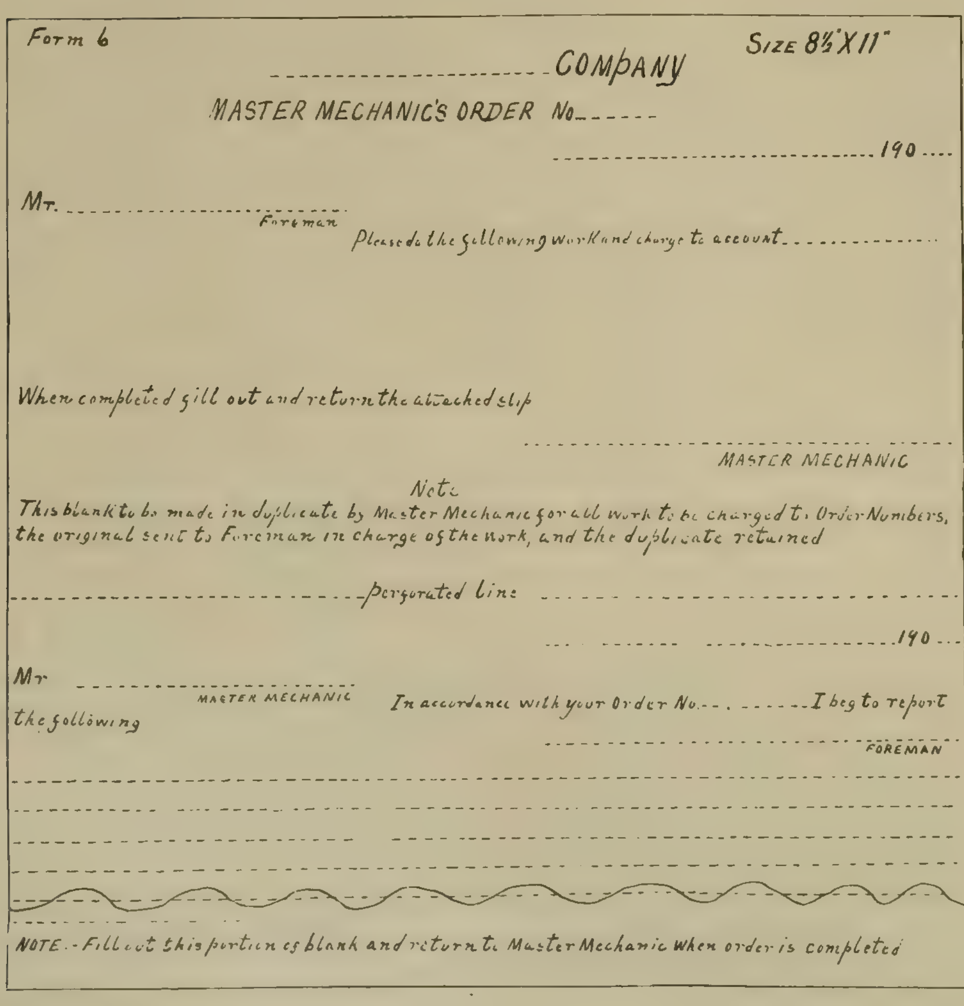
....

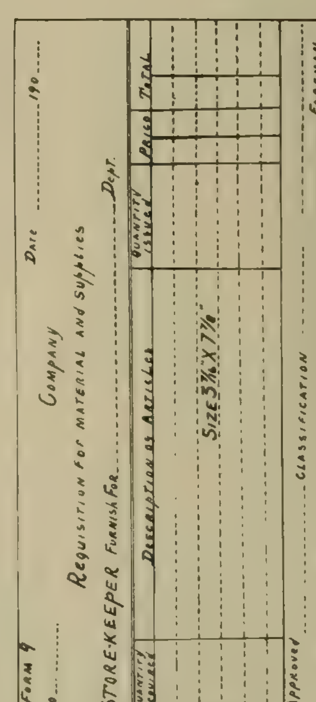
ALL LABOR AND MATERIAL USED IN MAKING THE ABOVE SHOULD BE CHARGED TO THIS SHOP ORDER NUMBER AND THE AUDITOR PROMPTLY NOTIFIED WHEN THE ORDER IS COMPLETED

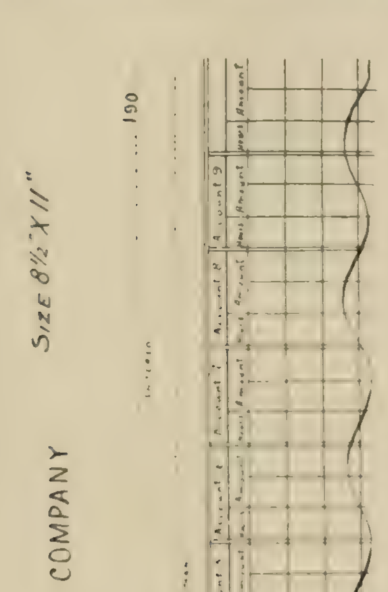

Form 4
No. ____
SHOP ORDER ORIGINAL
____ COMPANY
____ 190__
DESCRIPTION
Size 8¼ X 10⅞"
DATE
LABOR
MATERIAL
General Manager
COMPLETED ORDER APPROVED
GENERAL MANAGER
APPROVED FOR ENTRY
AUDITOR

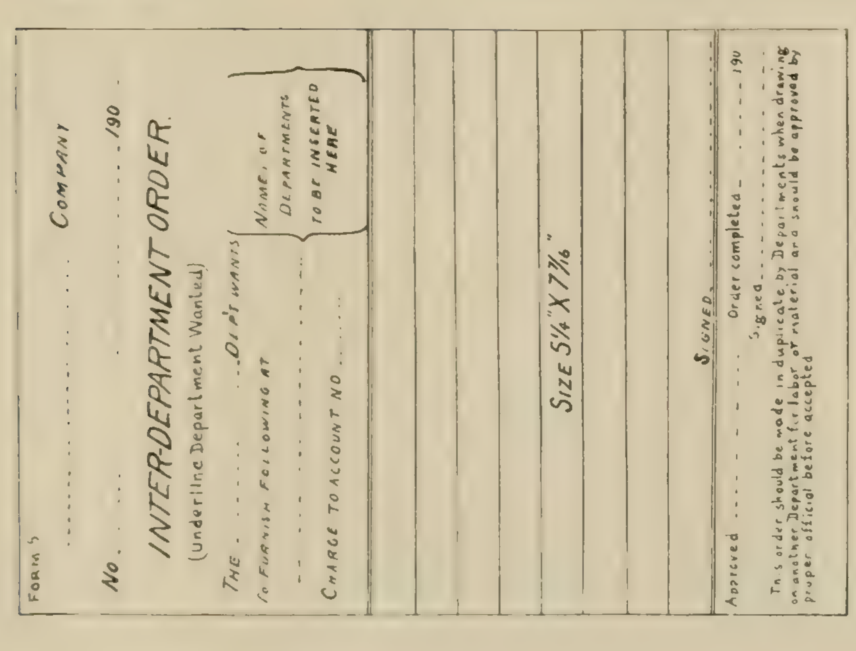

Form 4
No. ____
SHOP ORDER–DUPLICATE
COMPANY.
190
DESCRIPTION
Size 10⅞ X 8 9/16
Date | Quantity | Labor | Material | Date | Quantity | Labor | Material
General Manager
190
Order sent to Auditor

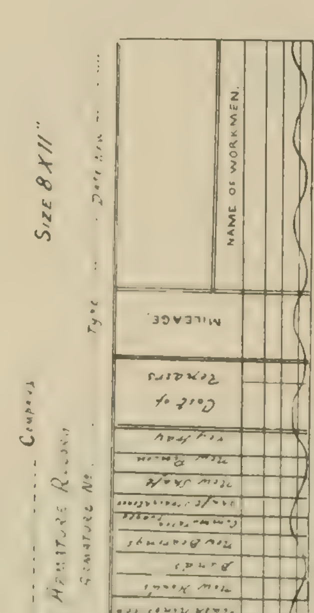

Form 13
COMPANY
ARMATURE TAG.
Arm. No. ____ Out of Car No ____ Date ____ 190__
Cause of Removal ____
Repairs made ____
Size 2⅝" X 7 7/16"
Workmen ____
Bearings and Pinion ____
Left Shop ____ Sent to ____
NOTE Keep this Tag with Armature and note hereon repairs as made. When Armature is placed or sent to shop, fill out blank and return this portion to Master Mechanic
WRITE WITH RED INK
FOREMAN.
Put in car No. ____
Date ____ 190__
Arm. No. ____
When Armature is put in car fill out this stub and forward to Master Mechanic
KEEP CLEAN
ARMATURE TAG


Form 6 Size 8½" X 11"
____ COMPANY
MASTER MECHANIC'S ORDER No.____
____ 190____
Mr. ____
Foreman
Please do the following work and charge to account ____
When completed fill out and return the attached slip
____
MASTER MECHANIC
Note
This blank to be made in duplicate by Master Mechanic for all work to be charged to Order Numbers, the original sent to Foreman in charge of the work, and the duplicate retained
____ perforated line ____
____ 190__
Mr ____
MASTER MECHANIC
In accordance with your Order No.____, ____ I beg to report the following
____
FOREMAN
NOTE.–Fill out this portion of blank and return to Master Mechanic when order is completed

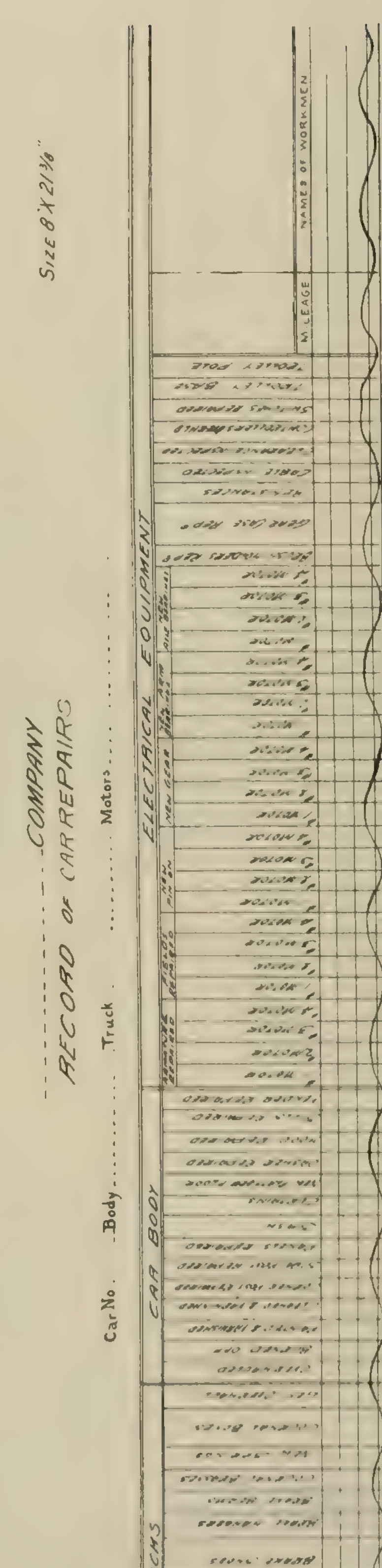

Form 9
No. ____
Company
Date ____ 190__
Requisition for Material and Supplies
STORE-KEEPER Furnish For ____ Dept.
Quantity Required | Description of Articles | Quantity Issued | Price | Total
Size 3⅞" X 7⅞"
Approved ____ Classification ____ Foreman







Note — Mark with an x in the Column or Columns the repairs to be recorded, on the Line opposite the proper dates, whenever possible place a number in the Column instead of the x to note the number of repairs to each item.



Note: Mark with an X in the column or columns the repairs to be recorded and on the line opposite the proper dates; whenever possible place a number in the column instead of the X to note the number of repairs to each item.

Form 8

............................COMPANY

APPLICATION FOR CHANGE IN PAY ROLL 190

Mr ....

Please approve the following change in the pay roll of the ....

Department to become effective ....

Size 5½X8⅜"

Approved and referred to Auditor for his information ....

NOTE.

Proposed changes in payrolls should be reported on this blank, submitted to proper officer for his approval, and sent to Auditor with first pay roll affected by the change. Give name, occupation or location, present and proposed rate of employee. In case of new appointment state if new position is being created or the name of employee who is being succeeded. When an employee is transferred from one local or location to another report the same whether rate is changed or not.

Form 11 Size 3¾"X5⅝"

.... COMPANY

WHEEL REPORT

Car No ____ Date ____

WHEELS TAKEN OUT		
Nos.	Circum.	Cause
Axle No..........	Gear No..........	
Make..........		

WHEELS PUT IN		
Nos.	Pressure	Circum.
Axle No..........	Gear No..........	
Make..........		
End No..........		
Remarks..........		

Form 12 .... COMPANY

WHEEL RECORD

Size 7⅞X9⅝"

Wheel No (Book form. These units may be arranged to suit convenience of users)								
Car No	Date in	Circ	Date out	Circ	Cause of removal	Mileage		
Wheel No								
Wheel No								
Wheel No								
Wheel No								

Form 15 ....COMPANY

INDIVIDUAL CAR RECORD Size 6⅝X7¹¹⁄₁₆"

Car No. ____ Date ________190__

Type of car	Make of platform gates
Builder	" " heaters Type
Date built	" " seats
Style of doors	" " trolley pole and stand
Total weight of car body	Style of seating Capacity
" " " trucks & el. equipmt	" " curtains and fixtures
Length of car body	Number of heaters
" over bumpers	Type of motors
Height of car body	Number of motors
" from rail to top of trolley stand	Horse power of motors
Width over sills	Type of controllers
" " eaves	Type of truck Motor
Wheel base	" " " Trailing
Make of truck Single Double	Size of wheels Motor
Size of axle	" " " Trailing
Make of car couplings	
Make of registers	

written in red ink. The data on this tag furnishes the information for filling out Form 14.

Individual Armature Record.

This record is arranged on the same principle as the record of car repairs, and in noting the repairs made, the same rules apply. This record will be more convenient in card form.

The last blank under consideration is Form 15.

Individual Car Record.

This blank is in card form and if properly filled out, will become one of the most important records in the mechanical department. Spaces are provided for the "Car Number," "Type of Car," "Builder," and other detail information.

The committee desires to thank the members of the above associations for their kind and prompt co-operation in sending blanks when requested.

Respectfully submitted,

H. H. ADAMS, Superintendent of Shops, The United Railways & Electric Co., Baltimore, Md.

H. E. FARRINGTON, Superintendent of Car Repairs, Boston & Northern Street Ry. Co., Chelsea, Mass.

For the American Railway Mechanical & Electrical Association.

H. M. PEASE, Auditor, International Railway Company, Buffalo, N. Y.

W. G. McDOLE, Auditor The Cleveland Electric Railway Co., Cleveland, Ohio.

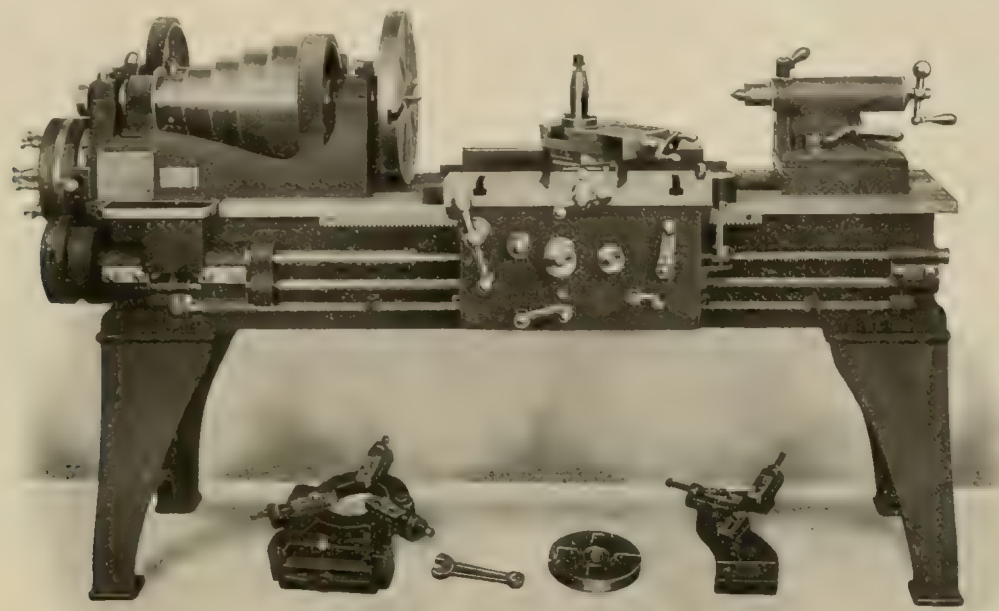
For the Street Railway Accountants' Association of America.

The National Electric Co., Milwaukee, Wis., has issued in pamphlet form the paper by Mr. W. L. Waters, read before the twentieth annual convention of the American Institute of Electrical Engineers, at Niagara Falls, June 29, 1903, on "Commercial Alternator Design," together with the discussion which was had on this paper before the Institute. This paper will be found of much interest to Electrical Engineers, as it describes and illustrates this type of apparatus as made by the National Electric Co.

Modern Machine Tools.

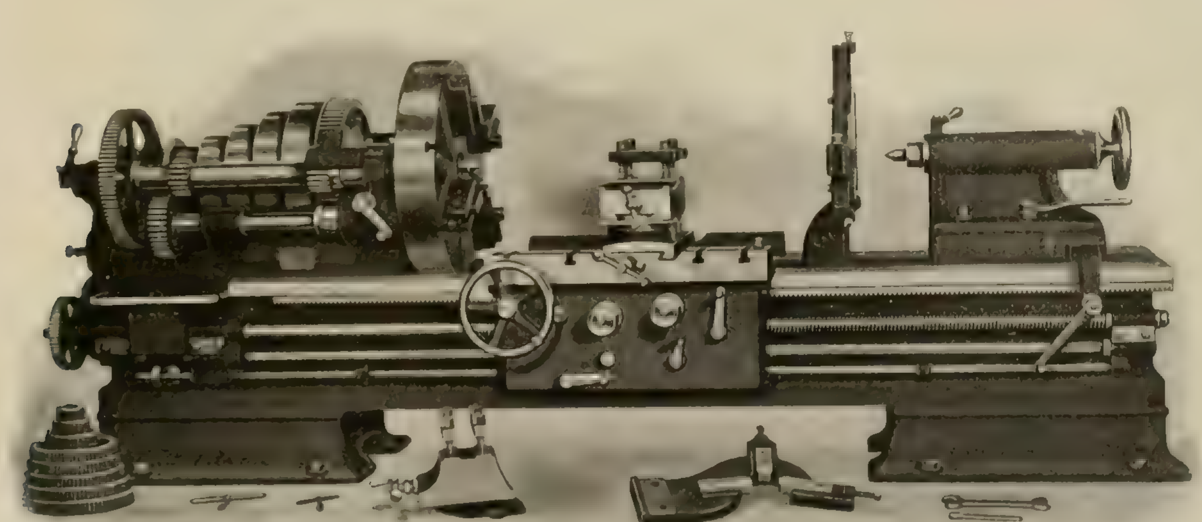
TWO "HAMILTON" LATHES OF RECENT DESIGN.

The demand for higher efficiency in the various types of labor-saving machinery seems to be steadily increasing, and this is nowhere more apparent than in the case of machine tools. Improvement after improvement has been made until the present day machines completely outclass those of only a few years ago. This development is well illustrated by the two machines shown in the accompanying engravings, one representing a 16-in. "Style A" lathe manufactured by the Hamilton Machine Tool Co., of Hamilton, O., and the other a heavy 32-in. triple geared lathe made by the same concern.



"HAMILTON" 16-IN. ENGINE LATHE, STYLE "A."

It is pointed out by the manufacturers that these are not special machines, in the sense that they are adapted to a certain class of work only, but that they are standard tools designed to take care of a wide range of work in the most satisfactory and profitable manner. These machines are a necessity in every machine shop, no matter of what size, but are particularly valuable in the small manufacturing plant and in such places as repair shops, where the equipment is often limited and where the same lathe is frequently called upon to do jobs of widely differing character.



"HAMILTON" 32-IN. ENGINE LATHE.

All sizes of "Hamilton" lathes have these features in common: They are strongly built yet symmetrical in appearance, and the different parts are proportioned so as to be most effective for their

purpose. They contain all the essential features of up-to-date lathes and in addition possess several advantages which are peculiarly their own. The spindles are from crucible steel forgings, have a large hole bored through their entire length, and are finished by grinding so as to insure accuracy; the spindle boxes are of hard phosphor-bronze, anti-friction thrust bearings are provided, the tail spindles are graduated, both the cross and longitudinal feeds are automatic, and in short every care is taken to provide for durability and convenience.

The distinguishing feature of the "Style A" lathes is the patented universal screw-cutting and feeding arrangement, an improved system of mounted change gearing, designed to give a full range of screw pitches or feeds without removing a single gear and thereby enable the operator to change quickly from one thread or feed to another. It also affords a positive geared feed of wide range, 48 changes being instantly available, the same as for the screw pitches.

The headstock has exceptional strength and rigidity and is provided with a five-step cone of large size, affording ample driving power. Lathes up to 20-in. swing, often used on work requiring frequent change from back gear to belt speed and vice versa, are provided with an improved cone locking device so that the changes can be quickly made without the use of a wrench.

The chasing dial on the carriage is a feature greatly appreciated when screw-cutting is being done. It consists of a small dial attached to the right of the carriage and rotating in unison with the lead screw; the top of the dial is graduated to show the movement of the lead screw and by watching these graduations it is a simple matter to throw in the half nut at the proper time; this makes it unnecessary to reverse the lathe and permits the carriage to be returned quickly by hand, resulting in a considerable saving of time, especially on long screws.

The 32-in. lathe is unusually heavy and powerful and is particularly adapted for a heavy class of work. It is usually furnished with triple gearing as shown in the illustration, but can also be supplied with plain back gears if desired. The apron is of the double or box construction, giving the studs a bearing at both ends. All feeds can be reversed from the apron by a lever conveniently located, same as on the smaller sizes. Quick change gears are not provided for the reason that frequent changes are not usually necessary on lathes of this size, simplicity of construction and plenty of driving power being the principal considerations. A powerful train of coarse pitch gears is therefore employed for obtaining both the screw pitches and feeds, the gears being connected through a pull-pin arrangement which affords double the usual number of threads and feeds, the range of the 32-in. lathe being threads from ¼ to 32 per inch and feeds from 2 to 256 per inch.

The compound rest has large and broad bearing surfaces and is provided with taper gibs permitting quick and accurate adjustment. A heavy clamping block for carrying large tools is used instead of the ordinary round tool post, although the latter will be furnished if preferred. Power angular feed is provided for the compound rest, controlled by a sliding shaft at the right of the cross feed screw.

In point of construction the lathes are of the highest standard, especial care being taken to insure accuracy at all points, while the materials used are of the best quality. The "Style A" lathes are built in various sizes from 14-in. to 28-in. swing, the larger sizes simply being designated as back geared or triple geared 32-in. and 36-in. lathes, as the case may be. All sizes are of course furnished with any lengths of bed required, and with taper attachments, turrets and similar accessories.

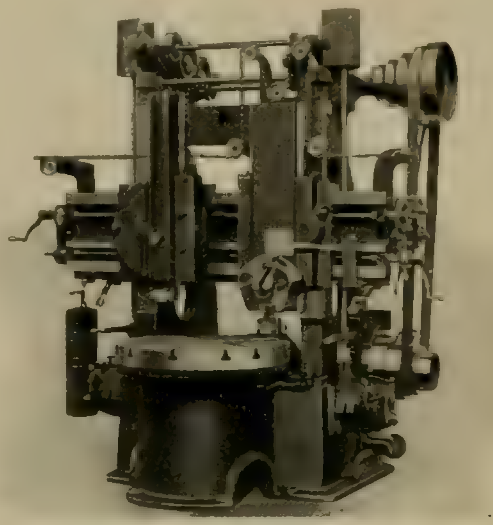
THE BULLARD BORING AND TURNING MILL.

The accompanying illustration shows the 42-in. rapid production boring and turning mill manufactured by the Bullard Machine Tool Co., of Bridgeport, Conn., a mill that is well adapted for repair shop work and one that is very generally used in the manufacture of electric motors.

This machine has a capacity of 42 in. diameter and 33½ in. in height, the table, which has ten changes of speed, being 37½ in. in diameter. The table spindle has a self-centering tendency, due to the large angular bearing, so that the combined weight of the table and spindle, as well as that of the work upon the table, tends to preserve rather than destroy the alignment. The journal and headstock gears are entirely immersed in oil and the wear is thereby reduced to a minimum.

One of the features of the Bullard machine is the speed changes that may be obtained by shifting of the one pulley belt, a thing very easily and quickly accomplished by the use of a mechanical belt shifter. The machine is so constructed that it is possible to at any time change from belt to motor drive by mounting the motor at the side of the machine and making belt connection to the top shaft. It is claimed that this element of elasticity between motor and cut has proved of great value in prolonging the life of both motor and machine. All high speed shafts are bronze bushed and self oiling and are amply protected.

The feeds are independent for either head and are positive. Ten changes are provided which range from 1-32 in. to 3-4 in. horizon-



BULLARD BORING AND TURNING MILL.

tally and from 1-50 in. to 1-2 in. in vertical and angular directions, any one of which is easily obtainable by the movement of a lever. The left hand head has a downward movement of 30 in. and the right hand turret head has a movement of 24 in. The right hand head is arranged for cutting all threads from 4 to 18 per inch, including 11½, and special gears are provided therefor. Either head may be brought to the center for boring and an absolute center stop is provided. By means of a quick power traverse device the heads are rapidly handled by power. This attachment is of great value as a time saver, operating the heads in one-fifth the time required by hand and with no expenditure of effort on the part of the operator. The construction of the cross head is entirely new, all tendency of the saddle to bind or tilt being obviated by the location of the guide bearing and the relation of the cross feed screw thereto. The cross rail is raised and lowered by power.

The machine as shown is equipped with one turret and one plain head, but is also regularly built with two plain heads, which can be set at any angle.

A very high ratio of gearing has been incorporated in the drive of this machine and there is an excess of power for all ordinary work, the machine having been designed with a view of using the new high speed steels to their highest advantage. The machine is self contained and does not require an expensive foundation. The net weight is 14,000 lb. and floor space required, 66x110 in.

AMERICAN TOOL WORKS CO'S. RADIAL DRILL.

The illustration herewith shows a plain radial drill with 4-ft., 5-ft. and 6-ft. arms which is made by the American Tool Works Co., of Cincinnati. While there is a great variety of work for a radial drill in street railway shops, it is particularly valuable for drilling up car and motor frames. The feeding mechanism on the head of this drill calls for especial mention, as it provides eight distinct rates of feed covering a carefully chosen range, in geometrical progression, from .007 in. to .063 in. These feeds are readily obtained by the simple turning of a dial on the feed box. This method of feed change is very simple, as it requires no reference to index plates and subsequent handling of levers. Feeds operate through

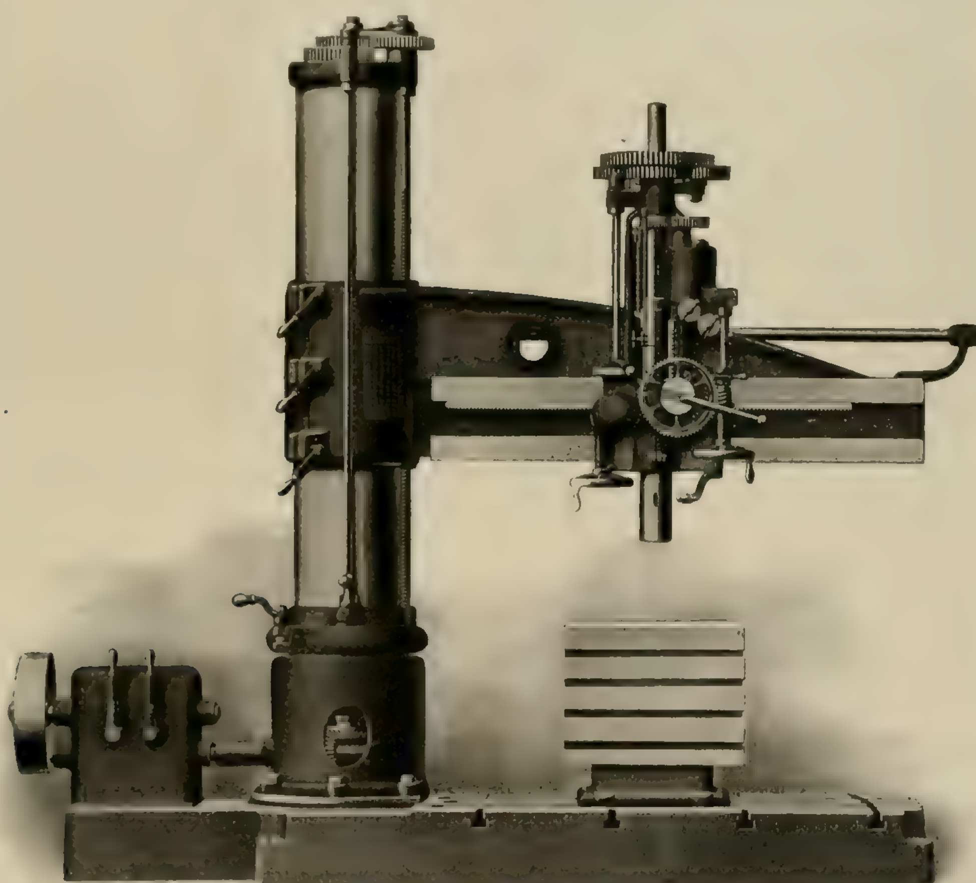
a friction which permits a drill being crowded to its limit without strain to the feed works.

A plate is provided indicating twist drill sizes, from ½ in. to 3½ in., inclusive, and their respective proper feeds, which in connection with the dial referred to permits the operator to immediately secure the proper feed for the drill he is using. Feeds can be automatically tripped at any position of spindle by an adjustable trip dog and pointer acting on a worm clutch. There are depth graduations on the spindle and all depths can be read from zero. Two or more dogs can be supplied, making it possible to counterbore any number of holes without resetting. The trip acts automatically at full depth of spindle.

The speed box is of the geared friction type providing four changes of speed, each being instantly available by use of the two levers shown in the illustration. Frictions are of the company's patent double band type, employing very few parts in their construction, which can thus be made of such large proportions as to be free from slippage under the severest cuts, and obviating the use of loose delicate parts. A motor of any type can be readily attached at any time, connection being made through chain, gear or belt. The speed box can be easily interchanged with a cone by simply breaking a coupling connection.

The spindle has sixteen changes of speed, ranging from 16 to 267 in geometrical progression, all immediately available without stopping the machine. The column is of double tubular type, the sleeve or outer column revolving on conical roller bearings and is clamped in any position by the company's patented V clamping ring. The inner column extends the entire height and has a full bearing for the outer column at both top and bottom. The arm is of parabolic beam and tube section, giving great resistance to bending and tortional strain. The arm is clamped to the column by three binder levers and is raised and lowered rapidly by double thread coarse pitch screw hung on ball bearings.

The head is moved rapidly along the arm by a hand wheel through a worm wheel and rack pinion, the device being self-locking at all points, and it being necessary to use the hand binder only for the heavier operations. Back gears are located on the head and they may be engaged or disengaged without shock or jar while the machine is in operation. The spindle is counterbalanced. The tapping mechanism is carried on the head, between the back gears and speed box, which location makes unusually heavy tapping operations possible, and permits taps to be backed out at an accelerated speed. The base is of massive proportions, strongly ribbed, especially at the point of support of the column. The table has a top surface of 20x20 in., and also side surface, the latter giving the equivalent of an angle plate.



AMERICAN TOOL WORKS CO. RADIAL DRILL.

LODGE & SHIPLEY ENGINE LATHES

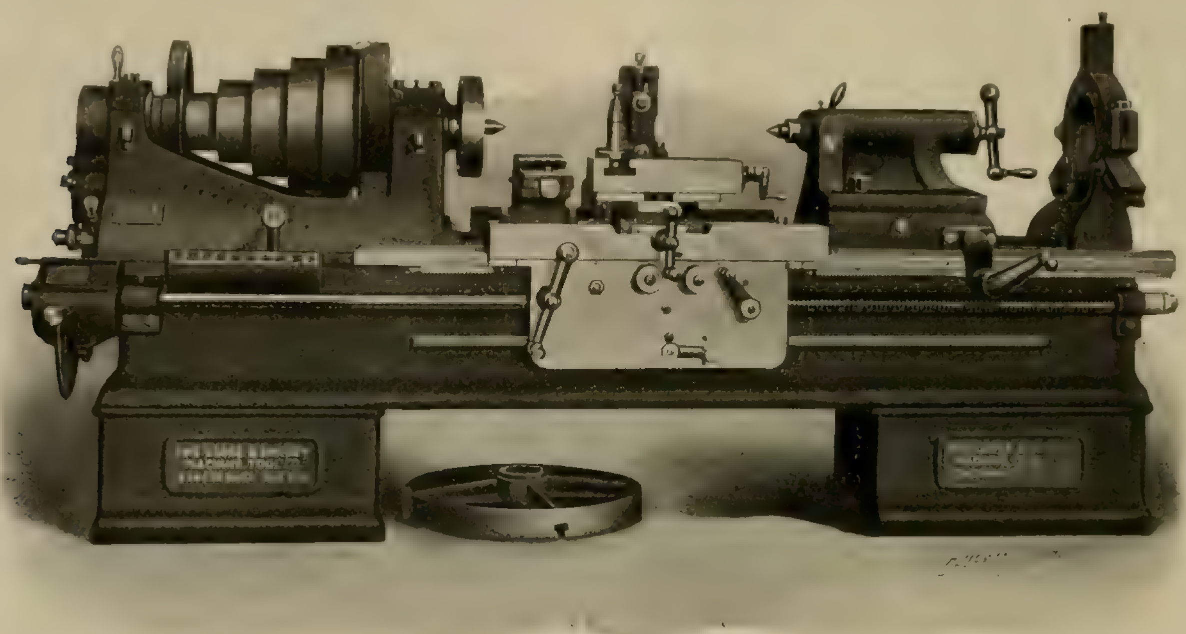
The engraving represents the latest improved engine lathe, manufactured by the Lodge & Shipley Machine Tool Co., of Cincinnati, Ohio. This company does not manufacture any machine tools other than lathes.

Among the several features of this lathe, special attention is called to the quick change gear mechanism, by which any feed or thread the lathe cuts may be obtained instantly and without taking off or putting on gears. The head is neat but massive, the cone pulley has five steps, the faces of which are extra wide, and the ratio of back gearing is very high. The tailstock is shaped so that the compound rest may be set at an angle which permits the tool to be operated on the smallest diameters. A new device has also been incorporated for clamping the tailstock spindle without any danger of throwing it out of line. The compound rest is substantially built and is in keeping with the rest of the lathe and both upper and lower slides are fitted with taper gibs. The apron is fastened to the carriage by hexagonal-head cap screws, besides being tongued and grooved to the carriage. The threads of the screws are never in use except when the lathe is cutting screws.

The points of excellence claimed for the screw cutting mechanism of this lathe are: No gears need be removed to obtain the differ

ent threads or feeds on the index; provision is made on the reverse plate of each lathe to receive a compound gear, so placed as to cut either a full column of finer threads or a column of coarser threads than shown on the index plates; the compound gear can be furnished of a ratio suitable for any reasonable number of threads per inch, or for coarser fractional pitches; the countershaft is provided with a cone pulley of larger diameter than the one on the spindle, in order to give ample belt power; the lathe is furnished with plain, compound, or raise and fall rest, as may be desired.

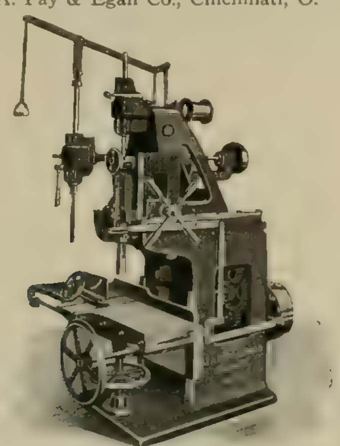
The Lodge & Shipley Machine Tool Co. lathes are on exhibition at the Louisiana Purchase Exposition, motor driven, in connection with the Bullock, Northern, Triumph and Western Electric companies' exhibits, also in the testing plant of the Pennsylvania Railroad. The Marshall & Huschart Machinery Co., 64 South Canal St., is the Chicago representative for the Lodge & Shipley company.



LODGE & SHIPLEY ENGINE LATHE.

AN ENTIRELY NEW MORTISER.

The accompanying illustration is that of a machine especially designed and built to supply the demand of street railway car shops for a thoroughly reliable hollow chisel mortiser and is manufactured by the J. A. Fay & Egan Co., Cincinnati, O.



NEW MORTISING MACHINE.

This machine embodies many new and important advantages, is easy of adjustment and operation, strong and rigid, and free from complicated mechanism. The main column is cast in one piece with a broad floor base and the upper part is carried on friction rollers, the pilot wheel for moving the upper column travelling back and forth with it. Stops are provided for the transverse movement of the upper column, the extent of which is 11 in. The chisel ram is mounted on a dovetail slide with a stroke of 6 in., making it easy of adjustment. The boring chisel is driven by miter gears, which permit of belting it from above or below the center of the machine. The feed mechanism is contained in the lower column and gives two speeds to the chisel. The feed is controlled by levers within convenient reach of the operator and is so arranged as to instantly stop the chisel at any point of its stroke. The table is mounted on the lower column and is raised and lowered 12 in. by means of screws, has a lateral movement of 18 in. by means of rack and pinion and has stops for gaging the length of mortise. It will accommodate material 17 in. high and 12 in. thick and an adjustable clamp is provided for holding any thickness of mortise. The auxiliary boring attachments are placed on one or each side of the frame at such a distance from the chisel as will permit of adjusting them to an angle of 30° in either direction. The depth of stroke of these boring attachments is 12 in. and the transverse movement 11 in.

A recent new patent is for a swivel bullseye signal, granted to Mr. A. S. Macreadie, superintendent of the South Portland branch of the Portland Railway Co. The device consists of a round piece of brass painted red on one side, and green on the other. It is arranged in a socket that allows the motorman to reverse it without the least trouble. If there are cars following, the motorman simply exposes the red side of the bullseye. If the road is clear the green side is shown. The attachment is screwed on to each end of the car, thereby doing away with the present jumping off. The bullseye is eight inches in diameter. The spring attachment allows it to be reversed with three simple movements of the hand and in time almost instantaneous.

MINES AND MINERALS DIRECTORY has recently been compiled and published by Mines and Minerals, Scranton, Pa. This publication was compiled for the convenient use of mine owners, mine and mill officials, purchasing agents, etc., and contains the names and addresses of reliable manufacturers of, and dealers in, machinery, equipment, supplies, instruments, tools, etc., used in the mining and milling industries. The various headings are alphabetically arranged so as to make it easy to find the names and addresses of concerns from whom any desired article may be purchased. This directory is revised, corrected, and brought up to date semi-annually.

Personal.

MR. M. M. QUIMBY has been appointed master mechanic of the Northern Texas Traction Co., Ft. Worth, Texas.

MR. A. H. WARREN, formerly superintendent of the Houghton County Street Railway Co., Houghton, Mich., has been appointed manager of the Brockton & Plymouth Street Railway Co., Brockton, Mass.

MR. ARTHUR W. BRADY, who has been general counsel of the Indiana Union Traction Co., and the Indianapolis Northern Traction, was elected president of these two roads to succeed Mr. George F. McCullough, resigned.

MR. CHARLES A. GARDINER has been appointed general attorney for the Interborough Rapid Transit Co. Mr. Gardiner was general attorney of the Manhattan Railway Co., and this appointment makes him attorney for both the underground and elevated systems.

MR. J. S. YOUNG, formerly traffic agent of the Toledo Railways & Light Co., but who resigned a year ago to take a position as auditor of the Rapid Transit Co. of Chattanooga, has been appointed general freight agent of the Toledo, Bowling Green & Southern Traction Co.

MR. EDWIN C. FABER, general manager of the Aurora, Elgin & Chicago Railway Co., was on October 19th married to Miss Bessie May Hawley, daughter of Mr. and Mrs. Frank Oswald Hawley of Aurora, Ill. Mr. and Mrs. Faber will be at home after November 15th at their residence, Golf Lane, Wheaton, Ill.

MR. L. ROBINSON, formerly superintendent of the interurban and the Oak Cliff lines of the Northern Texas Traction Co., has been appointed general superintendent of the entire system. Mr. C. T. Edwards, formerly superintendent of the Ft. Worth line of the company, has been appointed assistant superintendent.

MR. JOHN H. CAMLIN, who, it was reported, had resigned as secretary of the Rockford & Freeport Railway Co., on account of the consolidation of this road with the Rockford & Interurban, still retains his office with the former company, which continues its organization for the purpose of building new branches tributary to the Rockford & Freeport line.

THE OKLAHOMA GAS & ELECTRIC CO. was reorganized Oct. 20, 1904, and the following officers and directors chosen: President, C. B. Ames, Oklahoma City; vice-president, H. M. Byllesby, Chicago; secretary, D. T. Flynn, Oklahoma City; treasurer, A. H. Grimes, Guthrie; R. C. Dawles, Chicago; Samuel Insull, Chicago; H. M. Newton, Sparta, Wis. R. J. Graf, Chicago, was appointed assistant secretary and treasurer, and H. M. Byllesby & Co., New York Life Bldg., Chicago, were retained as engineers for the property.

MAJ. EDWIN E. DOWNS, president and general manager of the Winnebago Traction Co., Oshkosh, Wis., has resigned his position. Mr. Downs became identified with the Winnebago Traction Co. several years ago and during the period he has had the management of the company, the system has prospered and grown. Ten miles have been added to the city tracks, making a total of 17 miles, and the interurban lines from Oshkosh to Neenah, a distance of about 16 miles, and from Oshkosh to Omro, have been constructed during that period. Mr. Downs' successor has not been chosen at this writing.

Obituary.

MR. HENRY C. PAYNE died October 4th at the Arlington Hotel, Washington, D. C. Mr. Payne was Postmaster-General of the United States, and formerly vice-president of the Milwaukee Electric Railway & Light Co., and he was also president, in 1893-94, of the American Street Railway Association. He was born in Ashfield, Mass., Nov. 23, 1843, and graduated at Shelburne Falls Academy in 1859. In 1863 Mr. Payne went into the dry goods business in Milwaukee, and in 1872 he entered politics. He became secretary of the Milwaukee Young Men's Republican Club, and then its president. He next filled leading positions in county, state and national committees and conventions and was postmaster of Milwaukee from 1876 to 1886. He became Postmaster-General Dec. 17, 1901, succeeding Mr. Charles Emory Smith. Mr. Payne also had important business connections. In 1886 he organized the Wisconsin Telephone Co.; from 1890 to 1895 he was receiver of the Northern Pacific Ry. He was also prominently identified with the consolidation of the Milwaukee street railway and electric lighting plants.

Strong Car Construction as a Factor of Safety.

An accident which occurred on the electric division of the Fonda, Johnstown & Gloversville Railroad near Amsterdam, N. Y., September 16th, emphasizes the importance of heavy car framing for electric cars intended for high speed interurban service. The accident was a collision between one of the large interurban cars built by the St. Louis Car Co. for the Fonda, Johnstown & Gloversville Railroad Co., and a 15-ton road roller. At the point where the accident happened, the electric road crosses the old Mohawk Pike, which was the original stage route from Albany to Buffalo before the time of steam railroads. The highway or Pike was being repaired at this point by a construction company.

The contractors were using the road roller in their work and had occasion to cross the electric tracks with the roller. An interurban car, westward bound, left Schenectady at 5 o'clock in the evening and it was about 5:30 p. m. when the accident happened. The schedule of the car on this run is about 45 miles an hour. From facts which the company has been able to obtain, the road roller had started to cross the track and in some way it became stalled on the crossing. The road makes a curve east of this point, and the motorman was unable to see a distance of more than 500 ft. It is thought that the motorman saw the roller at a distance of about 500 ft. and started at once to slacken the speed of his car. It is believed that the car was running at the rate of about 15 miles an hour when it came in contact with the roller. Mr. H. O. Rockwell, to whom we are indebted for the information concerning the accident, happened to be on the car following the one involved in the accident. Mr. Rockwell states that the results of this accident proved to him beyond question of doubt that the construction of this car is the proper thing for high speed interurban work. The car in question is one of the eight double truck closed cars built by the St. Louis Car Co. for the electric division of the F. J. & G. R. R., and they were among the first electric cars in this country to be built with steel floor framing. The cars have steel floor framing throughout, and are mounted on extra heavy spring motion M. C. B. type double trucks. The cars were fully described and illustrated in the "Street Railway Review" for Aug. 20, 1903, page 495.

The car showed comparatively little damage after the accident, excepting to the front platform which was of wood. The roller came in contact with the car above the bumper and demolished the front vestibule. Otherwise the framing was uninjured. Mr. Rockwell states that the alignment of side and cross sills underneath the car was as good as when it came from the factory.

There were 33 passengers on the car and only 3 of them were injured, one of them having a slight scalp wound, another was struck in the eye by some foreign substance and the third was bruised a little. The motorman was pretty severely hurt when the vestibule was demolished and received a fracture of one leg. After the car struck the roller, the front end of the car was forced from the leading truck, and the truck went back toward the center of the car, and the car body not having any support at the front end came down on the end sills which rested on the track. The end sills or knees were bent slightly but the sides of the car including the frame work, glass, sash, etc., were uninjured.

At the point where the accident occurred, center pole construction had been used and when the car left the truck it struck a 40 ft. pole and broke it off close to the ground and also broke the pole about 8 ft. above the ground. The road roller was utterly demolished.

Freight service has been inaugurated on the line of the Indiana Union Traction Co. between Indianapolis and Logansport, which will give Logansport freight connections with all of the cities on the company's lines.

The new power house of the Terre Haute Electric Co., Terre Haute, Ind., is now ready for use. The plant will be used as a sub-station to the present station, and will give the company plenty of power to operate the city and interurban lines.

Test of a Reeves Simple Engine.

At Sibley college, Cornell University, several tests of the Reeves simple engine were made by Prof. R. C. Carpenter, assisted by Prof. H. Diederichs. The purpose of these tests was to determine the steam consumption, mechanical efficiency and general behavior of the engine under various conditions of load.

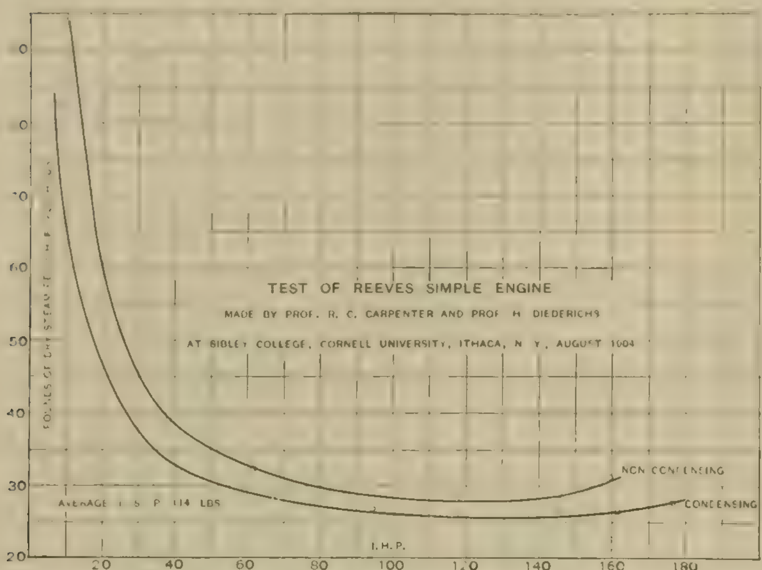


CHART 1.

The diameter of the cylinder of this engine is 15 in., the stroke 14 in. The steam valve is of the piston type, the cylinder and valve chest are well lagged, and the main bearings and pin bearings are lined with the best quality of anti-friction metal, insuring low bearing pressures and good lubrication. All of the adjustments on this machine are easily made, and after everything was put in good order no trouble was experienced through heating or otherwise under any load the engine was able to carry. The engine was furnished with two fly wheels for the purpose of this test, one containing an automatic governor of the Rites type, the other was used for the application of a prony brake to furnish the desired load.

The engine was connected through 25 ft. of 4-in. pipe to a battery of two Babcock & Wilcox boilers, while the exhaust was connected through about 20 ft. of 7-in. pipe to a Wheeler surface condenser. The steam after being condensed was pumped to tanks on the floor above and weighed, the steam used by the engine being thus accurately determined. Two series of runs were made, one condensing the other non-condensing. For the latter the air cock of the condenser was left open, thus insuring condensation under atmospheric pressure. For the former this was closed, and the runs were made under a vacuum as high as could be attained. The observations taken were as follows:

The condenser itself was found to be tight. The load was applied by means of a prony brake the arm of which was 8 ft. 6 in., the zero reading on the scale being 47 lb. Speed was observed by means of a continuous counter and a throttling calorimeter was used to determine the quality of the steam, which was high throughout. The other readings taken were those of steam pressure at the throttle, temperatures of injector water, inlet and outlet, and that of condensed steam. All of these readings were taken every 10 minutes, except those of the weight of condensed steam. Indicator cards were taken every 10 minutes.

The most important result, the steam consumption, is computed for the i. h. p. and the d. h. p. per hour on the basis of dry steam. This with all the other results are shown on the accompanying charts. The first shows the pounds of dry steam per i. h. p. per hour. The second chart shows the dry steam consumption per d. h. p., these curves being similar to the preceding ones. The third chart shows the relation between the mechanical efficiency and the d. h. p. The results are excellent. The highest mechanical efficiency reached non-condensing is 92.5 per cent at 147.1 d. h. p. and 159.2 i. h. p. For the condensing series the best figure is 95.8 per cent at 154.1 d. h. p. and 165 i. h. p. The mechanical efficiency reaches 90 per cent at 78 d. h. p., 95 per cent at 133 d. h. p. and remains nearly constant from there up to the highest load, 168.2

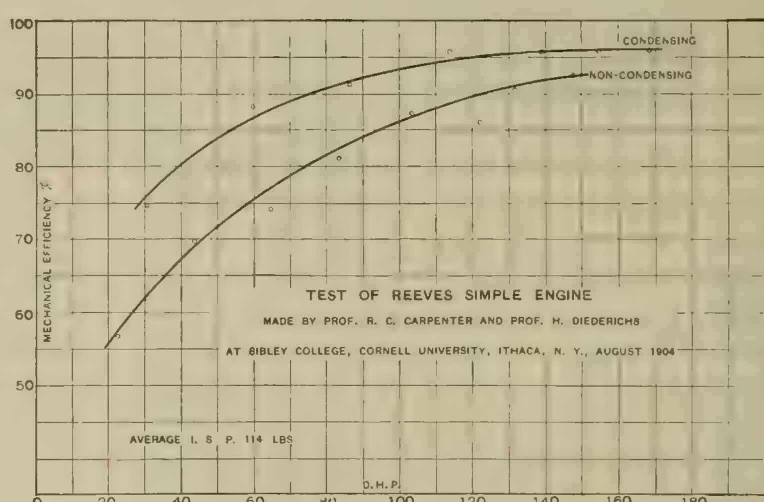


CHART 3.

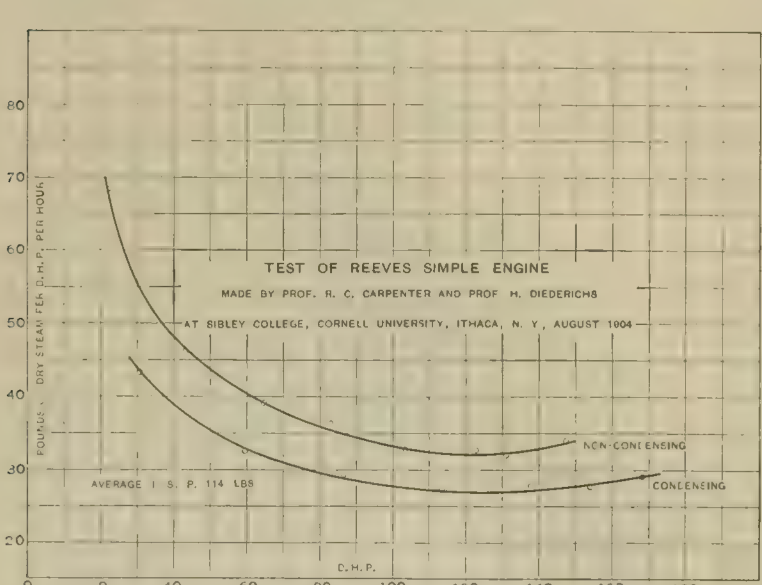


CHART 2.

St. Marys Street Railway Co.

Among recent street railways that have been projected and which undoubtedly will be a marked success is the St. Marys Street Railway Co. of St. Marys, Pa., which has been incorporated with a capital stock of $42,000. The immediate object of the company is the construction of an electric railway in St. Marys. Later the line will be extended to Kersey, Pa., a distance of six miles. The officers of the company are H. C. Stackpole, president; D. B. Anderson, vice-president; J. S. Speer, treasurer. These officers, with H. A. Speer and G. P. Fryling, constitute the board of directors. Mr. H. A. Speer is also vice-president and general manager of the Speer Carbon Co., and Mr. G. P. Fryling is also connected with the same company. The preliminary work has already commenced.

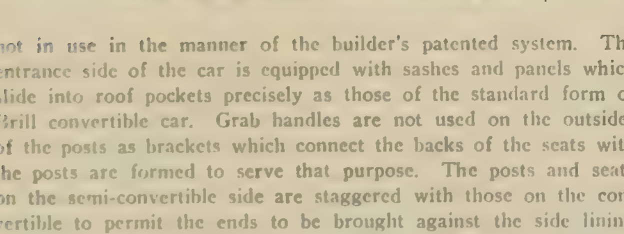
A Remarkable Type of Car for Cleveland.

An article in the "Review" for August, 1904, described a novel type of car being built by the J. G. Brill Co. for the Montreal Street Railway Co. Another car of similar type has just been completed by the same builders for the Cleveland Electrical Railway Co. Instead of having end entrances as the Montreal car, the car for Cleveland has a vestibule in the center on the convertible side. This car is for trailer service and the special advantages of the type are large seating capacity; division into two compartments, one being for smokers; ability to change from closed to open, or vice versa, in a few minutes, and the left side being semi-convertible, passengers are prevented leaving or entering that side, thus doing away with the cause of many accidents. The car is divided exactly

BRILL CAR FOR CLEVELAND—SEMI-CONVERTIBLE SIDE.

at the center with a partition which extends to a post half-way between the sides of the car, at which post the doors giving entrance to both compartments meet. The doors when open taken position at right angles to the sides of the car at the side of short partitions, and by a swivel wheel at the top guided by a curved rail move at an angle to the partition posts mentioned. The distance between the two vestibule outer posts is 4 ft., and the section of folding running board at the vestibule is 5 ft. long.

The rear compartment is for smokers and has seats composed of ash slats. At the very rear is a long curved seat accommodating six passengers, which with the ten double seats, afford seating for 26 passengers. The forward compartment is arranged in the same manner but with seats upholstered in spring cane. The three large sashes at either end are arranged to drop into pockets while those of the convertible side are raised into pockets in the side roof when



BRILL CAR FOR CLEVELAND—CONVERTIBLE SIDE.

not in use in the manner of the builder's patented system. The entrance side of the car is equipped with sashes and panels which slide into roof pockets precisely as those of the standard form of Brill convertible car. Grab handles are not used on the outsides of the posts as brackets which connect the backs of the seats with the posts are formed to serve that purpose. The posts and seats on the semi-convertible side are staggered with those on the convertible to permit the ends to be brought against the side lining and between the posts, thus increasing the aisle space about 3½ in. At the side of the vestibule partition in the smoking compartment is a vertical hand-wheel on a brake-shaft 6 ft. 6 in. from the floor to center of wheel. The shaft and wheel are placed in this position to take up as little space as possible as the brakes are only required while moving the car in and out of the car barn. The seats on the semi-convertible side are 37 in. long and those on the convertible side 36¼ in.; the aisle is 19 in. wide. A bright and attractive appearance is given to the interior of the car by the wood work being finished in ash and with ceilings of birch.

The length of the car over the crown pieces is 37 ft.; width over sills including sill plates 7 ft. 10½ in., and over posts at belt 8 ft. 2 in. The sweep of posts on the semi-convertible side is 1¾ in and on the convertible side 1¼ in. From center to center of posts 2 ft. 8 in. Thickness of corner posts 5¾ in. and side posts 3⅜ in. on the convertible side, and 3¾ in. on the semi-convertible side. The size of the side sills is 4¾ x 7 in., center sills 3½ x 6 in., intermediate sills 2¾ x 4½ in. and end sills 5¼ x 7 in. The sill plates are 8 x ⅝ in. The height from rail to the under side of sill is 26 in., height from rail to tread of lining board 18½ in., and from lining board to car floor 15¼ in. Among other patented specialties of the builder's make with which the car is equipped are angle iron bumpers, radial draw bars and round corner and seat end panels. The car is mounted on a new form of trailer truck built by the J. G. Brill Co. after a type patented by it some years ago. It is known as the No. 23 type and is well adapted to trailer service. The wheels are 26 in. in diameter and the wheel base 4 ft. The weight of the car and trucks is 21,260 lb.

National Electric Co. Announcement.

The National Electric Co., of Milwaukee, advises us that it has entered into an important arrangement with Robert Lundell and Robert T. Lozier, by which the National company will manufacture and market the new motors and generators, and systems of operation and control that are covered by the latest inventions of Robert Lundell; the commercial direction of the undertaking being placed in the hands of Robert Lozier (who will also act as general manager of the electrical sales department of the National company). Under this arrangement Mr. Lundell assumes the direct supervision of the engineering involved under the license that he grants the National company. This license covers all of Mr. Lundell's inventions not already under license to other companies, and all inventions that he may hereafter make during the life of this license.

These inventions of Mr. Lundell are of particular interest to the trade, in that they cover important developments in direct current apparatus. Some of these patents are for a new type of motor and dynamo frame construction, as well as a new method of commutation, by which a material gain is obtained in the space occupied by the apparatus, its efficiency, and the flexibility of its speed control and regulation.

This form of construction represents an important departure in standard motors of fixed speed, and is particularly advantageous in variable speed motors for direct application of machinery, both from point of construction and flexibility of control. The Lundell inventions are equally valuable in systems of regenerative operation and series parallel control and to the numerous other uses to which electric motors are now so generally applied, among which are electric railways, electric elevators and electric automobiles. The Johnson-Lundell Traction Co. of England has been organized to manufacture under these patents in Great Britain and elsewhere abroad.

As to the commercial significance of this new arrangement, the field to which Mr. Lundell's inventions particularly apply is one of the broadest and best established in the business. It is a field with which Mr. Lozier has been associated from the earliest commercial development of the electric motor, he having been placed in the testing department of the Sprague factory when it was started in West 30th St. in 1887, when the first commercial electric motors were developed, and has since followed the development of the business in all its phases. It was in this shop that Mr. Lozier first met Mr. Lundell and formed a friendship that has developed into the alliance consummated by the arrangement with the National company. In the 17 years that have followed, each has had the opportunity of maturing in his experience in his own special line, and now their conjunction with the National company's splendid manufacturing facilities and high commercial standing completes an advent of considerable importance to the trade and to the art.

The National Electric Co. of Milwaukee, formerly operating under the style Christensen Engineering Co. has in the past seven years equipped a very large number of the electric cars using air brakes.

Four years ago it built the present plant, abundantly equipped it with the best tools and labor saving machinery. A foundry having open hearth and crucible furnaces for making steel castings, also

cupolas for gray cast iron, and a complete brass foundry are included, and the plant has all the other features necessary to make it one of the most comprehensive and modern plants to be found in the electrical manufacturing business.

The success met with in the air brake business encouraged those financially back of the National company to enter into the general field of electrical machinery, and two years ago a competent engineering corps under the able direction of Mr. W. L. Waters, chief engineer of the National Electric Co., and an active sales organization was put into operation, and the results of this work have in turn been so thoroughly successful that the National company has now decided to follow up the material gain already made, with a view to developing this branch of its business to its fullest capacity, and to this end has established a separate electrical department.

Mr. Lozier will be aided in directing the work of that department by his long experience in the electrical field, beginning with Edison early in '83 and running down through the engineering and commercial branches of the business for 13 years, with the General Electric Co., and for the last eight years with the Bullock Electric Mfg. Co.

Mr. Samuel Watkin is the president of the National company. He organized it, and under his able direction the company has reached its present prominence.

Mr. Bernard T. Becker, who represents the interests of those financially back of the company, and who is himself a large stockholder and a director in the company, will act in an executive capacity in connection with operation of the company.

The first vice-president and general manager of the National Electric Co., Mr. Frank C. Randall, is widely known throughout the electric street railway field and the air brake sales will continue as in the past, under his direct charge.

Of the operative force, Mr. R. P. Tell is the secretary and treasurer. Mr. J. H. Denton, well known to all those who come in contact with the air brake business, is general superintendent.

B. F. Sturtevant Co's. New Offices.

The B. F. Sturtevant Co., Hyde Park, Mass., has moved into its handsome new office building which has recently been constructed. One-half of the basement is occupied by the printing plant and its stock room. Here are printed the catalogs, circulars, letter-heads and all printed forms used in the office and shops. Another portion is used as a lunch room for the office force, while the heating and ventilating apparatus is also located in the basement. Naturally the building is heated and ventilated by the Sturtevant fan system. The galvanized iron heat flues are built into the walls and convey the heated fresh air through register openings into the various rooms. On the first floor are located the production, time and cost departments, and the publication department; on the second floor are the sales and accounting departments, cashier, clerks, etc., the manager's office and the filing department. The drafting rooms occupy the whole of the third floor, while the blueprint department is on the fourth floor. The fourth floor also contains two large vacant rooms which may be utilized for future growth, either as offices or drafting rooms. Eight large fireproof vaults, each about 9 ft. wide and 19 ft. long, give abundant room for the safe keeping of books, correspondence, drawings and valuable data.

The first two floors are finished in quartered oak and the upper two in plain oak. The wainscoting, painting, the tinting of the walls and ceilings and the office fixtures are all very tasty and add much in making this office building one of the finest in the country.

Grand Prix for St. Louis Car Co.

The St. Louis Car Co. advises us that the grand jurors of the Louisiana Purchase Exposition have awarded it the Grand Prix for its exhibition of cars, trucks, seats, headlights, vertical wheel brakes, gray and malleable iron castings, bronze car trimmings and other specialties.

The Brown system of discipline is now in effect on the Brooklyn Rapid Transit Co's. lines and is meeting with the approval of both officers and employes.

Allis-Chalmers Personnel.

We are advised by the Allis-Chalmers Co., that the following gentlemen have entered its service: Mr. Chas. S. Buell, mechanical engineer, who until recently represented the Westinghouse Machine Co., in Chicago, has entered its employ as salesman and engineer in the power department; Mr. John F. Burke, formerly with the Westinghouse Electric & Manufacturing Co., as salesman with headquarters in Omaha; Mr. Wilbur M. Ruth, until recently assistant to the president of the Mesta Machine Co., Pittsburg, as salesman and engineer at the Pittsburg office; Mr. M. C. Miller, formerly in the alternating current department of the Westinghouse Electric & Manufacturing Co., in a similar capacity with this company; Mr. Chas. F. Adee, lately manager of the Pittsburg office of the C. Lee Cook Co., as salesman at the New York office; Mr. S. H. Sharpesteen, for a number of years salesman of the General Electric Co., in a similar position in the New York office of this company; Mr. C. Fred Collins, as special representative of this company at its New York office; Mr. W. M. S. Miller, until lately in the supply department of the Westinghouse Electric & Manufacturing Co., in the Chicago office; Mr. R. L. Richardson, for a number of years in the Pittsburg sales office of the Westinghouse Electric & Manufacturing Co., in a similar capacity at Pittsburg for this company; Mr. John S. Redfield, for some years in the Chicago sales office of the Westinghouse Electric & Manufacturing Co., to the sales staff of the Chicago office; Mr. James Ashworth, until recently engineer of the City of Chicago, as salesman in the pumping engine department; Mr. Otto Clyde Ross, lately in the employ of the Hartford Lead, Zinc, Mining & Smelting Co., as engineer, as salesman and engineer with this company.

Ticket Fraud at Worcester, Mass.

An alleged conspiracy and scheme to defraud the Boston & Worcester Street Railway Co., has recently been discovered and two trusted employees have been placed under arrest. The company realized sometime ago that it was being robbed and accordingly plans were made for the discovery of the guilty parties. Tickets were missed from the general manager's desk and inasmuch as the night-watchman was the only one who had access to this office he fell under suspicion. One of the shades of the office was left up about an inch; a buzzer was also connected with the room in which the tickets were kept, which would ring an electric bell some distance away. When the electric buzzer rang one of the men on guard ran to the office and there saw the watchman in the act of sorting out and looking at the punch marks of the cancelled tickets. In the morning, when the office was opened, it was found that the drawer in which the key to the ticket closet was kept had been opened during the night and 18 tickets had been taken. The numbers of the various tickets were noted each night and in the morning were checked off to show whether any were missing. These were compared with those turned in on subsequent days to show how many stolen tickets were received by the company. Also as an additional precaution, a great many of the tickets were marked. The arrest of the night watchman and a conductor, and the further investigation of the matter developed the fact that the night watchman had stolen the tickets which were turned in by this conductor and which bore the punch mark used by him. These would then be turned over to the conductor the following day and again turned in by him at night. In this way the two conspired to defraud the company.

The conductor was a roomer at the home of the watchman, and a search of the house revealed cancelled and unused tickets in the rooms of both men, but no great amount of value. Very fortunately the scheme was discovered before it had an opportunity to develop as it would have been possible to have defrauded the company of considerable money.

The Underground Electric Railways Co. of London has applied to the New York Stock Exchange to list $16,500,000 5 per cent profit sharing secured notes of 1908.

The Dayton & Troy Electric Railway Co. and the Springfield, Troy & Piqua Railway Co. have jointly established a free hack service at Troy for the transfer of patrons of those lines to their respective stations.

Accidents.

October 10th five persons were seriously injured and another badly bruised in a rear-end collision between two trolley cars of the Chester Traction Co., Chester, Pa.

October 9th a car on the Illinois Valley electric railway was wrecked at Spring Valley, Ill., and of the 50 passengers on board the majority were more or less injured. The car jumped the track when it struck a sharp curve and was turned over.

September 30th seven persons were injured in a trolley wreck on the Cleveland & Southwestern Traction Co. near Lorain, O. The forward truck broke away from the car body, causing the accident.

September 18th a car on the White line of the Public Service Corporation jumped the track about 300 yd. beyond the Hackensack bridge, and injured 12 people, 4 of them seriously.

September 22d ten persons were killed and 20 injured at Melrose, Mass., by an outward bound Boston & Northern car striking a box of dynamite on the tracks. The explosive had been lost off of an [illegible]

September 26th 20 persons were injured in a rear end collision of two trolley cars of the Brooklyn Rapid Transit on the Canarsie division.

September 29th 12 persons were injured in a head-on collision between a regular passenger coach and an express train on the Scioto Valley Traction line near Hookers, O.

Advertising Literature.

THE JOSEPH DIXON CRUCIBLE CO. has recently issued a pamphlet containing three facts worthy of thought concerning the lubrication of axles.

THE AMERICAN STEEL & WIRE CO. has recently issued its circular B 132, showing illustrations of the leading varieties of wire rope manufactured by the company.

HARTSHORN'S ROLLER, for October, published by the Stewart Hartshorns Co., E. Newark, N. J., has recently been distributed and contains some interesting editorial ideas.

THE HIGHLAND MACHINE CO., Boston, Mass., has recently issued a very neat and interesting pamphlet in regard to the National self-clamping cutter manufactured by this company.

THE CROCKER-WHEELER CO., Ampere, N. J., has recently distributed its bulletin No. 49, descriptive of the railway generators at the Louisiana Purchase Exposition, which are for sale with delivery after January 1st.

THE KEYSTONE TRAVELER, Vol. II, No. 9, September, 1904, which is published by the Mayer & Englund Co., Philadelphia, Pa., has been distributed among the trade. This publication is as interesting and breezy as ever.

THE KITTS MANUFACTURING CO., Oswego, N. Y., has recently issued a new catalog and price list of the well-known Kitts Steam Specialties. This publication includes some very useful information in regard to its products.

THE BROWN CORLISS ENGINE CO., Corliss, Wis., report the receipt of an order from the Jones & Laughlin Steel Co. for one 30 x 60 x 48-in. tandem compound condensing Corliss engine to be placed in its rolling mill plant at Pittsburg, Pa.

THE GOHEEN MANUFACTURING CO., Canton, O., has recently issued a new card regarding its paints, on the reverse side of which is a cut showing a group of large steel tanks at Beaumont, Texas, which are painted with Goheen's carbonizing coating.

"REMEMBER THE TROUBLE you had last Fall and Spring," says the R. D. Nuttall Co., Pittsburg, on one of its recent postal cards, "with the icy wire as an almost constant annoyance, while a small stock of Nuttall sleet cutters would have made life pleasant for you."

THE SPAULDING PRINT PAPER CO., Inc., Boston, Mass., has recently issued a descriptive pamphlet of its "Federal" blue-printing machines. This machine is adopted for both sunlight ex- [illegible] light by the addition of an electric-light chamber.

CRANE CO., Chicago, has recently issued its special catalog No. 100, with price lists and descriptions of its patent pop safety valves, water relief valve, cylinder relief and snifting valve, hydraulic relief

valves and boiler trimmings. This catalog is complete, well arranged and contains an index.

A DIRECTORY OF THE ENGINEERS' CLUB of Philadelphia, including its charter and by-laws, is one of the recent publications. The book is a vest pocket edition and contains a list of the present and past officers, list of members, house rules, charter and by-laws and general information in regard to the organization.

THE STORAGE AIR BRAKE SYSTEM of the St. Louis Transit Co. is the subject of a recent and interesting publication issued jointly by the Ingersoll-Sergeant Drill Co. and the Westinghouse Traction Brake Co. The pamphlet also includes an article on the tests made upon this storage brake system by the Railway Test Commission.

THE BUDA FOUNDRY & MANUFACTURING CO., Chicago, is distributing its September bulletin on "Switch Stands", showing its line of these goods. This is one of the most complete catalogs illustrating and describing switch stands that has ever been published. In addition to the stands shown in this catalog the company manufactures a great many specialty stands for various roads, under contract.

THE EUREKA AUTOMATIC SIGNAL CO., manufacturer of block signals for electric railroads, Lansford, Pa., has recently issued a bulletin illustrating and describing its products. The more than ordinary interest manifested by electrical engineers and other street railway officials led to a rapid exhaustion of a large edition of the first catalog describing its products, and as a result this very interesting and complete catalog has been issued.

THE ELECTRIC STORAGE BATTERY CO., of Philadelphia, is distributing a very neat pocket memorandum book, bound in celluloid covers, containing data of the "Chloride Accumulator." The leading chapter in the book reviews the characteristics of a good storage cell, and this is followed by brief descriptions of "Chloride Accumulators" as applied to street railway stations and substations, line batteries, water power plants, isolated lighting plants, railway car lighting, etc. In addition to much useful data on batteries, given in brief, but comprehensive in scope, the book contains a number of tables relative to accumulators, and some blank pages for any desired additional notes.

Trade Notes.

THE TOLEDO & JACKSON RAILWAY CO. has retained the Roberts & Abbott Co., Cleveland, as engineers for its road to operate between Toledo, O., and Jackson, Mich.

FOREIGN SHIPMENTS being made by the J. G. Brill Co. include 10 trucks of the 21-E type for Tamagawa, Japan; 24 "Eureka" maximum traction trucks for Pontypridd, Wales, and six electric motor cars mounted on 21-E trucks for Aquascalientes, Mexico.

H. M. BYLLESBY & CO., who are at present constructing the gas plant at Muskogee, I. T., have been retained as engineers by the Muskogee Electric Traction Co. to design and construct a railway in the town of Muskogee, with an approximate trackage of 4.7 miles.

THE GENERAL ELECTRIC CO. has been awarded the contract for installing the electrical appliances and machinery in the West Albany shops of the New York Central Railroad Co. Mr. G. H. Patten, erecting engineer of the Schenectady office, is in charge of the work.

THE ROBERTS & ABBOTT CO., Electric Bldg., Cleveland, will have on file for the use of bidders on and after October 17th, plans and specifications for the construction and equipment of the Michigan & Indiana Traction Co., to operate between Battle Creek and Lansing, Mich.

THE J. A. FAY & EGAN CO., of Cincinnati, O., advises us that the fire which recently damaged one of the erecting shops of its woodworking machinery plant at Cincinnati, Ohio, will prove to show no detriment or delay in filling orders. A large part of the force of men employed in these shops has already resumed work and the remainder have been transferred to the Egan shops and their regular work continued.

THE LAGONDA MANUFACTURING CO., Springfield, Ohio, advises us under date of October 15th that the Jury of Awards of the Louisiana Purchase Exposition, at St. Louis, has given the Gold Medal for boiler tube cleaners to the Lagonda Manufacturing Co. for the well-known Weinland or Lagonda machines. The company is to be congratulated on this further evidence of the superior merit of these machines.

AMONG THE RECENT INSTALLATIONS for heating and ventilating public buildings made by the B. F. Sturtevant Co., Hyde Park, Mass., include that for the Worcester City Hospital at Worcester, Mass. The new power plant for the new shops of the Mexican Central Railway Co., at Aquascalientes, Mexico, contains a Sturtevant induced draft apparatus consisting of two steel plate fans, each driven by a Sturtevant vertical engine.

ADAM COOK'S SONS, 313 West St., New York City, the only makers of "Albany" grease, advise they are in receipt of a letter from C. F. Miller, superintendent of ice department, Sparta Gas & Electric Co., Sparta, Ill., in which he states that they have tested this well known lubricant and find it much the best grease they have ever used. Mr. Miller adds, "We would like very much if we could use cups on all of our bearings, as the "Albany" grease last so long, and saves much trouble in oiling." They also advise that the Terre Haute Electric Co., after thoroughly testing a sample can of "Albany" grease on its dynamos and motors, recently sent a testimonial of high praise through their manager, Mr. Gardner F. Wells.

Street Railway Patents.

This list of patents is furnished by Ralph Sturtevant Warfield, No. 800 "H" street, n.w., Washington, D. C.

Sept. 13, 1904.

No. 769,698. Traction Switch, J. C. Keller and O. F. Kadow, Cleveland, O.
No. 769,839. Air Brake, Wm. H. Sauvage, New York City.
No. 769,841. Draft Rigging, L. A. Shepard, Brooklyn, N. Y.
No. 769,854. Trolley Wheel, Wm. T. Wilkinson, Medford, Mass.
No. 769,862. Third Rail Guard, Jno. H. Guest, Brooklyn, N. Y.
No. 769,900. Traction Switch, H. S. Hale, Philadelphia, Pa.
No. 769,920. Dynamo for Trucks, W. F. Richards, Buffalo, N. Y.
No. 769,929. Sanding Device, Chris. Allenbach, Chicago, Ill.
No. 769,983. Block Signal, Fred B. Corey, Schenectady, N. Y.
No. 770,004. Car Coupling, O. H. Grupe, Alden, Iowa.
No. 770,040. Motor Control System, Chas. E. Barry, Schenectady, N. Y.
No. 770,041. Electric Railway, Asa F. Batchelder, Schenectady, N. Y.
No. 770,107. Street Car, Chas. B. Price, Oakmont, Pa.
No. 770,113. Trolley, Edw. D. Rockwell, Bristol, Conn.
No. 770,125. Car Sign Changing Device, Jos. M. Smith, Worcester, Mass.
No. 770,158. Third Rail Covering, Thos. Buckley, New York City.
No. 770,161. Car Chair, Geo. W. Chambers, Newark, Ohio.

Sept. 20, 1904.

No. 770,265. Track Switch, C. J. Coleman, New York City.
No. 770,298. Hand Brake, Jas. Maquire, Wm. M. and Frank Young, Reno, Nev.
No. 770,342. Insulated Track Joint, Geo. A. Weber and Percy Holbrook, New York City.
No. 770,464. Convertible Car, W. H. Hovenden, Salt Lake City, Utah.
No. 770,537. Draft Gear, Jos. F. Raders, New York City.
No. 770,583. Car Wheel and Axle, Wm. A. Honeyman, Wallace, Idaho.
No. 770,584. Emergency Coupling, Geo. J. Hubbard, Port Jervis, N. Y.
No. 770,620. Track Structure, Wm. Wharton, Jr., Philadelphia, Pa.
No. 770,656. Interlocking System, B. C. Rowell, Chicago, Ill.
No. 770,657. Block System, B. C. Rowell, Chicago, Ill.
No. 770,681. Car Axle Box, Edw. Denegre, Chicago, Ill.
No. 770,684. Lubricator, Geo. F. Godley, Philadelphia, Pa.
No. 770,698. Car, I. W. Phelps, New Bedford, Mass.
No. 12,268. Railway Car, Geo. Gibbs, New York City. (Reissue.)

Sept. 27, 1904.

No. 770,737. Third Rail, Albert F. Chase, Haddonfield, N. J.
No. 770,744. Trolley, Samuel Fisher and Albert Sanders, Butler, Pa.

No. 770,757. Signal System, Wm. A. Kibbe, Kansas City, Mo.
No. 770,759. Car Ventilator, L. C. Lanphear, Boston, Mass.
No. 770,766. Block Signal System, C. T. Morey, Cambridge, Mass.
No. 770,886. Controller, P. S. Barrett, Scranton, Pa.
No. 770,901 Fare Register Rod Handle, A. H. Hall, Quincy, Mass.
No. 770,911 Third Rail System, L. M. La Barr, Forest City, Pa.
No. 770,929. Brake, Thos. W. Saling and Jas. B. McKiel, Marshall, Texas.
No. 770,949. Safety Switch Lock, F. C. Anderson, Cincinnati, Ohio.
No. 770,960. Third Rail Insulator, Robt. V. Dunbar, New York City.
No. 771,027. Signal System, L. B. Stillwell, Lakewood, N. J., and Henry Latey, New York City.
No. 771,029. Crossing Signal, Eugene W. Vogel, Chicago, Ill.
No. 771,030. Track Signal, Eugene W. Vogel, Chicago, Ill.
No. 771,105. Car Coupling, J. J. Swint, Stroud, Ala.
No. 771,193. Emergency Brake, Chas. A. Wells, Chicago, Ill.
No. 771,197. Brake Shoe, H. L. Winslow, Chicago, Ill.
No. 771,206. Trolley Wheel Controller, Benj. F. Jackson, Boston, Mass.

Oct. 4, 1904.

No. 771,234. Track Switch, Ed. F. Davis, Springfield, N. Y.
No. 771,244. Car Coupling, G. Heinicke, Crefeld, Germany.
No. 771,295. Trolley Illuminator, W. Burling, Grand Rapids, Mich.
No. 771,318. Trolley, Peter McNaughton, Charlotte, Mich.
No. 771,329. Fender, F. H. Seavy, Medford, Mass.
No. 771,334. Third Rail Insulator, S. B. Stewart, Jr., Schenectady, N. Y.
No. 771,341. Car Wheel, E. A. Vickroy, Atlanta, Ga.
No. 771,407. Underframe for Cars, H. C. Williamson and H. Pries, Michigan City, Ind.
No. 771,423. Trolley, Jos. N. Drake, Cincinnati, O.
No. 771,427. Car Coupling, L. W. Jenkins, Mulberry, Ind.
No. 771,428. Passenger Car, Geo. I. King, Middletown, Pa.
No. 771,472. Trolley, John Hensley, Huntington, Ind.
No. 771,476. Fender, Fredk. R. Keith, Randolph, Mass.

No. 771,510. Electric Wire Coupling, J. G. Thomas and D. E. Lewis, Scranton, Pa.
No. 771,522. Car Brake, W. S. Adams, Philadelphia, Pa.
No. 771,523. Circuit Controller, Bert Aikman, Chicago, Ill.
No. 771,529. Semiconvertible Car, John A. Brill, Philadelphia, Pa.
No. 771,533. Electric Railway, Alex. Churchward, New York City.
No. 771,539. Sander, Thos. F. Doyle and Wm. E. Tice, Chicago, Ill.
No. 771,545. Fender, Jacob Happell, Middletown, Ky.
No. 771,550. Side Bearing, F. K. Hosler and Chas. Fueller, Butler, Pa.
No. 771,563. Trolley Catcher, Wm. M. McArthur, Lockport, N. Y.
No. 771,585. Brake, Evie Stevens, Monroe, Wash.
No. 771,589. Metallic Tank Car, Cornelius Vanderbilt, New York City.
No. 771,590. Locomotive Tender, Cornelius Vanderbilt, New York City.
No. 771,592. Draft Gear, Wm. B. Waggoner, Chicago, Ill.
No. 771,634. Fluid Pressure Brake, M. W. Hubbard, Chicago, Ill.
No. 771,708. Cattle Guard, L. W. Carden, Iron City, Tenn.
No. 771,785. Electric Railway System, Wm. G. Lowrie, New York City.

News Notes.

NEW INCORPORATIONS.

*BUFFALO, N. Y.—Buffalo, Batavia & Rochester Electric Railway Co.; capital, $3,500,000; to construct and operate an electric line 65 miles long from Williamsville, Erie County, to Rochester, with a branch to Akron. The directors are Loran L. Lewis, Stuart R. Mann, Spencer Kellogg, George L. Lewis, George E. Pierce, William N. Evarts, Charles N. Almy, Robert Leslie, Loran L. Lewis, Jr., and William C. Carroll of Buffalo, and Lafayette L. Grove of Williamsville.

*PHILADELPHIA, PA.—Philadelphia, Lancaster & Harrisburg Street Railway Co.; capital, $90,000; to build an electric line between Mt. Joy and Middletown and between Strasburg and Coatesville. The incorporators are: Jacob L. Ranck, Strasburg; William Trimble, Samuel L. Hibberd, Jr., Philadelphia; Joseph F. Raymond, A. L. Etter, Middletown, and Jacob G. Stauffer, Elizabethtown.

*EATON, GA.—Putnam Mills & Power Co.; capital, $75,000, with privilege of increasing to $500,000; to develope water power and erect an electric plant to transmit the power. The incorporators are: James B. Floyd, Thomas B. Floyd and O. B. Nisbet.

*NIAGARA FALLS, N. Y.—Suburban Power Co.; capital, $10,000; to distribute electric power to various towns in the vicinity. The directors are: D. O. Mills and Edward A. Wickes of New York; William B. Rankine, George W. Davenport and De Lancey Rankine of Niagara Falls, and Nathaniel Rochester and James Sweeney, Jr., of Buffalo.

*WOODVILLE, MISS.—Woodville-Ft. Adams Electric Railway Co.; to construct an electric line 23 miles long in Mississippi. The officers are: L. T. Ventres, president; Charles Cohen, vice-president; W. H. Woods, secretary; James M. Sessions, treasurer.

*YORK, PA.—Sunbery & Selinsgrove Street Railway Co.; capital, $30,000; to construct an electric line between the above-named points. Mr. L. G. Brown of York is president.

*FORT SMITH, ARK.—Mount Mena Traction Co.; capital, $50,000; to build an electric line from Mount Mena to Rich Hill. The officers of the company are: President, Alfred Bissell; vice-president, E. J. Mills; secretary and treasurer, James L. Hale. The officers, together with G. H. Little, G. B. Noble and W. W. Lowrey are the incorporators.

*ITHACA, N. Y.—Ithaca & Cayuga Heights Railway Co.; capital, $50,000; to operate an electric street railroad 2½ miles long. The directors are J. T. Newman, C. H. Blood and C. H. Hull of Ithaca.

*OSHKOSH, WIS.—Oshkosh & Western Electric Railway Co.; capital, $10,000; to construct and operate an interurban railway between Oshkosh and Berlin. Incorporators: J. H. Porter, Clement C. Smith, George Hiltman and C. S. Morris.

WABASH R. R. EXCLUSIVE WORLD'S FAIR TERMINAL.

All Wabash trains to and from St. Louis, both regular and special, pass and stop at the World's Fair main entrance, where the Wabash R. R. has its own magnificent passenger station, with every facility for the rapid handling of passengers and baggage. Certain other lines up to a short time ago were using the C. R., I. & P. R. R. tracks to reach the Fair Grounds, but a recent order from the United States Court prohibits this, and inasmuch as the Wabash has refused permission to run other trains than its own over its tracks to the Fair Grounds, it is now the only line that can handle trains to the World's Fair Grounds.

STREET RAILWAY REVIEW

Vol. XIV | NOVEMBER 20, 1904 | No. 11

Sterling, Dixon & Eastern Electric Railway.

In the northwestern part of Illinois close to the banks of the beautiful Rock River are the two cities of Sterling and Dixon. Sterling, with its cross river suburb, Rock Falls, has a population of 10,000. Dixon, which lies 13 miles up the Rock River in an westerly direction from Sterling, has about the same number of inhabitants.

These cities are located in the heart of the "Corn Belt," and thus enjoy the patronage of, and are the distributing points for the exceedingly rich farming district which surrounds them. Added to the support which they receive from the farming districts is the support of many large manufacturing establishments. Among the products of the Sterling factories are barb and woven wire fencing, harvesting machinery, paper, gas engines, caskets and hearses. In Dixon are located shoe factories, plow works, and a large milk condensing plant which has the facilities for condensing daily the milk from fifty thousand cows. Good water power is furnished in both cities from the dams in the Rock River.

In laying out a route to connect Sterling and Dixon three possible routes presented themselves. Two of these followed the river, one on the north and one on the south side. A third route lying about two miles north of the river and being a mile longer than either of the other two was, after a careful study, decided upon as the most desirable. Such a decision was due to the fact that the last named route, while having more severe grades, serves a much finer and more thickly settled rural district which includes the hamlets of Fairieville and Gap Grove.

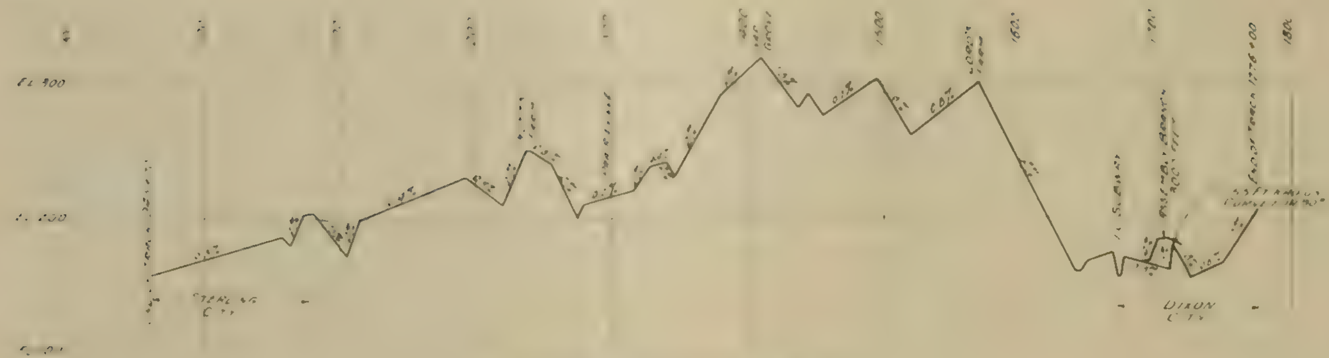
A private right of way 40 ft. in width was purchased for the entire distance between the limits of the two cities. This right of way parallels and is adjacent to a fine macadamized highway for the entire distance, with the exception of three detours which were necessary to economically obtain better grades. The paralleling of a public highway called for several curves, but where necessary to [illegible] right of way was purchased so that there are no curves on the interurban having radius of less than 500 ft., and but few are that sharp. The public highway was crossed at [illegible] 100 ft. radius.

The boundary of the right of way on the side away from the public highway is marked by a 52-in. woven wire fence hung on cedar posts, but the side adjacent to the highway was not fenced. In this manner a boulevard 100 ft. in width has been established, 60 ft. of which is public highway and 40 ft. the electric railway right of way. One of the engravings shows the track and parallel highway at a point three miles east of Sterling. Wherever old fences, shrubs, or obstructions of any sort disfigured the view of the highway from the track or vice-versa, the management has had them removed. The trees along the right of way were in every case possible saved from harm during the construction period and have since been shaped and trimmed, not only to do away with any chance trouble to the power distribution circuits, but with the idea of beautifying the right of way as much as possible.

At three points on the route better curves were secured by using part of the public highway for the right of way. In order that this might be done, and the railway company still own its land as a private right of way, it purchased a 40-ft. strip on the opposite side of the highway, which was deeded to the highway authorities in consideration for the vacation of, and the transfer in conjunction with the owners of the abutting farms, to the electric railway company, of the fee of the desired 40 ft. of the old highway. Throughout the length of the strip (3,600 ft.), it was necessary for the electric railway company to build a macadam road 15 ft. in width with stone 12 in. deep at the crown.

VIEW OF ROCK RIVER FROM POWER HOUSE GROUNDS—STERLING, DIXON & EASTERN RY.

In constructing the roadbed, the center line of the grade was placed 6½ ft. south of the center line of the right of way and all cuts were made the full width of the right of way. Space was thus left for double track, and it is believed that this added open space on the north side of the track will be a valuable protection from snow. The sub-grade line was established so high that wherever cuts do occur they are shallow, and of the full width of the right of way. In this manner a well drained roadbed was built throughout the entire length of the line. A "New Era" elevating grader made by the Austin Manufacturing Co., Harvey, Ill., drawn by a traction engine was used for handling the dirt, both in throwing up a bank and for loading wagons in the cuts. The short haul work was done with wheeled scrapers. Embankments less than 4 ft. in height are 14 ft. wide; those 4 ft. high or higher are 16 ft. wide. One of the illustrations, a condensed profile of the road, shows in a rough way the grades of the entire route including both cities and the interurban. At all breaks in the grade line vertical curves having a projected length of 400 ft. were inserted. The small drainage areas are taken care of by extra heavy tile pipes 22 in. in diameter,



PROFILE OF STERLING, DIXON & EASTERN RY.

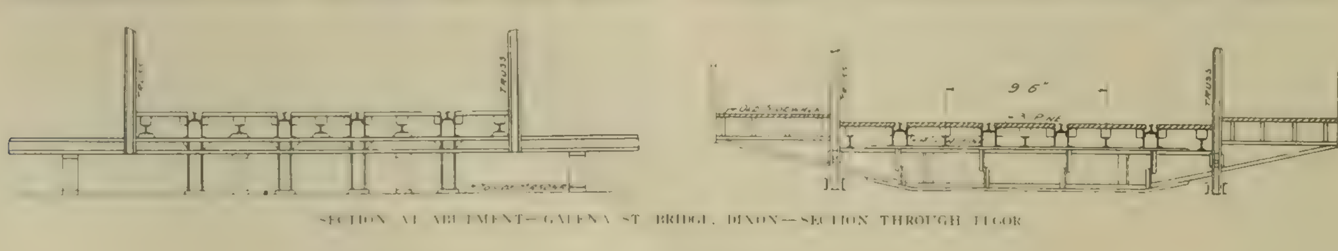
MAP OF STERLING, DIXON & EASTERN ELECTRIC RY.

with inlets and outlets anchored and protected by stone masonry. For larger drainage areas, timber box culverts were built. Such boxes were made large enough to allow a proper sized stone culvert to be built inside of them at the end of their period of usefulness. Several cattle passes were necessary at different points along the line. These are built of standard four post trestle bents surmounted by a superstructure of four 8x16 in. stringers and two 6x16-in. jack stringers carrying 12-ft. pine ties and 6x8-in. guards. All trestle bents are built on stone masonry foundations laid in portland cement. There are two small creeks crossed by 16-ft. spans having the same floor system as the cattle passes but mounted on retaining walls of stone masonry 3 ft. in thickness.

Just west of the city limits of Dixon is a 70-ft. through girder span. The foundations for this bridge were obtained by driving piles through quicksand to a gravel bed 14 ft. below the level of the stream. Steel tubes were then centered over the piles and filled with portland cement concrete, a steel plate being inserted between the tubes for stiffening. A false retaining wall of timber was built to relieve the bridge foundation tubes from the weight of the embankments at either end.

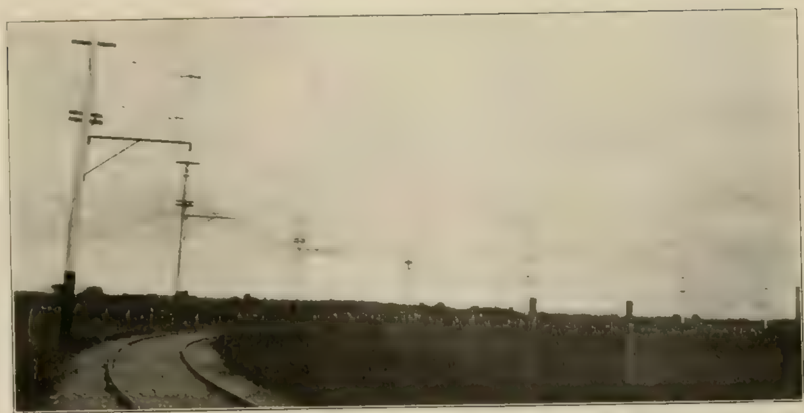
The route of the car line in the city of Dixon crosses the Galena St. bridge over the Rock river. This bridge is 660 ft. in length, and though built for street traffic only, was unusually strong and substantial except in the floor system. The railway company, at its own expense, put in a complete new floor system with steel girders for carrying the rails, and new end hanger posts. The bridge was thus strengthened so that its safe load is now more than double any possible load from the interurban cars. The bridge work was done by the Worden-Allen Co. of Milwaukee, under contract with Columbia Construction Co.

In Dixon there are about three miles of track, 4,000 ft. of which is in brick pavement, the rest being laid on macadamized streets. The rails are 70-lb. A. S. C. E. section in macadam. Standard cedar ties spaced 2 ft. between centers and ballasted with crushed rock



SECTION AT ABUTMENT—GALENA ST. BRIDGE, DIXON—SECTION THROUGH FLOOR.

were used throughout the city. Similar construction was used in Sterling, where the total length of city track is also about three miles, 2,000 ft. of which is in brick pavement. The track on the interurban section, which is 11.3 miles long, is laid with 70-lb. A. S. C. E. section rails in 60-ft. lengths, spiked with standard 5½ x 9/16 in. spikes to 8 ft. cedar ties spaced 2 ft. between centers. The Weber rail joint was used on the entire road except where pavement was encountered at which locations six [illegible] joints were used. In laying the steel on tangents rail joints were placed opposite, and on curves they were staggered. Pressed steel rail braces are used on curves and all bridges and cattle passes are guarded. The joints from the power house east one-third of the way to Dixon are double bonded on each rail. Half the remaining distance is double bonded on one rail and single on the other, and the rest has one bond per joint. The type of bond used was a No. 0000 under fish plate bond with ⅞-in. terminals 10 in. between centers. All bond holes were drilled after the track was laid and the bonds were put in place by the use of screw compressors. The rail bonds are the Mayer & Englund "Protected" type.



VIEW OF OVERHEAD CURVE CONSTRUCTION.

POWER STATION AND CAR HOUSE.

In order to reach a satisfactory bank of gravel for ballast, 4,000 ft. of spur track was built in a northerly direction from a point midway between Sterling and Dixon. Here a deposit of excellent gravel, having a 25-ft. face, was found and three acres of land, including the gravel deposit purchased.

A 30-ton locomotive and center dump ore cars were used in distributing the ballast, six inches of which was placed under the ties and enough distributed on the roadbed to make a 12-inch shoulder even with the tops of the ties.

For carrying trolley spans in the cities and the brackets on the interurban section 35-ft. cedar poles, set 6 ft. in the ground and braced with 36 x 12-in. breast blocks, are used, with the exception of those streets in Dixon that are paved, where steel tubular poles are used. Poles are spaced 100 ft. apart on tangents and 100 ft. or less on curves.

The overhead work in Sterling is of the Ohio Brass Co's. design and make. Two No. 0 trolley wires hung on ears and soldered to type D double [illegible] hangers are used. The Milwaukee Electric Railway & Light Co's. standard trolley fittings, are used on the interurban section and in Dixon, supporting No. 000 figure 8 trolley wire. This type of hanger is uninsulated, but protection is provided in span work by inserting two globe strain insulators on each side of the trolley between the hanger and the pole, one insulator being near the hanger and one near the pole on each half of the span.

Part of the trolley wires are suspended from a 9 ft. flexible suspension bracket made of angle iron, as illustrated. Two No. 000 figure 8 trolley wires are suspended upon the bracket span wire by Milwaukee type hangers, insulation being provided as in the span work by globe insulators. All poles on curves and at anchors are provided with strain guys. The trolley wires have been anchored and the overhead work guyed at all curves, joints and at the severe breaks in the grade. General Electric lightning arresters are used for line protection.

In order that the road might be started before the completion of the sub-station at Dixon, the direct current feeders have been installed as follows: From the power house to the end of the No. 0 city trolley, and the beginning of the No. 000 interurban copper, 500,000-c. m. stranded copper weather proof cable has been strung on glass feeder insulators. From here east bare cable is used. The first section is 2½ miles of 350,000-c. m. copper. The next section, three miles of 300,000-c. m., and the last section which reaches a point about three miles west of Dixon 211,600-c. m. in sectional area.

The power house is a brick building 52 x 160 ft. in size, with a fire proof partition wall between the engine and boiler rooms. This building is in the city of Sterling adjacent to the Chicago & Northwestern Ry. and is located on the bank of the Rock River. The boiler room contains two 300-h.p. Stirling boilers, surmounted by a steel stack extending 110 ft. above the grates. Water for boiler feed

STANDARD INTERURBAN CAR.

and condensing purposes is obtained from the Rock River. One 20x42 in. 1890 pattern Reynolds-Corliss engine is now installed and operating the road, but provision has been made for a second similar engine.

The engine is belted to a Stanley Electric Manufacturing Co.'s S. K. C. standard six-pole, three phase rotary converter of 300 kw. capacity. This rotary is run at present as a direct current generator. The switchboard is of the S. K. C. standard railway type having one direct current machine panel and one two-circuit feeder panel with 1,000-ampere quick break switches.

The entire line is fed directly from the power house through the trolley and direct current feeders as described, but a General Electric 500-kw., three bearing, double current generator, together with the necessary transformers, is now on the ground and will be installed in place of the present machine. The present S. K. C. rotary converter which is now being used as a generator at the power house will then be moved to Dixon where a suitable building is being fitted up as a sub-station. Three No. 4 hard drawn copper wires have been provided for feeding this sub-station from the alternating current side of the double current generator which is to be installed.

VIEW OF FARMING COUNTRY FROM COUNTY LINE HILL

RIGHT OF WAY AND ADJACENT HIGHWAY

The car barn and shop building is of brick and of similar construction to the power house. It is 160 ft. long by 40 ft. wide, having one pit and two storage tracks. The entire front of the building is protected by Kinnear rolling steel doors. At the rear of the barn are the repair room and office of the Superintendent of the road. The railway company's property between the car barn and the Rock River has been graded and so cared for as to present a pleasing view to the public and to passing railroad trains. A view of the Rock River as seen from this part of the electric railway property is shown in one of the engravings. The rolling stock of the road consists of four interurban cars built by the St. Louis Car Co., and fitted with four G. E. 70 motors and Christensen air brakes. There are also six single truck cars for city service and one double truck motor car for baggage and general use.

Hourly service is maintained between Sterling and Dixon with two cars, which permits a lay over of about ten minutes at each end. Local service of fifteen minutes headway is given by two single truck cars in each city. A fare of 25 cents is charged for the ride between Sterling and Dixon. Six tickets for 25 cents are sold for the city lines.

The owners of the Sterling, Dixon & Eastern Electric Railway have during the past year and a half, obtained a gas franchise in Dixon and built a very efficient and complete gas generating plant and laid the necessary pipes to supply the city. Both properties are managed from the same office.

The organization of the Sterling, Dixon & Eastern Electric Railway Co. is as follows: John I. Beggs, president; John H. Van Dyke, Jr., secretary and treasurer; H. C. Higgins, vice-president and manager.

Mr. H. C. Higgins formerly of Wisconsin, and now of Dixon, Ill., promoted this enterprise, secured its right of way and franchise, and built the Sterling end, including the building and equipping of the power house and car-barn, before interesting other capital with him, and is temporarily managing the property.

The interurban line and the city line in Dixon were built according to the plans of the Columbia Construction Co., which was also the general contractor for the entire construction and equipment of this part of the system.

The line commenced operation in May, 1904, and has since enjoyed a very satisfactory business.

New Park for Citizens Street Railway Co. of Vincennes, Ind.

The Citizens Street Railway Co., of Vincennes, Ind., has leased for a period of six years the fair grounds of the Knox County Fair Association with a view of installing a modern, up-to-date park. The company has a double track to these grounds and expects to increase its transportation facilities and make out of the park such a pleasure resort as will double or treble its present receipts therefrom. On special days the company has handled as many as 11,000 people to and from this park, but it will increase its facilities to such an extent as to amply care for any additional patronage possible. It is stated a dancing platform will be erected and arrangements will be made with various amusement companies for many other attractions.

Plans have been submitted by an electrical engineer of the Southern Pacific Co. for the conversion of the ferry steam roads and the Southern Pacific narrow gage line as far south as San Jose, Cal., into electric roads, together with estimates of cost for construction and the cost of obtaining electric power.

The St. Gall-Speicher-Trogen Electric Railway.

BY S. HERZOG.

This railway which was recently constructed by the Oerlikon company is driven by direct current obtained through transformers and converters from the three phase 10,000-volt supply coming from the Kubelwerk. The transforming and converting takes place in a sub-station situated close to the terminus and car barns of the railway in Speicher. The ground floor of the sub-station is occupied by the converter room, the main switching room and the transformer room. The second story contains the second switching room and the basement is used for a storage battery. The current from Kubelwerk is stepped down in the transformer room to 2,000 volts by means of three transformers of 150 kw. capacity each. Two of [illegible] supply the current required for the tramway and the third transformer is used for lighting purposes. The three transformers are arranged so as to be used interchangeably. Each of the two converter groups in the generating room consists of a high tension induction motor coupled by means of an insulated [illegible] coupling to a direct current shunt dynamo. The three-phase motors are of the Oerlikon type, No. 3067, and operate at [illegible]. They have a capacity of 155 h. p. and [illegible] r.p.m.

The stator [illegible] mm in diameter and is 325 mm long. It is provided with 144 slots, each slot holding 15 conductors. [illegible] slots, each slot car[illegible] copper wire. In these [illegible] the stator and the induced [illegible] by the rotor. The efficiency of the motors is 91 [illegible] and 87 per cent with a power [illegible].

The direct current [illegible] of the same make as the motors and generate 131 amperes at 800 volts. The armature is 745 mm in diameter and 330 mm long and has 95 slots. The conductors consist of copper band. The commutator has a diameter of 400 mm and is made up of 285 segments. There are four field coils each consisting of 4,350 turns and these coils are joined in series. The efficiency of the direct current machines is 91 per cent at full load and 87 per cent at half load.

The storage battery consists of 400 cells and has a capacity of 198 ampere-hours. The glass vessels containing the plates are mounted upon stands made of inpregnated wood and these stands are insulated from the earth by glass insulators. The battery is divided into

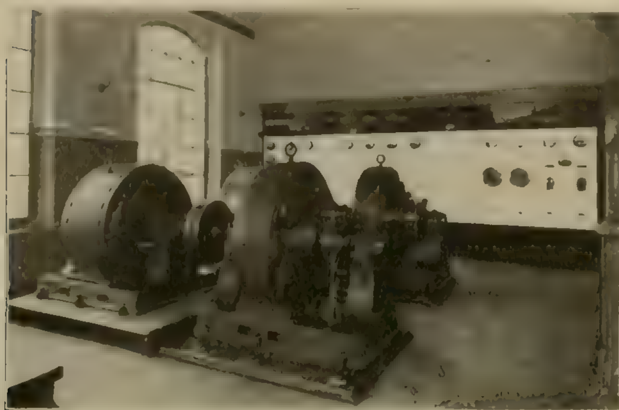
DEPOT AT SPEICHER, SWITZERLAND.

two halves of 200 cells each which are connected in series for the purpose of charging.

The secondary terminals of the transformers are joined through leads provided with fuses to the bus bars, the latter being controlled by high tension switches in the switching room below. A voltmeter is connected to the circuit before it reaches the switch and on the other side of the switch is connected an ammeter with current transformer. Each of the motor panels, one of which is in reserve for a future motor, carries an ammeter, the lever of the high tension switch and the hand wheel which operates the starting box. The high tension switch, high tension bus bars and high tension fuses in the switching room are separated from the rest of the apparatus by a partition of perforated metal. The starting box in the rotor circuit serves both as a regulator and as a switch. After short circuiting the rotor while the motor is running, and lifting the brushes, the starting box is cut out. The direct current leads pass to the bus bars from which the battery circuit and trolley wire circuit branch off and are provided with an ammeter, voltmeter a

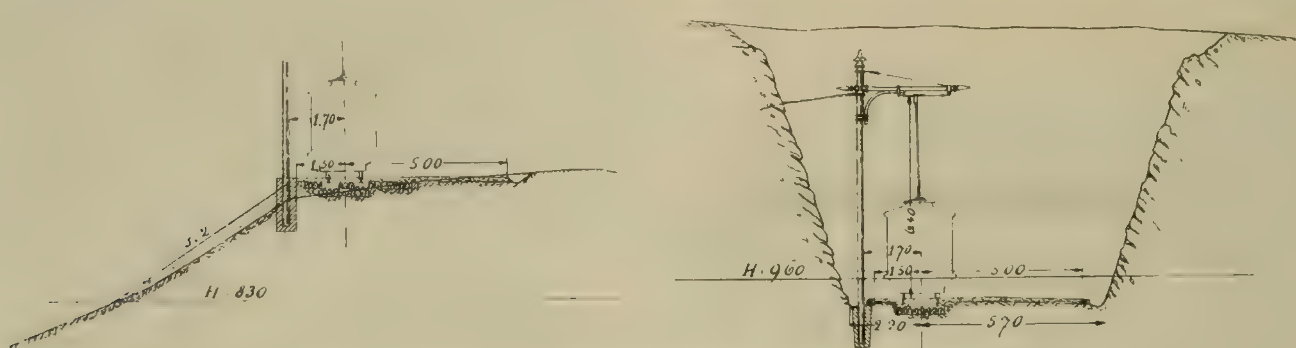
hand and automatic switch and fuses. The exciter circuit of each dynamo contains a regulating resistance fitted with a carbon break and also a circuit connecting piece.

The battery current is controlled by two hand regulators, a battery switch and a battery change-over switch, the latter serving to connect the two halves of the battery in series or in parallel. The



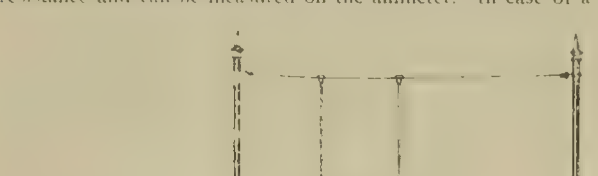
CONVERTER STATION.

instruments used with the battery are an ammeter, a voltmeter and a multiple way voltmeter switch joined to the two halves of the battery. The feeders as well as the leads to the trolley wires each contain two automatic circuit breakers, two ammeters, two lightning arresters and a ground detector. The latter consists of two change-over switches, one for each feeder, a resistance and an ammeter. Should a short circuit occur on one of the lines the circuit is at once



STANDARD SECTIONS WITH BRACKET CONSTRUCTION. (DIMENSIONS IN METERS.)

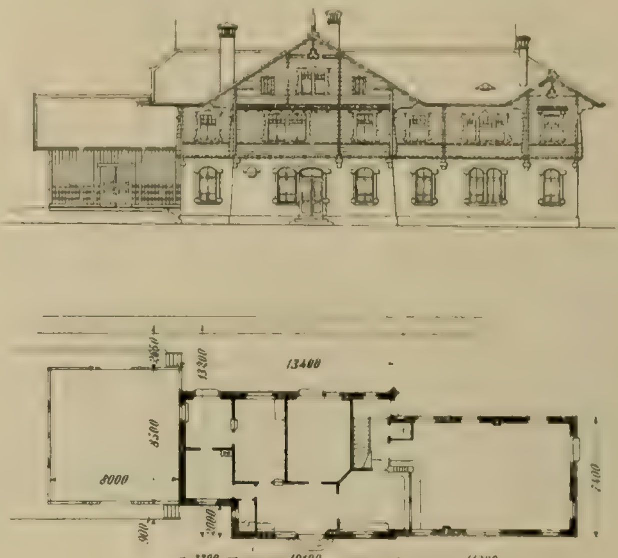
broken by the automatic switch. The change-over switch of the ground detector is then thrown over bringing a resistance into circuit, so that on again switching in the current passes through the resistance and can be measured on the ammeter. In case of a com-



STANDARD SECTION WITH SPAN CONSTRUCTION.

plete short circuit the ammeter reading reaches the maximum, while a zero reading indicates that the cause of the short circuit has been removed. The change-over switch is thereupon brought back to its normal position. The switches are mounted in the lower switching room each being enclosed in a cell made of xylolite sheathing.

The switching room in the second story controls the incoming 10,000-volt circuit. Between the high tension line and the leads



PLAN AND ELEVATION OF DEPOT IN TROGEN.

going to the transformers are inserted lighting arresters of the horn type provided with water resistances. On the side of the room opposite to the incoming lines are arranged three switch stands which can be shut off from the gangway by xylolite doors. Switches mounted upon these stands are connected to the secondary terminals of the transformers. Each stand carries two three-pole switches one for lighting and one for power, and the secondary fuses. The switches mounted upon each stand are interlocked so that when either one is closed the other must be open.

Two feeders pass out from the power station, one towards St. Gall and the other to Trogen. These feeders consist of bare copper cable of 70 sq. mm. section supported on porcelain insulators carried on the whole line. The square section iron pin of the insulators are fastened in with a special cement composed of glycerine and litharge.

A feeding point is provided every 300 meters. The trolley wire is of copper of 8 mm. in diameter and is placed at a height of 6 meters above the rails.

In St. Gall the cars run upon the town lines and are supplied with current from the local railway at a pressure of 550 volts, while outside of the town a pressure of 800 volts is used. On account of this considerable difference in pressure the trolley lines of the two systems are insulated from each other by means of two section insulators placed in series. At this part of the line there is an upward grade in going toward Trogen of 6.2 per cent. If a car going toward Trogen with a full load of 30 tons should stop upon the siding just in front of the section insulators there is no certainty that on re-

starting the momentum of the car would be sufficient to carry it past the break, because in addition to the low speed consequent upon the low pressure of 550 volts the current must be shut off about 400 [illegible] of the section insulators which occupy a little over a

EXTERIOR OF CONVERTER STATION

meter. To overcome this difficulty a branch wire is taken off from the 800-volt side and is carried parallel to the St. Gall trolley wire for a distance of 100 meters, going over the siding. If the car on the ascent has to stop at this siding its trolley is shifted over to the branch wire so that its motors start up with 800 volts. On the descent

SWITCHING ROOM ON FIRST FLOOR

[illegible] the trolley is not changed over as the car gains sufficient impetus from the grade to carry it across the junction. The two trolley wires are connected together every 200 meters in order to equalize the drop in voltage between them. Eleven lightning arresters are placed at intervals along the line.

Where the line [illegible] iron poles are used and in the country wooden poles impregnated with copper sulphate. The span wires have no soldered fastening but are connected by a loop and twist joint. There are two phosphor bronze telephone wires carried on the poles and these are transposed every 300 meters. Telephones are installed along the lines and in the baggage compartment of each car so that the trains are in telephone communication with the stations and with one another. The return circuit is carried by the rails which are bonded with copper bonds.

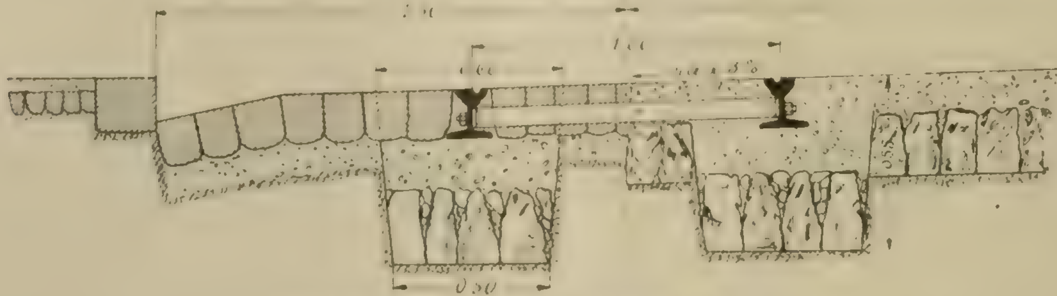
The rolling stock consists of double truck motor cars for passengers, single truck motor cars for baggage, passenger trailers and baggage trailers. The bogie trucks are built with side frames of pressed sheet steel secured by rivets and connecting plates to angle iron cross-bars. Spiral springs are placed between the frames and the axle boxes. From the side frames are swung the plate springs which carry the bolster which is guided between two cross bars.

VIEW OF LINE AT JUNCTION OF [illegible]-VOLT AND 800-VOLT CIRCUITS

The cars are furnished with tranverse seats built with wooden slats and each car contains three compartments, two for passengers and one for baggage. The latter are fitted with folding seats and the entrances to the cars are closed with sliding doors.

Each wheel of the double truck cars is acted upon by combined hand and air brakes. A compressor for the air brakes is operated by a toothed wheel gear from one of the axles. There are also

eight sand jets worked by compressed air. Motors were chosen of a size to give a speed of from 13 to 14 km. per hour on the



CROSS SECTION OF ROADWAY. (DIMENSIONS IN METERS.)

steepest grades and 25 km. per hour on the level. Each motor car is provided with four 25-h.p. motors of the Oerlikon type. These motors are built with closed cast iron magnet frames to which the laminated iron pole pieces are screwed. The two halves of the frames are hinged together and can be easily opened and the armature readily changed. The motor bearings are lubricated by means of oil rings and the axle bearings by felt strips. The current is collected by means of four carbon brushes and holes are provided in the upper part of the case of the frame to permit the commutator to be inspected when the motors are in position under the car.

The series parallel system of control is used. For slow speeds and for starting the motors are used in series; for high speeds and heavy loads they are used in parallel. The same controller provides for both the forward and backward motion of the car.

There are four different points for the series connections, six for the parallel connections and six for breaking. In the motorman's cab are mounted an automatic switch with blowout coil in addition to the necessary fuses and lightning arresters. The cars are heated by electricity, there being 18 heaters, which may be regulated for three degrees of heat corresponding to consumptions of 1,200, 2,400 and 3,600 watts. Sockets and plugs are provided for coupling the heating and lighting circuits of the trailers.

The lighting of the cars is provided by two series of lamps, each series containing seven lamps, five of which burn simultaneously. In order to adapt the system of lamps to either of the two working pressures a change-over switch is provided which operates automatically in passing from one trolley wire to another,

STANDARD PASSENGER MOTOR CAR

FREIGHT MOTOR CAR

this switch serves to put in or cut out a resistance in series with the lamps.

The single truck passenger trailers are also built with tranverse seats and have enclosed platforms, each provided with one side entrance. All motor cars are built to carry five tons and the axles are permitted sufficient play, both longitudinal and transverse, to enable the cars to take curves of 15 meters radius. The electrical equipment of the trailers consists of the two coupling sockets previously mentioned, six lamps with a throw-over switch for the two working pressures and four heaters which can be regulated to work at 500, 1,000 and 1,500 watts. The baggage cars are equipped with two 40-h.p. motors, but are otherwise similar in their electrical equipment to the passenger cars. All of the passenger cars are provided with two trolleys, the one in the rear always being used. The baggage cars have only one trolley.

This road has a gage of 1 meter and its length is 9.7 km. The length of its own track is 9.36 km. and the difference in these two lengths corresponds to the length of the St. Gall city line over which these cars run.

The steepest grades occurring on the line are one of 7.5 per cent for a distance of 48 meters, one of 7.4 per cent for a distance of 50 meters and one of 7.3 per cent for distance of 100 meters.

The roadbed consists of a layer of broken stone blocks 30 cm deep upon which is 25 cm. of gravel filling. The total depth of the roadbed therefore is 55 cm. The line is paved at all sidings and stations. Drainage pipes are placed at right angles to and under-

neath the rails every 50 meters, and these empty into the road ditches or into neighboring drains. At one point on the line a cut was necessary which measured about 100 meters in length, 845 meters in breadth, and had a maximum depth of 8.2 meters. A stone bridge was also built for this line which has a span of 10 meters and which crosses the Saeglibach, a stream flowing between Speicher and Trogen. The smallest radius of curvature on this line is 25 meters, but the cars pass over curves of 15 meters radius on the city line in St. Gall. The rails are 12 meters long and have a weight of 42.8 kg. per meter. Distance rods of round iron are provided in the number of six to each rail length on tangents and seven per rail length on curves. The sidings branch off the line in the country at an angle of 1 to 6 and at the stations 1 to 4. The switch points are controlled along the country line by springs and at the stations some are controlled by springs and some by weights.

The car barns in Speicher are provided with four tracks and a repair shop. The building is of wooden frame with stone filling and covers an area of 480 sq. meters. Both Speicher and Trogen have well equipped passenger stations, these buildings having brick foundations with superstructures of stone.

The Growth of an Electric Railway.—IV.

BY L. F. GOULD.

Car Barn and Shops.

If possible the car barns and shops should be located near the power station. All buildings should be fire-proof and as an added safeguard, the storage tracks be given sufficient grade toward the doors of the barn that in case of fire the brakes may be thrown off and the cars thus drift unhelped from the burning structure. In case the shops are placed in the same building with the storage, wash, paint and other tracks, a fire wall must intervene. Offices may be located over part of the shops and thus additional floor space be gained.

The design of such structure will conform necessarily to the type of equipment to be served, hence none but a general statement can be made here concerning car barn, machine shop, etc. In order that the cost of machine work for the power house construction, and in fact all construction, may be greatly lessened, the machine shop should be built and equipped in advance of other work, thus saving not only the charges for hiring machine work done, but the time lost while such repairs are being made.

No matter what the size of our road may be, some kind of automatic block signal system more or less expensive, in harmony with other costs, should be installed. While powerful head lights and double tracking of curves do indeed greatly lessen the element of danger from collisions, still these are ineffective in a fog or snow storm. The electric roads run more trains and at equal and faster speeds over poorer tracks than their steam competitors, but still many managers speak of block signals as luxuries, and yet many others would say that "had a block signal system been installed before such and such a collision which we experienced happened, the costs of the one accident would have more than paid for the signal system."

Local conditions will serve as the best guide for placing waiting rooms and platforms.

Here follow detailed estimates for the cost of construction of a sixty-one mile electric interurban railway.

Estimate.

All Quantities Figured per Mile.

Roadbed.

...... cu. yd. earthwork at .... cts. per yd...	
...... cu. yd. rock at .... cts. per yd..................	....
...... acres grubbing and clearing at .... per acre	
640 rods wire fencing at .... per rod	
Pipe culverts	
Masonry bridges and culverts	
Wooden and steel bridges	
Highway and farm crossings..........................	....
Land for right of way	
Cattle guards	
Approximate total roadbed per mile	$5,200.00

The above quantities vary so greatly with local conditions that no attempt at detail prices is made.

Track.

110 tons 70 lb. A. S. C. E. Sec. 60 ft. T-rail at $35	$3,850.00
176 rail joints at $1.60 each	281.60
2,640 ties, cedar, 8 ft. x 6 x 6 in., at .55 each	1,452.00
30 kegs spikes, 9-16 x 5½ in., at $4 per keg	120.00
360 bonds, No. 0000 copper, .62 each (placed)	223.20
10 cross bonds, at $1 each (placed)	10.00
1,800 cu. yd. gravel ballast, at .60 per yd	1,080.00
Sub-delivery of material	300.00
Special work (average per mile)	100.00
Labor laying track	1,000.00
Total track per mile	$8,416.80

Trolley.

50 poles 35 ft., cedar, 8-in. tops, at $7.50 each (placed)	$ 375.00
50 brackets, flexible suspension, at $2.25 each	112.50
200 bolts for brackets, ½ x 12 in., at .06 each	12.00
50 eye-bolts, ½ x 14 in., at .08 each	4.00
125 globe strain insulators, at .25 each	31.25
100 hangers, uninsulated, at .10 each	10.00
20 pull-overs, S. C. double trolley, at .60 each	12.00
6 pull-overs, D. C. double trolley, at .65 each	3.90
8 anchor bars, at .40 each	3.20
150 mechanical ears, at .20 each	30.00
3 splicing clamps, at $1.00 each	3.00
2,500 ft. span wire ¼-in., 7-strand galv., at $6.50 per M	16.25
500 ft. span wire, 5-16-in, 7-span galv., at $10.00 per M	5.00
2 miles No. 0000 figure 8 trolley wire, 6775 lb., at .15	1,016.25
20 anchor rods, at .50 each	10.00
20 track ties for anchors, at .50 each	10.00
Delivery	25.00
Labor on trolley and anchors	170.00
Total trolley per mile	$1,849.35

Direct Current Feeders.

60 cross arms standard 2-pin, at .25 each	$ 15.00
60 pins standard wooden, at .05 each	3.00
60 bolts ½ x 16 in., at .08 each	4.80
60 insulators, heavy feeder type, at .25 each	15.00
60 sets cross arm braces, complete, at .20 per set	12.00
Feed wire bare copper avg. 6,650 lb. per mile, at .15	997.50
Labor on feed wire	90.00
Delivery	30.00
Total d. c. feeders per mile	$1,167.30

High Tension Feeders.

60 cross arms 3½ x 4½ x 60 in., at .50 each	$ 30.00
50 pole top bands, at .20 each	10.00
170 pins and bases, at .13 each	22.10
170 insulators, 30,000-volt type, at .40 each	68.00
60 bolts, ½ x 14 in., at .07 each	4.20
60 pair cross arm braces, complete, at .25 a pair	15.00
Labor on high tension line	100.00
3 miles copper wire, No. 4 hard drawn 2,002 lb., at .15	300.30
Tie wire, 40-lb., No. 6, hard drawn copper, at .15	6.00
Total h. t. feeders per mile	$ 555.60

Telephone System.

60 cross arms, 4-pin standard, at .30	$ 18.00
240 pins locust, at .03 each	7.20
240 class insulators, at .04 each	9.60
60 pair cross arm braces, complete, at .20	12.00
4 miles No. 8 galvanized iron wire at $15.00 per mile	60.00
20 telephone sets in place, at $20 each—60 miles	1.35
Labor on telephone line	50.00
60 cross arm bolts, ½ x 16 in., at .08 each	4.80
Total per mile	$ 162.95

Power Station.

Buildings and foundation	$14,000
Three 450 kw. generator sets, at $16,500	49,500

900-h. p. water tube boilers, erected	10,350
Condensing plant, feed pumps and heaters	14,000
Automatic stokers	4,000
Boiler settings and stack	4,000
Piping	6,500
Fuel and ash handling apparatus	8,500
1 motor-driven exciter set	1,100
Additional cost to battery for exciting purposes	1,500
7 step-up transformers 200-kw	8,400
Switchboards and lightning protection	4,000
Overhead crane	3,500
Cables, wiring and erection	9,000
	$138,350

Cost per kw .....$ 102.47
Cost per mile of track..... 2,268.00

Estimate assumes that material can be brought to power house on

Sub-Stations.

3 buildings, at $3,000 each	$ 9,000
1,025 kw. rotary apparatus, complete, at $40 per kw	41,000
4 batteries, 975 amperes, complete, at $45 per ampere	43,875
Total sub-stations	$93,875

Car Barn.

Car barn, 35 ft. x 110 ft	$ 3,500
Car barn and machine shop, 100 ft. x 200 ft. (equipped)	26,500
Total car barns	$30,000

Cars.

8 standard cars, at $8,000 each	$64,000
1 snow plow and freight motor, complete	5,500
	$69,500

Block Signal System

Automatic semaphore system, placed	$250

Total Costs.

Roadbed, approximate	$ 317,200
Track (61 miles)	513,424
Trolley (61 miles)	112,810
Direct current feeders (55 miles)	64,201
High tension feeders (41 miles)	22,780
Telephone system (61 miles)	9,040
Power house	138,350
Sub-stations	93,875
Car barns	30,000
Rolling stock	69,500
Engineering and superintendence	60,000
Contingent fund	65,000
Block signal system	13,000
Total Ry cost	$1,510,080

Cost per mile of track, $24,755.40.

Transit Tidings Prize Jingles.

Sometime ago reference was made to the prizes offered by Transit Tidings, the publication of the United Railroads of San Francisco, for the best jingle embodying the primary rules to be observed by passengers. A number of the verses awarded prizes appear below:

Rule I.

When you pay your nickel,
Get your transfer then;
If you don't the chances are,
You'll have to pay again.

If a transfer you would make,
If a transfer you would take,
Get a transfer then and there,
When you pay your nickel fare;
When you pay your nickel fare,
Get a transfer then and there.

Rule II.

Take a seat, or take a strap,
If under five, please take a lap,
And never block the door, old chap,
Nor on the platform take a nap.

Rule III.

There was a young fellow named Hectory,
Who jumped on a car while 't was going;
His name isn't in the new directory,
On the dark river Styx he is rowing.

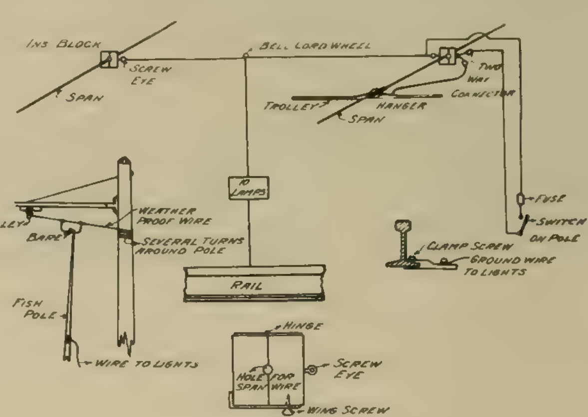
Rule IV.

Don't quarrel with the conductor
Or with the motorman,
To live at peace with every one
Is far the better plan.

Night Light for Track Work.

The accompanying sketch shows the details of the methods used by the track department of the Connecticut Railway & Lighting Co. for lighting the tracks at night when any kind of track or street work is to be carried on.

On lines where span construction has been used, the scheme is to attach two wooden insulator blocks to the span wires, and from them, between two spans, a No. 10 bare wire is suspended, this wire between the blocks being tapped into the trolley wire at one hanger. The wire to the lights is suspended from a small bell-cord wheel which runs upon the bare wire just mentioned and acts as a trolley when the lights are moved. This arrangement permits of moving the lights over a very large territory. When the arrangement is once in place, it becomes unnecessary to disturb the lights except to remove them to better point of vantage in



CONNECTIONS FOR LIGHTING.

light distribution. The passage of cars is not hindered in the least, which feature especially commends the arrangement. The ground connection is made through a special form of clamp which is attached to the base of the rail.

For temporary service it is the practice to secure current for the lights from the trolley wire by fishpole connection, the pole being jointed, and when not in use is in very compact form.

The fishpole is also used on suburban lines having bracket construction and where the work remains open along highways, the lights are used all night when connected as shown in the diagram, thus doing away with the necessity for watchmen and the annoyance due to the stealing of ordinary lanterns.

There is a rumor afloat that the Michigan Central R. R. will change its Battle Creek and Sturgis branch to an electric line.

The Ft. Wayne & Springfield Railway Co. will soon equip its road with the new Westinghouse single phase alternating current system. It is said that this road will be the second in the country to use the new system.

Piping and Power Station Systems. I.

BY WILLIAM T. MORRIS, M. E.

Inferior Pipe Work.

The first chapter of this work will be devoted to the origin and results of improper piping, and will also explain the necessity of better piping systems and suggest methods of securing better pipe work and piping systems by employing different methods in engineering offices. The chief requisite in pipe work engineering is to so design as to permit of repairs to or a shut down of disabled lines without interfering with the regular service of the plant. There are but few requirements to insure continuous operation, but these few must be very carefully considered and well safe-guarded, for no matter how careful the station attendant may be he cannot foresee every possible difficulty. It is only by experience with trouble that we learn to keep out of it, and it is foolish to assume that any man has experienced every difficulty and mishap that is possible in a steam plant so that by careful inspection he could avert any possible difficulty that might arise.

Moreover, a plant should not be laid out with a system that necessitates repairs after the plant is shut down, say between 1 a. m and 5 a. m., for it is not reasonable to expect an operating man to take much interest in his station work as he must work night and day to keep the plant in good order. If a plant is to be well kept up it must be so designed that repairs can be made whenever the chief can find spare help to do the work; this may happen at 10 a. m. one day and possibly 3 p. m. the next day. Repairs that can be made only at certain hours cause such disturbance in the general organization of the men that it takes a day or two before matters fall back into their regular routine again. This disturbance of regular duties means increased expense and it discourages the men, and after a time the station will show conspicuously that it is run down. The first to receive the blame for this is the operator, whereas in reality it should fall upon the designer. Any station manager who has found it necessary to make repeated changes in station operators, who has paid fair salaries and who has failed to obtain satisfactory results, can blame the entire difficulty to faulty design. A station operator very naturally objects to leaving his home at 1 o'clock in the morning to make some slight repair in order to keep his station in a neat condition. His incentive when he makes night repairs arises from fear, not pride; fear of a mishap that may affect the sum he receives in his pay envelope. What a strong contrast is exhibited between a neat, well kept plant and a dirty delapidated looking one! If we visit the former we are informed by the chief sitting at his desk, possibly studying his station records, that everything is running beautifully, and upon making a trip through the plant we may note that an intelligent looking assistant is making some joints on a steam line, and in the boiler room the fireman is placing packing in one of the reserve pumps. The general appearance of these men is neat and they are attending cheerfully to their work.

In the delapidated station we find steam blowing everywhere and a dirty looking, tired out man getting up from an old box just long enough to fill the oil cups or throw some coal into the furnace and then sitting down again. Off in a corner we find the chief taking [illegible] "I was up most of the night trying to make a joint in that old steam line." When asked how things are running, he will say, "the old station is going to pieces; we have all kinds of trouble."

In the first case the men are all working, they appear intelligent and cheerful, and everything is running smoothly. In the other case no one seems to be working, the men take no interest in their work as the station has become delapidated. The fault lies in the design of the station. Conscientious capable men are in demand and they want better positions. None of them want to come back nights and work on a dirty, hot job. The result is that good men attend [illegible] designed plants, and consequently [illegible] plants run down for the lack of intelligent care by men who take an interest in their work. The first cost of making ample provisions for all contingencies will amount to so many dollars and will readily be appreciated by the purchaser. But why, if an engineer is familiar with station operation, does he allow the purchaser to see only the initial cost? If he cannot succeed in persuading the purchaser to abandon a design which would necessitate night repairs, it would be better for the engineer not to be identified with the undertaking. When an engineer loses control of an undertaking and is constrained to accept details which he knows are wrong, it is far better for him and for his reputation as a designer to go on record as opposing the design and to relinquish all connection with the work. Instead of being known as the engineer who designed the monstrosity, he had better be known as the engineer who refused to do so.

Unfortunately, the cause of the greater part of inferior station pipe work can be traced directly to the engineers themselves. There is no other portion of station work that affords the engineer a similar opportunity of showing his knowledge of station requirement, none that requires as much time to properly design, and none that is more certain to develop the station into a run-down, expensive plant to operate, or the reverse. The piping and piping system and the electrical wiring are the only features in power station design that really require extensive engineering knowledge. The machines required are designed by their builders for given capacities, and if the piping and piping system are not properly cared for by the engineer he fails to do that work which is purely his. In other words, the engineer is either incapable or else he is conducting his engineering office on a purely commercial basis and puts as little time and care into the project as is possible. A system of paying for engineering knowledge according to the amount of money a man can spend is certainly far from an equitable basis. The engineer must then make some show for his money. He will possibly resort to a display of inexpensive drawings and allow the builders to furnish the decorative features of the plant. The piping drawings must be prepared so as to let the contract in two weeks, and they are therefore turned over to a draftsman. The percentage system is wrong; but it is in vogue and will unquestionably remain in vogue for some time. But some better method of designing pipe work is badly needed, and already steps in the right direction are being taken, for we can find men in the large piping establishments who are now making a special study of piping details and who design new details which take the place of those furnished by the engineers. The shop drawings have dimensions center to face, flange, templates, etc., all of which are standard in each particular shop.

As it is necessary for fitters to make these details, this fact suggests a method of letting contracts for pipe works. The method is one that would enable engineers to let contracts for piping with the least possible expenditure of labor, although it entails more time for drafting on the part of the fitter; but the saving effected in pipe work detail determined by the fitter rather than by the engineer will more than compensate for the extra cost of drafting. Each shop knows best that style of work for which it is best fitted, and what it can construct most economically, and by allowing the fitters to take advantage of these economies they can make lower estimates for the completed work even though they are compelled to furnish detail drawings. The details will be subject to the approval of the engineer in the same way as with structural details. The engineer should ask the fitters to furnish all pipe supports and special features, such as steam gages, safety valves, etc., as well as pipe covering, as the engineer would not have any details to show these.

The engineer should specify either the make or the style of the valves, fittings, pipe, etc., for each system. He should also furnish drawings showing the location of the boilers, engines, pumps, etc., and well developed and complete station diagrams as will be shown in a future chapter. The pumps should be located to conform to the

diagram of station piping as far as possible. In short, the engineer would develop the entire piping system, determine sizes and number of parts, but allow the pipe contractor to determine the exact location of lines and branches, as well as the supports; a class of work that very few engineers are sufficiently posted on or wish to take the time to do well. Instead of the engineer laying out pipe details that will be redesigned by the fitter, he will save expense both to himself and to his client by confining his efforts to designing the station system and to obtaining bids from those fitters who are known to have piping engineers who can properly detail piping.

The result of this method of handling the complex problems involved in pipe work will be that the engineer would give his entire time and study to the station system, a class of work for which he is best suited, and the piping contractor will use more time and skill in planning the different lines and details than the engineer would be able or willing to devote to it. The work when completed would cost less money and would be more creditable to all concerned than if all the details devolved upon the engineer. The pipe contractor of today is no longer the petty contractor of former years. His contract runs into large figures and he employs the highest skilled labor to expedite his work. His erecting labor is very high-priced and he can readily save the expense of a capable piping engineer by simplifying his field work, though in many cases it would slightly increase the cost of shop work, on account of the practical details that a purely office man never learns. Structural iron shops have employed this method of redesigning work to such an extent that power station engineers do not even attempt to detail steel work, but give general requirements to steel contractors and allow them to make their details after receiving the contract, and then submit them to the engineer for his approval. In the case of an extremely large undertaking an engineer will sometimes engage a structural engineer to design and detail the work, but will keep him only while he has a large amount of such work on hand. He cannot afford to retain a specialist after the work is designed and the specialist cannot afford to undertake such temporary work. The result is that the specialists of ability are found with the manufacturers, not with the engineers.

The power station engineer is virtually the assembly engineer and his training has been that of an examiner and a judge. He is not a specialist in any line of manufacture and when he undertakes such work it is very much in the nature of an experiment. Some years ago the engineers designed the boilers, not because they were specially fitted for this work, but because the boiler business had not developed to such an extent that the manufacturers required skilled boiler designers in their employ. But this is no longer the case. Manufacturers now employ engineers who make a specialty of boiler designing and the power station engineers make no attempt to design boilers. The same will be the case with pipe work and it will undoubtedly be but a short time before piping details will be developed by the manufacturer and not by the power station engineer. Not until then will we find good serviceable pipe work installed in the various plants under construction.

The introduction of piping system diagrams, and the letting of contracts based upon them, will be the first move toward developing this method. It will then devolve upon the piping contractor to design the details and he will no longer be able to evade the responsibility of bad pipe work design. His reputation will then depend upon his design as well as upon his workmanship. To protect himself he will be compelled to design his work more thoroughly than it could or would be done by the power station engineer. As previously stated the practice of relegating the details of pipe work to the fitter is in no way detrimental to the engineer or to the purchaser. The engineer could then devote his time to the system, which is generally overlooked; the fitter would lay out a neater and more reliable job and one costing less money to construct; when completed there will be more to show for the labor expended than by the present method of indifferent, incompetent or hasty work laid out by the power station engineer. Instead of making a study of how to connect flanges to pipe, the engineer should devote his thought and study to systems, as for the system alone will he be held responsible. The contractor will assume the responsibility of how to attach flanges to pipe and it will have to be done his way if he does assume the responsibility. An engineer must not expect to hold a contractor responsible for his own notions in regard to certain details. If a contractor is to be held responsible for results he must be permitted to use such details as he knows will accomplish what is demanded of him.

In inviting bids it is not necessary to state what details the manufacturer shall use, but is advisable to ask him to state the details he is supposed to furnish. This can be clearly outlined in specifications, using a loose data sheet for the bidder to fill in, covering such information as the engineer wishes to obtain. If such a system required additional labor on the part of the engineer, or cost more money, or was less effective, the engineer would undoubtedly continue to design his own pipe details. But since the engineer and his clients have much to gain and virtually nothing to lose through the method here outlined, it should not require much argument to prove the desirability of this method becoming common practice.

Piping Diagrams.

This chapter will be devoted to the laying out of piping diagrams, the first move necessary to determine the equipment required for a power station. It will further be shown that to determine sizes of machinery, boilers, etc., before the pipe system is laid out is wholly wrong, and that by so doing there can be no defined system but merely the connecting of a hole in a boiler with a hole in an engine. Almost any novice is able to say, "we shall want so many units of a

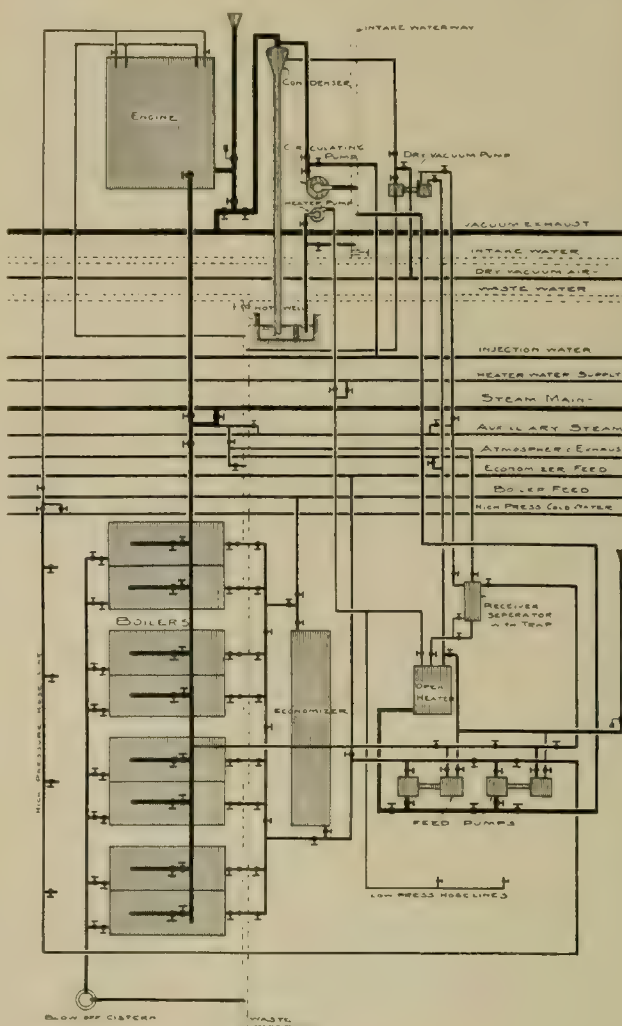


FIG. 1.

certain size and so many other units of another size." But why should we expect systematic results from a mere guess? When the question arises how to determine the machinery for a plant, shall we find a well conceived system laid out to determine it? Unfortunately for all concerned the almost universal method is to order the machinery by rule of thumb, and then turn the piping work over to almost anybody in the office that can make the drawings and never

[illegible] step to think about what system is to be used. In fact, if the question be asked in one out of every ten engineering offices, what their system is of connecting up the apparatus, they would most certainly hesitate before endeavoring to make an answer. When referring to piping we invariably hear the expression, "boilers connected up so and so," and the same with other apparatus. The thought is wrong, and not until "piping" is recognized as the system of the station and given first consideration, will we find better or more reliable installations.

The diagrams illustrated indicate a form of drawing which is quick to make and readily understood. The relative location of apparatus may be different from the diagram, but the connections, etc., would be brought to the same relative point as shown. The diagram should be the first drawing made of the station, and after determining the system the proper number and size of units can be established. The diagram of all station piping should be framed and placed in a conspicuous place, so station attendants will become [illegible] with the system. Any changes made in piping should be also shown on these diagrams. It matters not how crude the piping [illegible] diagram should be in plain view showing it clearly.

[illegible] method of laying out a diagram is to make detached [illegible] each line, such as main steam, main exhaust, [illegible] and after carefully considering all the lines [illegible] diagram can be more readily laid out. A [illegible] drawing is neither desirable nor practicable. While laying out the diagram it [illegible] of various details to be retained [illegible] determine many of the details that require decision before writing specifications for apparatus. Some of the connections shown on the diagrams may appeal to the reader as being rather unusual; the fact that they appear so is the desired demonstration of the value of the diagram. A full comprehension of the entire problem is possible at a very early stage, by making a diagram at the beginning of the work. Dimensions of apparatus, as well as pipe lines, can be determined in the early stages of the work, avoiding the difficulties occasioned by altering specifications after the work is let. It matters not how small the undertaking may be, the diagram will save time in many ways. If it be at all possible, all lines should be on the one diagram. A very practical method is to use a heavy paper that will stand considerable erasing, and lay out the different lines, machines, etc., free hand, making the diagram on a large sheet—say 24 x 36 in.—so that plenty of room will be afforded for notes, dimensions, etc. Whenever any changes are found necessary in placing orders for apparatus, the diagram should be changed and brought up to date.

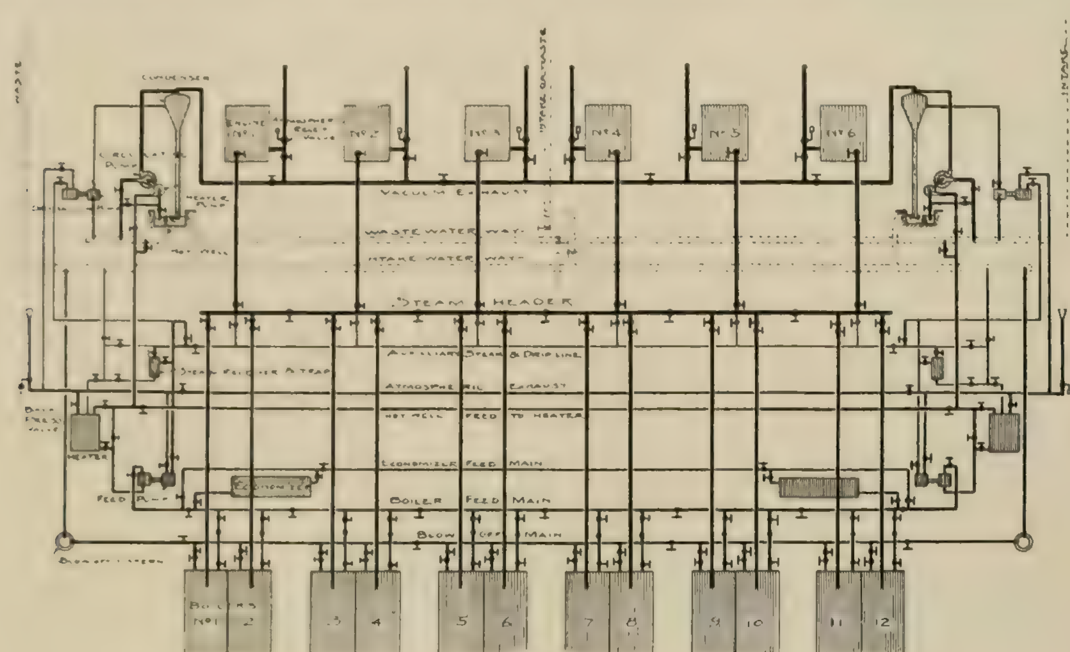


FIG. 2.

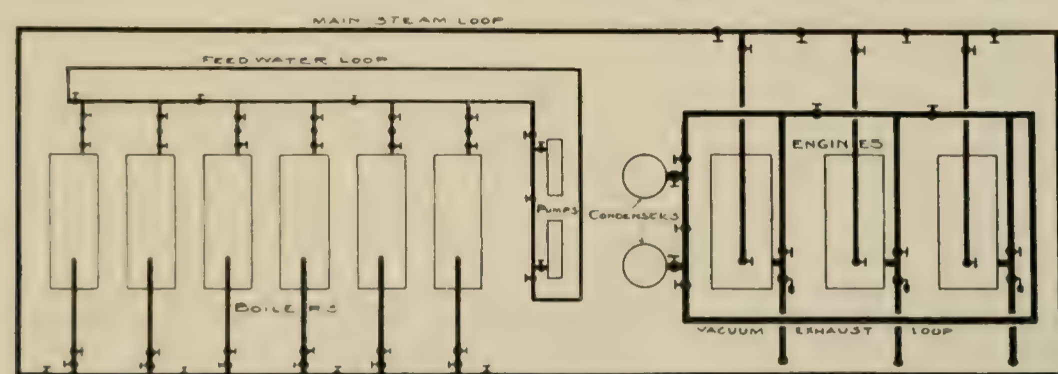


FIG. 3.

This paper drawing is virtually a study, and after details are made and the machinery, piping, etc., have been contracted for, a smaller and neater diagram should be made from it, one suitable for permanent station use. The prints furnished the station would be better if they were white prints so as to permit marking changes on them in case changes are made in the station system. The exhibition of diagrams is not customary, but if they were prepared and put on exhibition, many designing engineers would actually be ashamed of the conglomeration of pipe work that they had designed without employing even the slightest semblance of system.

It is but just that the purchaser should know what his general

station system is to be, and he should demand a diagram and learn what he is receiving. If the system is not provided for at the very inception of the work there is but little chance to provide a system after the machinery has been ordered. The old saying "any system is better than no system," holds in station design and the conditions of service will have to determine which system is to be employed. The most complete and perfect system is required for stations that are continuously in service, requiring a large portion of their equipment to be in operation at all times. This system is shown in Fig. 1, and is virtually composed of numerous stations, each complete in itself, and means for connecting them into a collective plant when desired. This is the only system that will permit repairs or shut down of any portion of the plant and at the same time permit full operation of the major portion of it. The connecting mains are merely conveniences, and whenever desired can be entirely shut off from the operating machines, allowing each sectional part of the plant to be operated independently of the remainder. For instance, if the steam header be shut off and out of use, the four or more units would be separately operated and would have different steam pressures. The steam from one group of boilers would then be used in its companion engine only. This system is somewhat expensive, requires more room for lines than a less complete system and necessitates the arrangement of machines in station groups; in fact, the grouping of the related machines is necessary for virtually all systems, rather than the grouping of similar machines. For example, if a plant is laid out with engines in one group and then a group of pumps, then a group of economizers and then a group of boilers, we can rest assured that but little system in pipe work can be employed.

As stated before, in order to establish a system in station design it must be done before any machinery is ordered. There are various systems to employ in station designing, each suitable for a particular line of service. The more flexible system is likewise the more expensive to construct and maintain; it requires a much more intelligent operator and necessitates many cross-connections that frequently bring in difficulties in regard to expansion and contraction. This, however, must be given proper consideration and determined by competent pipe work engineers, as it is often the case that the cross connections occasion more difficulties and shut downs than would the machine for which cross connections have been provided.

Fig. 2 shows a divided station, necessitating the use of certain sections of mains in order to operate the plant. With this system, a station of say six units, may be divided into three distinct parts, each operative throughout and wholly independent of the others. This system costs much less than No. 1 and requires but two auxiliaries of each kind for the entire plant. This system is suitable only for such installations as are worked on less than full load for sufficient time to make any necessary repairs to the mains. A plant that has half of its installation idle, say for six hours a day, can be divided into two sections instead of six, as shown, and the necessary repairs to mains be made at times of light load by using one-half of the plant. If the plant requires two-thirds of its installation for its lightest loads, then it would be necessary to divide the station into three sections. The machinery should be ordered to suit these conditions; instead of using four engines and eight boilers, there should be three engines and nine boilers, allowing the boilers to be of relatively larger capacity than the engines so that while working under ordinary conditions, one boiler can be off and the others handle all the engines. Each heater, feed pump, etc., should be able to handle the requirements of the entire plant, even though it be necessary to slightly crowd it if the plant is in full operation. In case of shutting off a middle section both ends would be separately operated. This system is suitable for installations that will permit repairs to be made to the mains during time the load is light. If the mains be extremely heavy or require much time for repairs to be made, system No. 1 is imperative, for with that system the mains may be out of service for weeks at a time and not necessarily interfere with ordinary service.

There is another system which can be employed, necessitating the use of much more piping and resulting in increased cost of installation, operation and maintenance. This is shown in Fig. 3. Property conditions may demand such a lay out. This system is the loop system and it will permit shutting off any portion of the mains and

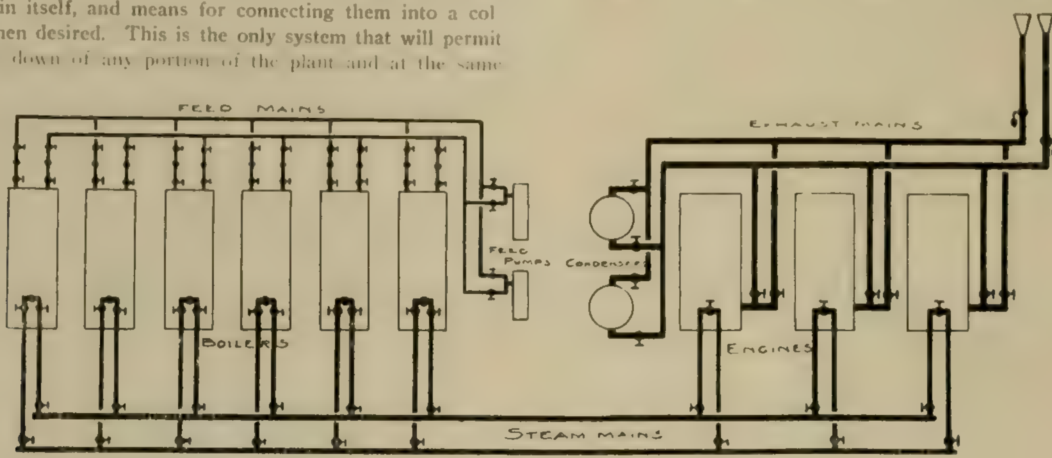


FIG. 4.

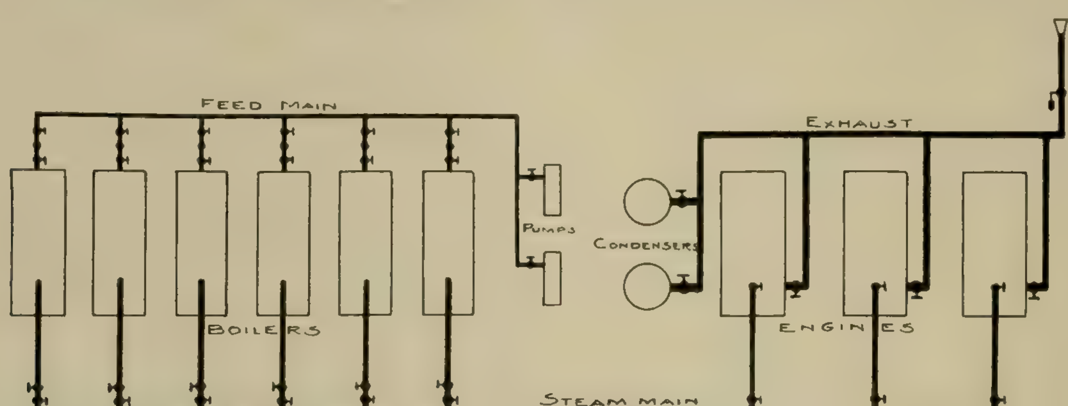


FIG. 5

[illegible] necessitates shutting down one-third of the plant. This system requires about four times the length of steam main required for system No. 1. The size of the mains must also be, if anything, slightly larger. In system No. 1 there is no point in the steam main where one-half the output of plant will pass. In system No. 3 either side of the loop may be compelled to carry two-thirds of the output of station in case a portion of the main is shut down. This system has many objections, but it is far preferable to a double main system as shown in Fig. 4. The double main system necessitates tying from each piece of apparatus to two different mains, and due to the fact that one main would be expanded and the other contracted, severe strains are thrown on joints unless both mains be kept a sufficient distance away from their connections. Each main would of necessity be compelled to carry not less than two-thirds the output of the plant, if arranged as in Fig. 4.

Fig. 5 shows such a crude method of piping a plant, that it is hardly worthy of being called a system. In case of repairs to the mains the plant must be completely shut down while they are being made. Generally, difficulties can be anticipated in a failing line, and repairs arranged before a shut down becomes necessary. If

The object of station system is to insure continuous operation. The condenser, heater and economizer are not absolutely essential, and the same amount of refinement is not necessary with these devices, which are virtually station economies, not operating necessities. However, their importance must not be under estimated, and fair protection should be given them by the systems according to which they are connected. To operate without these auxiliaries is possible, but very undesirable. One condenser doing the work of two and giving but 10 or 15 inches vacuum is far preferable to exhausting to atmosphere with the attendant engine difficulties. One heater doing the work of two and delivering water to the boilers at but 125° F. is far preferable to feeding cold water. These considerations are covered by system No. 2. The condensers, heaters, economizers and pumps would be suitable for four units and capable of supplying all six under reduced economy. This enables repairs at any time of any auxiliary without interfering with the operation of the plant. The main steam header and feed mains are divided into six sections, permitting the use of five-sixths of the entire plant at all times.

In formulating the plans for a station it is well to bear in mind

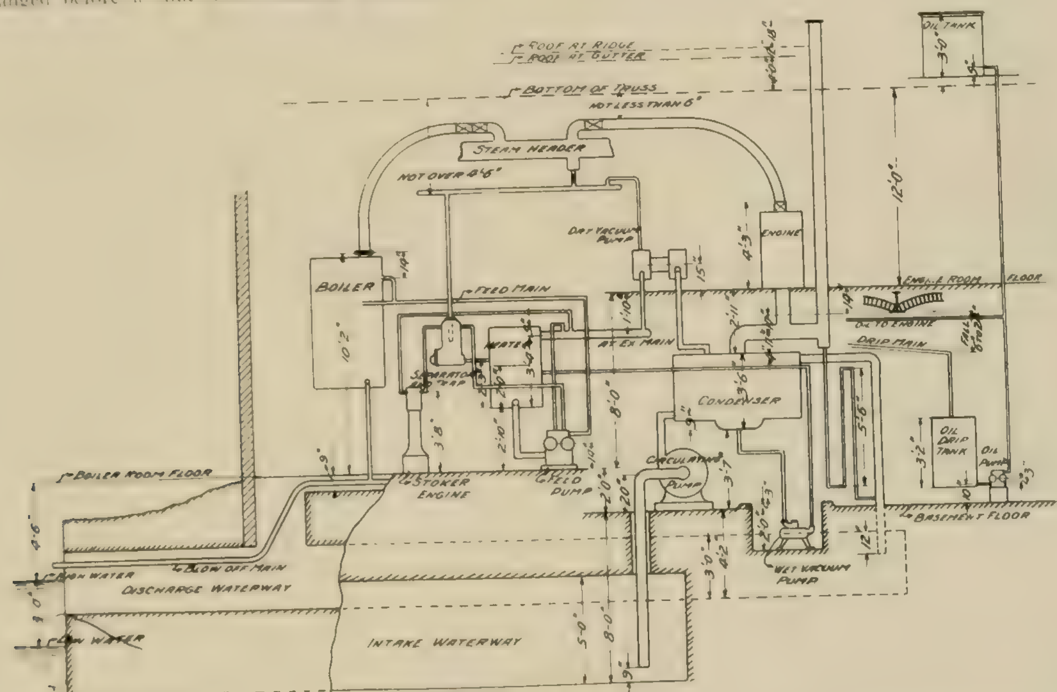


FIG. 6.

[illegible] imperative that there be no shut downs during the regular run. [illegible] shown in Fig. 5 should not be considered. To [illegible] system and at the same time not be compelled to make a big investment in piping, the plant should be laid out so system No. 2 may be used, this system giving by far the greatest protection for [illegible]. Unfortunately, we will find system No. 5 partially used in the same stations that are using some of the other systems. [illegible] expense for laying out main steam lines according to system No. 2, 3 or 4 and connecting up boiler feeds or [illegible] lines on system No. 5.

[illegible] piping [illegible] cannot be called a systematic arrangement [illegible] consistency. It is purely a waste of money to guard heavy steam and exhaust mains against almost any contingency and then [illegible] system No. 5 to supply engines with oil, etc. The station is [illegible] all the absolutely essential lines are not laid [illegible]. For example, if it is laid out on system No. 2 the operator should find it possible to shut off any [illegible] of piping or underground work and make repairs, and not [illegible] more than one-sixth of the plant; if on system No. 3 he should not shut down more than one-fourth of the plant using [illegible]. Feed mains, blow-off lines, pump suctions, oil drips, [illegible] all is comprised in the system. The condenser, heater and economizer connections can be looked upon as secondary and [illegible] to them may be on system No. 2 even though the [illegible] are on system No. 1.

the path of flow of steam and exhaust. The boiler can be considered the starting point of the loop and the engine the terminal. The pumps, heaters, condensers and pipe lines lie between. To simplify the piping plans it is very essential that the auxiliaries be located in close proximity to each other. The diagrams show them at considerable distances apart, but this is merely to make the system readily understood and to leave ample room to make alterations on the diagram if found necessary.

In addition to the plan diagrams, there should be an elevation diagram, laid out to scale for elevation only, as shown in Fig. 6. This elevation diagram is a portion of the station system and should be determined if piping is to be figured on from the diagrams and building drawings. It shows the various elevations of lines, lifts of pumps, drains for steam, exhaust and oil lines and other points that must not be lost sight of in the designing of pipe details. For example, it shows that auxiliary exhaust main must not be lowered very much or it will not drain to the heater. It also shows how much fall is given the pump suction from the heater and other details that should be considered and laid out by the engineer in order to locate the apparatus correctly. It is not necessary to show all the boilers or branches, but simply the lines that must be located in some fixed relation to each other. The location of lines should be left to the detailer and only interferences should be shown or noted.

Diagrams prepared as here shown are excellent means of study

ing station work. The different lines can be separately laid out and they make good studies. Take for example, Fig. 7. This diagram shows a boiler feed system, which is a loop system as regards boiler feeding, but in actual service the loops are divided, part being used for a secondary service such as a hydraulic line for tube cleaning or low pressure general water service for the station. In case it becomes necessary to shut down the left hand portion of the regular feed line, from valves A to B, then it becomes necessary to use the right hand portion and deliver water to No. 2 feed pump. If found desirable, valve C may be shut and pump can take water direct from the intake through valve D. Under all ordinary conditions, the hose line in front of the boilers would be under low pressure, about 50 lb., but if valves E and F must be closed, the

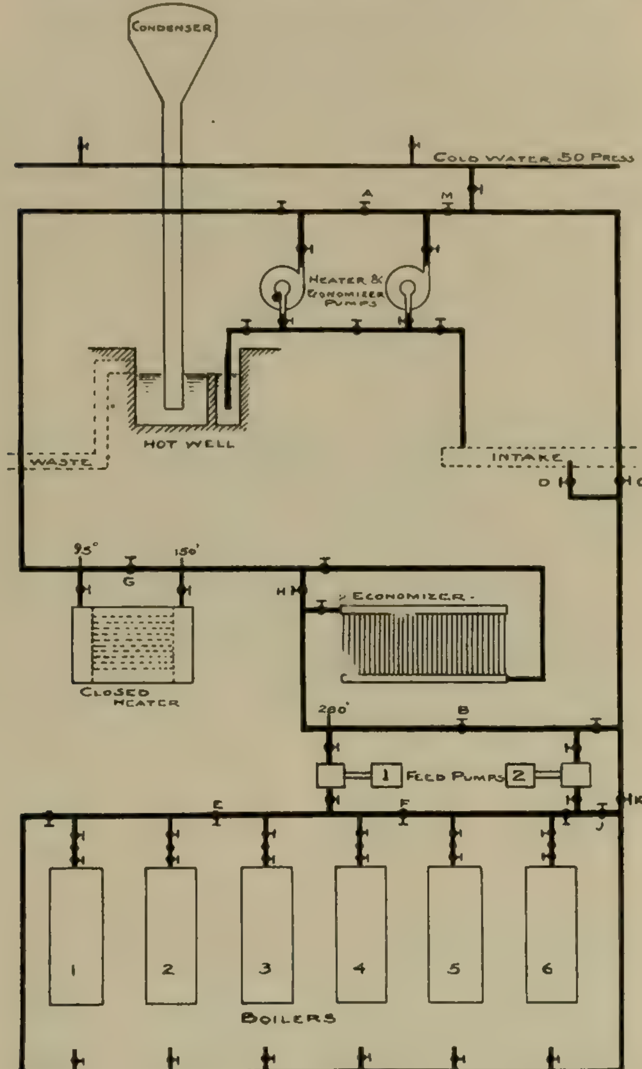


FIG. 7.

hose line may be used as part of the feed system to supply boilers No. 1 and 2. In case of fire, the by-pass valves G, H, S and K may be opened and L and M closed, thus putting the entire low pressure system under high pressure. This diagram shows a rather unusual method of feeding boilers. Water is taken from the hot well by means of motor driven centrifugal pumps and discharged under say 50 lb. pressure through the closed heater and economizer to the suction of the feed pumps. The feed pumps would be controlled by hand or automatically to supply the boilers, the suction being maintained under 50 lb. pressure by the centrifugal pumps. If at any time both centrifugal pumps are out of service, then the feed pumps would take their suction direct from the intake. The advantage of this system lies in the fact that the heater and economizers are never subjected to high pressure such as boilers would be. Instead of the economizers being a constant source of trouble, they will operate in their old-time reliable and satisfactory manner, on extremely low pressure as compared with those economizers which are placed between boilers and pumps and subjected to careless abuse of firemen, such as closing all feed valves and allowing feed pumps to pound away on them. The centrifugal pumps would maintain a uniform pressure and not require a relief other than a small one that would relieve the pressure in case the valves are shut both sides of the economizers and the rise in temperature of the water in the economizers should cause increase of pressure. The pressure in economizers must be sufficient to avoid generation of steam. There are, however, many low pressure installations using economizers, and the aim should be to use as low a pressure as is found practicable. It would also be advisable to place economizers sufficiently above the feed pumps to permit the suction to flow by gravity to the pumps.

The chief object in showing this unusual system is to call to the attention of the reader how readily the complex problems of station design can be laid out and made perfectly clear without resorting to scale drawings. No station work can be laid out even in a preliminary way until the system of connecting up is determined. It is very much to be regretted that the periodicals show general views of the new power plants and fail to show the system that determined the arrangement of the plant. Not only should the piping system be shown, but smoke flues, stacks, coal and ash systems. The object to attain is the use of as little machinery and piping as possible, and at the same time to permit shutting down any portion of the different apparatus and piping without interfering with the service for which the station is intended. To accomplish this, it is necessary to lay out the system first, then build the plant around it. Each of the various details must be separately considered and a careful determination made of its suitability for the purpose for which it is intended.

(To be continued.)

Metric System in Great Britain.

The advocates of the adoption of the metric system are beginning to show pernicious activity in Great Britain and the engineering press is giving considerable attention to the merits and demerits claimed for the metric and the English system of units. The Electrical Engineer quotes the following pointed paragraph from one of the opponents of the change:

"When the metric advocates are beaten on all other points, they invariably fall back on the sentimental idea of having one language for weights and measures throughout the world. They point out that 36 out of 39 civilized nations have already adopted the metric system, and it is only common justice that the minority—British Empire, United States, and Russian Empire—should give way to the majority. That looks very plausible, but what of the relative importance of those countries. Taking those 36 nations in order of population, none of the first four has the population of Liverpool. Lancashire has more inhabitants than any of the first 18. The total of the first 24 is only equal to the population of the United States. There is a larger population within fifty miles of Manchester Town Hall than in any one of the first 25 of those nations. The Russian Empire has a population equal to the first 28, and the British Empire alone has four million more people than the first 34 added together. Counting the three against the 36 we have 567 millions against 445,296,000, and the measures of those 567 millions are all based on the English inch. Looking at the question from the point of view of trade and commerce, the Anglo-Saxon race alone has the pre-eminence, which makes the vaunted position of meter users ridiculous."

The first of 40 electric locomotives ordered by the New York Central Railroad Co. for its interurban business is finished and will be tried on a stretch of third rail line near the works of the General Electric Co.

Conductors on the lines of the Indiana Union Traction Co. are provided wih cards addressed to passengers which are to be presented in case of dispute over payment of fares, requesting the patron to pay the fare demanded by the conductor and get a receipt and then appeal the matter to the general offices. It is believed that this plan will avoid many unpleasant incidents.

Directory of Street Railway Associations.

AMERICAN STREET RAILWAY ASSOCIATION.

President, W. Caryl Ely, president International Railway Co., Buffalo, N. Y. First Vice-President, Edwin C. Foster, president New Orleans Railways Co., New Orleans, La. Second Vice-President, John I. Beggs, president and general manager The Milwaukee Electric Railway & Light Co., Milwaukee, Wis. Third Vice-President, Richard McCulloch, assistant general manager St. Louis Transit Co., St. Louis, Mo. Secretary and Treasurer, T. C. Penington, treasurer Chicago City Railway Co., Chicago, Ill. Executive Committee: The President, the Vice-Presidents, W. G. Ross, president Street Railway Accountants' Association; C. F. Baker, president American Railway Mechanical and Electrical Association, ex officio, and John J. Stanley, general manager Cleveland Electric Railway Co., Cleveland, Ohio; Howard F. Grant, manager Seattle Electric Co., Seattle, Wash.; C. G. Goodrich, vice-president Twin City Rapid Transit Co., Minneapolis, Minn.; Frank G. Jones, vice-president and general manager Memphis Street Railway Co., Memphis, Tenn.; W. E. Harrington, general superintendent Public Service Corporation of New Jersey, Camden, N. J.

Next meeting, 1905.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION.

President, W. G. Ross, managing director Montreal Street Railway Co., Montreal, Quebec. First Vice-President, Frank R. Henry, auditor St. Louis Transit Co., St. Louis, Mo. Second Vice-President, Isaac McQuilkin, comptroller Indiana Union Traction Co., Anderson, Ind. Third Vice-President, J. W. Lester, treasurer Worcester Consolidated Street Railway Co., Worcester, Mass. Acting Secretary and Treasurer, W. B. Brockway, 40 Morris St., Yonkers, N. Y. Executive Committee: The officers and F. E. Smith, auditor for receivers Chicago Union Traction Co., Chicago, Ill.; G. B. Willcutt, treasurer United Railroads of San Francisco, San Francisco, Cal.; Arthur L. Linn, Jr., assistant secretary and treasurer, Utica & Mohawk Valley Railway Co., Utica, N. Y.; P. S. Young, comptroller Public Service Corporation of New Jersey, Newark, N. J.

Next meeting, 1905.

AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION.

President, C. F. Baker, superintendent motive power and machinery Boston Elevated Railway Co., Boston, Mass. First Vice-President, H. H. Adams, superintendent of shops The United Railways & Electric Co. of Baltimore, Baltimore, Md. Second Vice-President, John Millar, master mechanic International Railway Co., Buffalo, N. Y. Third Vice-President, F. G. Simmons, superintendent of way Milwaukee Electric Railway & Light Co., Milwaukee, Wis. Secretary and Treasurer, S. W. Mower, division superintendent Rapid Railway System, Detroit United Railways, Detroit, Mich. Executive Committee: The Officers and D. F. Carver, chief engineer railway department Public Service Corporation of New Jersey, Newark, N. J.; J. S. Doyle, master mechanic Interborough Rapid Transit Co., New York, N. Y.; C. C. Lewis, chief engineer Schenectady Railway Co., Schenectady, N. Y.; W. H. McAloney, superintendent of shops Denver City Tramway Co., Denver, Colorado.

Next meeting, 1905.

AMERICAN ASSOCIATION OF STREET RAILWAY CLAIM AGENTS.

President, W. A. Dibbs, general claim agent New York City Railway Co., New York, N. Y. Vice-President, E. W. O'Connor, claim adjuster Savannah Electric Co., Savannah, Ga. Secretary and Treasurer, B. B. Davis, claim agent Columbus Railway & Light Co., Columbus, Ohio. Executive Committee: The President, chairman ex officio, the Secretary, and W. H. Renaud, Jr., claim agent New Orleans Railways Co., New Orleans, La.; William White, claim agent Chicago City Railway Co., Chicago, Ill.; J. P. Feeney, claim agent, Public Service Corporation of New Jersey, Newark, N. J.

Next meeting, 1905.

THE COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION.

President, John A. Beeler, vice-president and general manager Denver City Tramway Co., Denver, Col. Vice-president, C. E. Doolittle, vice-president and manager The Roaring Fork Electric Light & Power Co., Aspen, Col. Secretary and treasurer, George B. Tripp, general manager Colorado Springs Electric Co., Colorado Springs, Col. Executive Committee: The officers and Wm. Mayher, treasurer and manager Greeley Power & Light Co., Greeley, Col.; J. F. Vail, general manager, Pueblo & Suburban Traction & Lighting Co., Pueblo, Col.

Date and place of next meeting not decided upon.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK.

President, C. Loomis Allen, general manager Utica & Mohawk Valley Ry., Utica, N. Y. First Vice-President, J. H. Pardee, president Ontario Light & Traction Co., Canandaigua, N. Y. Second Vice-President, A. B. Colvin, president Hudson Valley Railway Co., Glens Falls, N. Y. Secretary and Treasurer, William W. Cole, vice-president and general manager Elmira Water, Light & Railroad Co., Elmira, N. Y. Executive Committee: E. G. Connette, vice-president and general manager Syracuse Rapid Transit Railway Co., Syracuse, N. Y.; R. E. Danforth, general manager Rochester Railway Co., Rochester, N. Y.; B. B. Nostrand, jr., president Peekskill Lighting & Railroad Co., Peekskill, N. Y.; E. F. Peck, general manager Schenectady Railway Co., Schenectady, N. Y.

PENNSYLVANIA STREET RAILWAY ASSOCIATION.

President, F. B. Musser, general manager Harrisburg Traction Co. Secretary, C. H. Smith, superintendent Lebanon Valley Street Railway Co., Lebanon, Pa. Treasurer, W. H. Lanius, president York Traction Co.

MASSACHUSETTS STREET RAILWAY ASSOCIATION.

President, Edward P. Shaw, Newburyport. First Vice-President, Francis H. Dewey, Worcester. Second Vice-President, Robert S. Goff, Fall River. Treasurer, Fred H. Smith, Quincy. Secretary, Charles S. Clark, Boston. Executive Committee: The President, the Vice-Presidents and H. H. Crapo, New Bedford; P. F. Sullivan, Lowell; W. S. Loomis, Holyoke; W. W. Sargent, Fitchburg; R. T. Laffin, Worcester. Auditing Committee: Charles F. Grosvenor, Palmer; George W. Cook, Springfield; H. C. Page, Pittsfield.

NEW ENGLAND STREET RAILWAY CLUB.

President, J. H. Neal, chief of department of accounts, Boston Elevated Ry., Boston, Mass. Vice-Presidents for States: I. L. Meloon, Sanford, Me.; H. A. Albin, Concord, N. H.; C. K. Jones, Brattleboro, Vt.; John T. Conway, Quincy, Mass.; D. F. Sherman, Providence, R. I.; J. K. Punderford, New Haven, Conn. Secretary, John J. Lane, editor Street Railway Bulletin, 257 Washington St., Boston, Mass. Treasurer, Nathan L. Wood, with the Frank Ridlon Co., Boston, Mass.

Meetings are held the fourth Thursday each month, excepting July and August.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION.

President, J. F. Strickland, Waxahachie and Dallas, Tex. Treasurer, A. E. Judge, Tyler, Tex. Secretary, C. W. Hobson, Dallas. Recording Secretary, Frank E. Scovill, superintendent of the Austin Electric Railway Co., Austin, Tex. This is a consolidation of the Southwestern Electrical Association and the Southwestern Gas, Electric & Street Railway Association.

Next meeting at Denison, Tex., April, 1905.

THE OHIO INTERURBAN RAILWAY ASSOCIATION.

President, Harrie P. Clegg, vice-president and general manager Dayton & Troy Electric Railway Co., Dayton, O. Vice-President, E. C. Spring, general superintendent Dayton, Covington & Piqua Traction Co., West Milton, O. Secretary and Treasurer, J. H. Merrill, auditor Western Ohio Ry., Lima, O. Executive Committee: E. B. Gunn, general superintendent Appleyard Properties, Springfield, O.; F. J. J. Sloat, general manager Cincinnati, Dayton & Toledo Traction Co., Hamilton, O.; R. E. DeWeese, uperintendent Dayton & Northern Traction Co., Dayton, O.; A. W. Anderson, superintendent Dayton & Xenia Traction Co., Dayton, O.; Howard Fravel, superintendent Dayton & Western Traction Co., West Alexandria, O.

Association meets monthly. Next meeting, Toledo, Nov. 19, 1904.

UNION INTERNATIONAL DE TRAMWAYS ET DE CHEMINS DE FER D'INTERET LOCAL.

President, Leon Janssen. Secretary General, P. t'Serstevens, 6 Impasse, due Parc, Brussels, Belgium.

CONNECTICUT STREET RAILWAY ASSOCIATION.

President, John B. Carrington, vice-president Fair Haven & Westville Railroad Co., New Haven, Conn. Vice-president, A. M. Young, president Connecticut Railway & Lighting Co., Bridgeport, Conn. Treasurer, E. S. Goodrich, president Hartford Street Railway Co., Hartford, Conn. Secretary, E. W. Poole, assistant treasurer and assistant secretary Connecticut Railway & Lighting Co., Bridgeport, Conn. Executive Committee: The officers and J. E. Sewell, general manager Connecticut Railway & Lighting Co., Bridgeport, Conn.; C. S. Treadway, president Bristol & Plainville Tramway Co., Bristol, Conn.; Walter Learned, president New London Street Railway Co., New London, Conn.

Date and place of next meeting not decided upon.

Nevada Transit Notes.

The city of Reno, Nevada, will probably within the present month claim the distinction of possessing the first and only electric street railway in the state.

For some time various parties have been interested in the project and a few months ago work was actually begun by one of them and a few hundred feet of track laid, but the work was later abandoned.

Recently, however, another company composed of some of the leading men of Reno took up the project and have already carried the work nearly to completion.

The Nevada Transit Company is the name of the new company and present indications are that at least a portion of its line will be in operation this month.

The city of Reno has a population of about 10,000 and is the largest city in the state. The main line of the road extends from Reno to Sparks, the route being about four miles in length. There are also loop lines to be built in Reno in the immediate future. At Sparks the Southern Pacific has recently erected repair shops giving employment to a large force of men, many of whom live in Reno, and there is a great deal of travel between the two cities, carried [illegible]

Having witnessed one failure the people of Reno were very skeptical when the new company entered the field and for this and other reasons it was determined to push construction work as rapidly as possible and with this end in view materials were ordered in the latter part of August for immediate shipment and by the middle of September sufficient material was on hand to commence construction work. Ground was broken about September 20th, and the work has been pushed as rapidly as possible since.

After leaving the city of Reno the road runs over private right of way for a short distance, thence along the county road for about a mile, then again over private right of way for over half a mile into Sparks.

The road is a standard gage, single track line and is constructed with 30-ft. 40-lb. T-rails of A. S. C. E. section, resting on yellow pine sawed ties 6 x 8 in. x 8 ft. Within the city of Reno and for a short distance outside span construction is used and the remainder of the distance is bracket construction.

The company will purchase its power from one of the power companies now in the field.

The directors are: H. F. Reid, president and manager; E. R. Dodge, secretary and treasurer; H. J. Gosse, H. J. Darling and S. H. Wheeler. Mr. George S. Wickerson is civil engineer, and Mr. [illegible] Barker electrical engineer of the company.

CHICAGO THE LONDON

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CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

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If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

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SUMMARY OF CONTENTS.

A. S. R. A. STANDARDS.

In 1901 the American Street Railway Association appointed a committee on standards which made a report at the New York convention held in October, 1901, submitting specifications for rails, car wheels, axles, brake heads, journal boxes, car bodies, painting, and ventilating devices for cars, which it recommended should be adopted by the association as the standard for practice. In this report the committee cited the electrical equipment as being one of the most important subjects that be taken up later, no recommendations regarding equipment being made in this report.

At the Detroit meeting of the association in 1902 a second report was made on the subject of standards, repeating the recommendations regarding rail sections made at the 1901 convention and amplifying the axle, journal and journal box and car wheel specifications and also recommending in detail method of painting. The committee at this time expressed itself as opposed to any recommendations for standards in trucks or in motors. The hesitancy shown by the committee in regard to entering upon the subjects of trucks and motors has been amply justified by the developments of the two years since the Detroit meeting.

At the 1903 convention the chairman of the standing committee on standards reported that for various reasons the committee had been unable to hold a meeting during the year and recommended that the matter be placed in the hands of the American Railway Mechanical and Electrical Association. We believe that no action was taken on this suggestion except to refer it to the executive committee.

Attempts of the association to adopt standards can scarcely be said to have been successful as in only one instance do we recall seeing reference made to the reports of the committee, and that is in the case of the rails recently adopted by the Milwaukee Electric Railway & Light Co. The failure to make substantial progress in the direction of getting its standards adopted is no indication that there is no need for such standards, but only that the right way has not been chosen. Some suggestions as to improvements in methods will not be inappropriate.

In the first place, however excellent the recommendations of a committee may be, it is not wise for the association to hastily adopt the committee report when presented at the convention. The attendance at conventions never represents all the members, and at the past meetings when standards have been adopted, it is doubtful if even a majority of member companies were represented. The delegates at a convention are from all departments of the companies, and a claim agent or an auditor should not be the one to bind his company on the question of wheel or rail design. In voting for the adoption of a standard a road with 500 cars should have more influence than the one with only 5 cars.

A better way of passing on proposed standards would be to substitute the letter ballot for the viva voce vote. And at this time it would be very proper to consider the desirability of apportioning voting power and dues on the basis of mileage or number of cars operated instead of giving to all companies equal voice.

A second point is that the recommendations of the Association are difficult of access. Being comprised in several volumes of the transactions, they are very hard to find unless one has pretty definite ideas as to where to search, and can rely on memory as well as upon the index. This condition makes the work done by the Association of far less use to newly organized companies than it otherwise might and should be.

The present membership of the A. S. R. A. as stated by Mr. Ely, comprises less than 200 companies, out of more than 700 operating railways in the country. Membership in the Association should be of greater value to the small company than to the large one, but the small companies, and especially the newly organized ones, will have to be convinced that the Association has something to offer. We believe that a "Manual of Recommended Practice" carefully compiled and issued each year, as soon as possible after the annual convention, would be a valuable work for members and a strong influence in bringing new companies into the association. When contemplated changes in the existing organizations that will bring them into closer touch are made effective, such a manual might include the widely adopted standards of the accountants, and the recommended practice of the mechanical and electrical association also.

WAGES AND ACCOUNTING ON MUNCIPAL TRAMWAYS.

The advocates of municipal ownership of street railways lay great stress upon the admirable results that have been attained in Europe, and especially in Great Britain. Considerable ammunition has been furnished through the reports made by United States consuls to the Department of Commerce and Labor which reports are widely circulated through the Department's daily publication. A great many of these letters from our consular representatives show slight knowledge of many of the most important features involved in street railway operation and for the most part consist of glittering generalities. American writers who do not believe in the desirability of having public utilities operated by municipalities have frequently called attention to the fact that if street car fares abroad are less than in America the rates of wages are also less.

It will do no harm to again quote some of the most recent figures on rates of wages paid by the municipal tramways of Great Britain. These are taken from a compilation made by Mr. Alfred Baker, general manager of the Birmingham Corporation Tramways and presented before the Municipal Tramways Association of Great Britain at its meeting held in September last. Mr. Baker compiled a table showing wages, hours of employment, premiums, sick benefit allowances, contributions in the way of uniforms, etc., for 47 municipally operated tramways, and covers all classes of employment. For the purpose of comparison we have taken eight tramways, four having the highest rates of wages and four having the lowest, and give herewith some of the principal data:

MOTORMEN.

City.	Hours per Day.	Wages.	Sick pay.	Vacation
London	10	\$1.14 to \$1.50	Half.*	None.
Liverpool	10	1.20 to 1.30	Benefit Assn.	5 days
Manchester	9	1.04 to 1.26	None.	1 week.
Sheffield	10	1.20 to 1.35	Half.*	1 week.
Derby	9¾	.96	None.	1 day in 14.
Glasgow	9	.96 to 1.20	Benefit Assn	5 days.
Southampton	10	.92 to 1.20	———	———
Warrington	8	.80 to 1.08	None.	None.

CONDUCTORS.

City.	Hours per Day.	Wages.	Sick pay.	Vacation
London	10	\$1.14 to \$1.50	Half.*	None.
Liverpool	10	1.00 to 1.20	Benefit Assn.	5 days.
Manchester	9	.98 to 1.22	None.	1 week.
Sheffield	10	90 to 1.12	Half.*	1 week.
Derby	9¾	.62 to .72	None.	1 day in 14.
Glasgow	9	.96 to 1.20	Benefit Assn	5 days.
Southampton	10	.75 to .90	———	———
Warrington	10	1.10 to 1.14	None.	None.

*Half pay when injured on duty.

Uniform allowances, varying from suit, overcoat and caps to caps and raincoat only are made.

The strongest point against municipal ownership as it would be in America is the fact that municipal accounting is conducted in such a fashion that one cannot tell the true state of the business. Many instances have been cited where municipal lighting reports show the cost of lighting as lower than could have been obtained from private companies, but analysis of these reports demonstrated that the figures given did not correctly represent the facts, because depreciation, taxes, interest and other proper charges were omitted from the statement of costs.

It may be urged that private corporations themselves do not make proper allowance for depreciation and there are at the present time a few street railway companies that are taking up a great deal of the time of the courts because they did not make proper provision for depreciation. A failure to follow good business methods, or to put it another way, a practise of deceiving themselves, in such cases affects the companies' stockholders only and not the general public, except insofar as an unsound financial condition may prevent needed improvements in the equipment and service. In the case of a municipality, however, the whole body of tax payers are the stockholders and deficits must be met by the public through taxes and not by indiscreet or unfortunate investors.

In the discussion of the proposed Standard System of Tramway Accounts presented before the Municipal Tramways Association of Great Britain, the president of the association urged that Contributions to Sinking Fund and Renewals Fund should not be included in Operating Expenses because were this done the municipal tramways would show results that compared unfavorably with those shown by private companies, and that the loss then indicated would be attributed to municipal operation when in fact it lay in the bookkeeping. This is the point exactly, if a private company kept its books so as to deceive its stockholders a limited number only of the public suffers, whereas if the same thing is done by the municipality the tax payers are led to believe that financial success has been achieved when in fact there is a deficit to be met.

TRAFFIC IN THE COMING WINTER.

The development of extra traffic has received a large amount of attention during the past few years at the hands of electric railway managers, but for the most part this has been confined to summer business. There would seem to be good reason for an enlargement of plans to include the winter season as well. Within the past decade a great change has come about in American life in regard to habits of recreation; out-of-door sports and games have acquired practically universal favor, and the end is not yet. Why should not the progressive electric railway do its share in encouraging out-of-door recreation this winter, for the double object of stimulating health-giving habits among the people in its territory and deriving an appropriate revenue for itself?

On many operating roads in northern latitudes the parks remain closed and desolate from October to May, and little effort is made to encourage pleasure travel during the interval. Fixed charges and depreciation go on in winter as well as in summer. Given a park upon which \$10,000 has been expended, and we have at least \$500 in fixed charges and depreciation to make up during the six or seven months that the property lies idle, and which must be liquidated by more than 10,000 five-cent fares at some other season of the year, allowing for the cost of transportation to and from the park.

It is worth while in this matter to take a leaf from the books of our Canadian cousins, who seem to have learned how to extract the maximum of pleasure from a rigorous winter season of long duration. Why should the Sunday School picnic, the rowing match, baseball and golf stick have a monopoly of the summer park season to an extent that shuts out the toboggan, the coasting hill, ice palace and skating carnival in the winter? Here is a field for the progressive traffic manager, waiting to be exploited, and much may be accomplished at comparatively little expense. Given a street railway park with a pond or lake cleared, at least in part, of snow, and there would seem to be ample opportunity for the creation of new business. Most resorts of this kind are favored with a sheet of water that answers admirably for skating purposes when frozen, and the cost of illuminating it at night by arc or incandescent lamps, cleaning it of snow, and maintaining a log cabin or pavilion where one may obtain hot coffee and other light refreshments, put on skates in comfort, etc., ought not to be excessive.

Without extensive advertising there is little chance of making much money in this way; but given an energetic manager, the problem is well-nigh solved. Church "sociables," Y. M. C. A. gatherings and other "round-ups" of pleasure seekers might just as well be held at the street railway park as inside some stuffy, ill-ventilated and dingy basement—only it is "up to" the traffic man to do a little home missionary work first. Even in the fall nutting parties may be organized and started on their travels; corn huskings and other sports unfamiliar to city dwellers may be arranged, and in a college town or city where student life predominates all sorts of jolly outings can be encouraged and stimulated by the street railway man who is alive to his opportunities. The officers of women's clubs, brotherhoods and other social organizations are often at their wits' ends to propose something new, and the opportunity to rent special cars to such societies ought to be made use of. A select little dance in some large barn along the company's line or a hot supper in some noted hostelry in the chestnut region after a long Saturday afternoon of nut hunting should find favor among organizations which ordinarily meet within the confines of city walls. The possibilities appear to be limited only by the ingenuity of the traffic man, coupled with a liberal supply of tact. It is to be hoped that more roads than ever before in these colder latitudes will this year push their potential winter traffic further afield, and thereby earn both an added income and a still greater reputation as benefactors

of humanity. The country calls to us in the winter if we but have ears to hear, and it is the street railway's opportunity to supply a demand for transportation which can undoubtedly be greatly stimulated. With its regular cars constantly in contact with the traveling public the question of advertising becomes a mere matter of detail in the arrangement of placards, and the cost of such displays is insignificant in proportion to their value.

ECONOMY OF COAL TESTS.

The choice of coal in a modern steam-driven power plant is a matter of no small importance, for the economical operation of the boiler room depends largely upon the combined skill of the fireman and the nature of the fuel consumed in the furnaces. Even mechanical stokers cannot be supplied with an indiscriminate assortment of coals without a falling off in the efficiency of combustion. A change to a poorer grade of fuel is liable to require the installation of artificial draft apparatus before it can be properly burned; a mixture of coals may give better results than a single coal of better heating quality and, again, the substitution of an unfamiliar kind of coal may so upset the firemen as to demoralize the records of fuel consumption per unit of plant output for many weeks.

Thus, the selection of fuel is a problem of as much moment in an electric plant as the choice of raw material is influential in a manufacturing establishment. The location of the mines with respect to the plant, the cost of transportation and handling, the calorific power per unit of weight, the proportion of the total heating value which can be utilized under the boilers, the expense of handling the ashes and the relative smokelessness of a given coal are all essentially considered in a wise choice of fuel. The larger the contract, the more important it is to avoid haphazard decisions based merely upon one or two of the foregoing considerations. In a street railway plant, for instance, the peak loads in the morning and evening rush hours may require a fuel which will give maximum generating capacity rather than economical combustion. At such times every piece of rolling stock that can be set in motion to gather fares is needed on the lines, and operating efficiency is far less important than keeping plenty of power on the system. This is why it pays to overload equipment at the cost of higher depreciation, and a similar case may be found in the forcing of locomotives on steam railways. Generally speaking, however, the two most important factors in the choice of coal for a given plant are the cost per ton delivered to the furnaces and the calorific power.

Careful analysis of the fuel problem is thus essential in every plant which attempts to run economically. Engineers and operating men are coming more and more to realize this so that it is rare today to find a plant which does not weigh its coal at least once before using it, and in many cases the fuel is weighed before it is dumped from the wagons or scoops of the supplying company. In the same manner, most private plants keep a record of the output at the switchboard, so that a rough check of the coal consumption is possible by periodic comparisons of the pounds of fuel burned per kw. hour. In cases where a number of different coals not varying widely in price are competing for the business of a plant it is advisable to give each a fair trial before definitely settling upon one brand of fuel, unless, considering the points previously mentioned, there is no room for doubt, on account of a radical difference in calorific power. Nothing but a trial will determine the relative ease of firing and general adaptability of a fuel to a given plant. Often the nearness of a plant to a mine precludes the use of any other than local coal. Information of value may also be obtained by weighing the ashes—a proceeding as yet but little in vogue.

After a coal has been selected and the contract signed it is a matter of great importance to determine that the ensuing shipments meet the specifications. Calorific power costs money, and far too many companies are accepting shipments of coal without making any attempt to see if each lot comes up to the specified requirements. An analysis or determination of the heating power is likewise desirable before the contract is awarded. The importance of having reliable tests made is realized in the case of a company which buys, say 50,000 tons a year at $4 on the specification of 14,000 British thermal units per lb. Supposing that the coal tests but 12,000 units after the first shipment has been made of 10,000 tons that meet the requirements; the operating company then saves nearly $23,000 on the four remaining shipments of 40,000 tons. The cost of calorimeter tests at $25 each in the hands of an expert chemist is but $125, allowing but one test to each 10,000 tons of coal burned. The honest coal dealer has nothing to fear from such tests and the example above quoted is in no way an exaggeration of what has already occurred in practice.

Considerable light may of course be thrown upon the quality of coal by proximate chemical analysis, and still more by ultimate analysis. The cost of the latter is about $15, but the advantages of scientific calorimeter work are so great that the difference in the expense amounts to little or nothing. A thorough determination of the calorific power of coal is more properly a problem for the laboratory than for the engineering department of an operating company. The apparatus required is complicated and delicate, and the task one of great precision. The accuracy of the work involves corrections for the water value of the calorimeter; for the heat lag of the bomb; influence of the outside air; heat by the C^2R loss of the current which raises the temperature of the igniting wire to incandescence, thereby firing the sample of coal under 25 atmospheres pressure of oxygen; the amount of sulphur and nitric acid present; the heat generated in stirring the water in the jackets, etc. Many of these factors are entirely neglected in analyses and the accuracy of the results has been open to great question as calorimeters have been developed. Within recent years, however, the Berthelot calorimeter has been improved by the Mohler apparatus, and the latter has been re-designed with many new and accurate features by Mr. Henry J. Williams of Boston, so that what is probably the most precise equipment of today is an American product.

The limits of accuracy in this class of experimental work involve for their appreciation a scientific insight by means common in engineering circles—at least in the commercial branches. The problem of fuel analysis is one of increasing complication the farther one examines its details. It is largely a waste of money for an operating company to buy complex apparatus and attempt to make laboratory measurements by the skill of employees who are not specialists in manipulation and whose experience does not cover the peculiar difficulties which beset the highly accurate determination of the calorific power of coal. The case is one for the expert, rather than the general practitioner. That the laboratory of the chemist may become of greater use to the operating power plants of the future cannot be doubted by anyone who has made a careful examination of the precision with which the calorific power of coal can now be obtained. The economy of having regular tests of this nature made is bound to become more and more appreciated as the great consumers of fuel advance in that perpetual war against waste which signallizes modern engineering practice.

New York Subway Opening.

The most complete underground railway system as yet designed, the New York Subway, was opened to the public at 7 o'clock, Thursday evening, October 29th. Large crowds besieged practically all the stations. The first train contained the official visitors and special guests and made the round trip over the route with Mayor McClellan as motorman.

The opening ceremonies began at the city hall at 1 o'clock. The mayor presided as chairman, and after making a short speech, called upon the chief engineer, W. B. Parsons, to state whether the railway was finished, safe, and ready for operation. Mr. Parsons replied that the Rapid Transit Railway was completed for operation from the city hall to the station at 145th St. on the west side line. Addresses were then made by President Orr, Vice-president Starin, of the Rapid Transit Co., by John B. McDonald, contractor, and by August Belmont. The mayor declared the subway opened, and the first section of the train left the city hall station at 2:34 o'clock, returning at 3:46. After the official train left the city hall, the invited public to whom passes had been given were admitted.

In the evening the board of directors of the Interborough company gave a dinner at Sherry's.

The Des Moines (Ia.) Women's Club is planning a campaign for reduced rates on the street cars for laboring men.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

The decisions which have been reported in the Legal Department of the "Street Railway Review" since 1893 have been published separately by the Windsor & Kenfield Publishing Co. under the title "Street Railway Law," four volumes of which have been printed. Vol. I covers the period from January, 1894, to January, 1897; Vol. II from January, 1897, to July, 1899, Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901, to April, 1903. Vol. V is now in press. Price: Bound in sheep, four volumes, $[illegible]; single volume, $3.00. Bound in buckram, four volumes, $6.50; single volume, $2.00.

RIGHTS OF PASSENGER LOST BY FAILURE TO PAY SECOND FARE WHEN DUE.

[illegible] vs. Lynn & Boston Railroad Co. (Mass.), 71 N. E. Rep. [illegible]. May 18, 1904.

A person ceases to be entitled to the rights of a passenger, the supreme judicial court of Massachusetts holds, on failure to pay a second fare when due.

ASSIGNED CLAIM FOR PENALTY FOR REFUSAL TO GIVE TRANSFER NOT ENFORCEABLE.

Coyle vs. Interurban Street Railway Co. (N. Y. Sup.), 88 N. Y. Supp. 136. May 5, 1904.

The penalty of $50 provided by section 104 of the New York railroad law for a refusal to furnish a transfer, the appellate term of the supreme court of New York holds, is both created and "regulated by special provisions of law," within the meaning of section 1909 of the code of civil procedure, which provides that an assigned claim is not enforceable "where the rights or liabilities of a party to a claim or demand which is transferred are regulated by special provisions of law."

ACCEPTANCE OF DEDICATED STREET—CROSS-STREETS TO BE OMITTED IN ESTIMATING LINEAL FEET OF PROPERTY NECESSARY TO AUTHORIZE CONSENT.

People's Traction Co. vs. Atlantic City (N. J. Sup.), 57 Atl. Rep. 972. May 24, 1904.

Acceptance of dedicated streets, the supreme court of New Jersey holds, is found in a resolution of acceptance, and in the passage by a municipality of an ordinance granting permission to a street railway company to lay its tracks therein, and conditioning its permission upon the grading and paving the streets in a specified way. In estimating the number of lineal feet of property necessary to authorize the consent of a municipality to the construction of a street railway, the cross-streets are to be omitted.

POWER OF LEGISLATURE TO REGULATE FARES.

San Antonio Traction Co. vs. Altgelt (Tex. Civ. App.), 81 S. W. Rep. 106. May 4, 1904. Rehearing denied June 1, 1904.

The legislature has the power, the court of civil appeals of Texas holds, to regulate the rates of fare of a street railway company in the absense of any provision in its charter relinquishing that right, provided, however, the rates established are not so unreasonable as to practically destroy the value of the property of the corporation, and thereby depriving it of its property without due process of law, and denying it equal protection of the law.

ABUTTERS ACCEPTING COMPENSATION FOR CONSTRUCTION OF EMBANKMENT NOT ENTITLED TO OBJECT TO OPERATION OF ROAD BY RAILWAY COMPANY AS AN ADDITIONAL SERVITUDE.

Ilgenfritz vs. Toledo & Monroe Railway (Mich.), 99 N. W. Rep [illegible]. June 7, 1904.

The supreme court of Michigan thinks it inequitable for property owners to accept compensation for making an embankment on an avenue across their premises when its purpose was to enable the road it was for to be operated, and at the same time insist that the [illegible] be [illegible] by a company organized under the general railroad law, in the manner authorized by the franchise of the traction company that built the line, because the railway company was not authorized to operate a street railway as such, or as part of its through line, without compensation to the abutting owner, because it imposed an additional servitude.

INTENDING PASSENGER IN ORDINARILY SAFE POSITION STRUCK BY CAR WIDER THAN USUALLY USED NOT GUILTY OF CONTRIBUTORY NEGLIGENCE—NO ASSUMPTION OF RISK.

Denison & Sherman Railway Co. vs. Craig (Tex. Civ. App.), 80 S. W. Rep. 865. April 20, 1904. Rehearing denied May 18, 1904.

The car in usual use on a certain avenue was a small one, six feet six inches wide, the steps of which hardly came out flush with the body of the car. The car in use on a certain occasion, at night, was an "interurban car," which was much larger, with a step which extended out about six inches. The court of civil appeals of Texas holds that a person struck by this latter car while waiting to take a car, would be exonerated from negligence by evidence that the position he took was a safe one with reference to the ordinary cars which the company used, and with which he was familiar, and that he had no notice or knowledge, up to the time he was struck, that the car was different. It also holds that the same facts would exclude the idea of an assumed risk, if such theory had any place in the case as a distinct issue from contributory negligence.

POWER TO CONDEMN LAND ADJOINING ELECTRIC RAILWAY FOR POWER HOUSE, ALSO LAND AT A DISTANCE, AND LAND FOR LINE OF WIRES BETWEEN POWER HOUSE AND RAILWAY.

Rockingham County Light & Power Co. vs. Hobbs (N. H.), 58 Atl. Rep. 46. May 3, 1904.

That the use of land for constructing and maintaining a line of wires to conduct currents of electricity employed in moving the cars of a railway serving the public, the supreme court of New Hampshire holds, is a "public use" within the narrower meaning of those words. If land adjoining an electric railway may be taken for a power house—as to which there can be no doubt—no good reason is apparent why land at a distance may not be taken if the public good so requires. Of course, if land located at a distance may be taken for a power house, it must follow that necessary land or rights in land may be taken for constructing and maintaining a line of wires between the power house and the railway.

AUTHORITY TO CONSTRUCT STREET RAILWAYS OVER STATE AND TERRITORIAL ROADS—POWER OF HIGHWAY COMMISSIONER.

Smith vs. Jackson & Battle Creek Traction Co. (Mich.), 100 N. W. Rep. 121. June 25, 1904.

The supreme court of Michigan says that the legislature has control over the state and territorial roads, and may authorize the construction of street railways over them. It has authorized the construction of these railways along the highways of the townships upon such terms and conditions as the township and the company may agree upon. The court thinks the authority thus conferred is broad enough to include the state and territorial roads within the territory of the township, and for whose condition the township is responsible. The highway commissioner has nothing whatever to do with the granting of these franchises. No power in connection

therewith is imposed upon him by statute. His sole power is to see that the roads are opened and kept in repair in the same manner as township roads. If the highway is obstructed to the detriment of the traveling public, he undoubtedly is the proper person to complain, and to take steps to remove or prevent the obstruction. Beyond this power, he has none other.

DUTY OF LOOKING AND LISTENING FOR CAR—CARE REQUIRED AT COUNTRY CROSSING OF ELECTRIC RAILWAY—IMPOSSIBILITY OF CAR BEING BEHIND BANK NOT TO BE ASSUMED.

Robinson vs. Rockland, Thomaston & Camden Street Railway (Me.), 58 Atl. Rep. 57. May 16, 1904.

There is no absolute rule of law, the supreme judicial court of Maine says, that it is negligence for a person not to look or listen for an approaching car before attempting to cross a street railway, but it may be determined as a matter of fact that in some situations the measure of ordinary care is not fulfilled by a person who crosses without doing either. The conditions of a country crossing of an electric railway in some respects more nearly resemble the crossings of steam railways than they do the situation in the city streets, where persons and teams are constantly traveling across and upon the tracks. A greater speed may be reasonable upon the part of the electric car, calling for a corresponding increase in vigilance on the part of the traveler. Moreover, if the traveler about to cross the track cannot see an approaching car on account of an intervening bank, he cannot, in exercise of ordinary prudence, assume that it is impossible for a car to be behind the bank.

NO GREAT PARTICULARITY NECESSARY IN DESCRIPTION OF NEGLIGENCE CAUSING INJURY TO PASSENGER—PRESUMPTION OF NEGLIGENCE FROM INJURY TO PASSENGER—DUTY TO PASSENGER—DASHING INTO SWITCH.

Indianapolis Street Railway Co. vs. Schmidt (Ind.), 71 N. E. Rep. 201. June 8, 1904.

In view of the very strict responsibility of carriers for injuries to passengers, the supreme court of Indiana holds that no great particularity is necessary in the description of the negligence by which the injury was occasioned. When an injury to a passenger occurs without his fault, negligence on the part of the carrier is presumed, and the latter can excuse himself only by showing that he exercised a very high degree of care to prevent the occurrence of such accidents as that causing the injury. In this case the company owed to the passenger the duty of carrying him safely to his destination on its road, so far as his safety could be secured by the exercise of care commensurate with the dangers likely to occur, and reasonably to be anticipated from that mode of transportation. It was guilty of a breach of that duty in running the car in which he was a passenger so fast and so carelessly that it dashed into a ewitch, and was thrown from the track. This was one of the dangers likely to occur, and which ought to have been anticipated and avoided by the company.

RIGHT IN ABSENCE OF ORDINANCE TO STOP ANYWHERE FOR PASSENGERS—PRESUMPTION FROM FREQUENT STOPPING AT PARTICULAR PLACE—DUTY OF MOTORMAN TO KEEP OUTLOOK FOR THOSE DESIRING TO RIDE—SUFFICIENCY OF SIGNALS—BOARDING OF CARS BY WOMEN WITH ARMS FULL NOT NEGLIGENCE AS MATTER OF LAW.

Jaques vs. Sioux City Traction Co. (Ia.), 99 N. W. Rep. 1069. June 8, 1904.

The company, in absence of any regulation by city ordinance, the supreme court of Iowa holds, had a perfect right to stop for passengers at the middle of a block, as is customary in many localities where the street intersections are at an unusual distance apart, or at any other point it might choose. And this, the court says, may be done so frequently at a particular place that the public may well assume that it has been fixed upon by the company as an appropriate locality to receive passengers. One of the duties of the motorman is to keep an outlook for those who may desire to ride, and, when this is manifested, to afford them a reasonable opportunity to get on in safety. The character of the signals given to him differ almost as much as the persons giving them. All essential is that in some way he be made to understand what is desired. Women daily board standing cars with safety, even though their arms are full, as carrying babies, bandboxes, and birdcages, and what is so commonly accomplished without injury or thought of danger ought not to be held, as a matter of law, to be negligent.

CARE REQUIRED TO AVOID COLLISION BETWEEN CAR AND FLOAT.

Haas vs. New Orleans Railways Co. (La.), 36 So. Rep. 670. May 14, 1904.

In a case sounding in damages growing out of a collision between an electric car and a float, the supreme court of Louisiana holds that the crowded street rendered it necessary to be more than usually careful. It devolved upon the floatman not to attempt to cross in face of danger, and the motoneer to hold his car under control so as to be able to stop within the shortest possible distance.

DUTY TO PASSENGER WITH REFERENCE TO PLATFORM REQUIRED TO BE USED IN CHANGING CARS—DUTY IN INSPECTION OF PLATFORM—REASONABLENESS OF INSPECTION—NO CONTRIBUTORY NEGLIGENCE.

Woods vs. Metropolitan Street Railway Co. (Mo.), 81 S. W. Rep. 152. March 23, 1904.

Bearing the relation which the plaintiff did to the defendant—having purchased a through ticket from a point on its cable line to a point on its connecting electric line, and required, as she was, to transfer to get on the electric car, and in doing so to go upon the defendant's platform provided for that purpose—the supreme court of Missouri, division No. 2, holds that she was entitled to the care which the defendant owed to a passenger. It says there was, and, indeed, could be, no question of contributory negligence in the case. The duty of maintaining a safe platform for the entering and alighting by passengers on their trains was a continuing one, and, as the platform was its own property, the duty of inspection from time to time devolved upon it to see that the platform was safe for its passengers; and whether an inspection is reasonable depends upon the facts of the case. Many things must be considered—the construction, the materials composing the structure, its age, and the uses to which it is put. The fact that large crowds might congregate on it; that human lives were endangered if it was not kept safe and sound—these and other varying circumstances must be taken into consideration. What would be ordinary care in one case might be gross negligence in another.

ELECTRIC RAILWAY NO ADDITIONAL SERVITUDE—SALE OF CONSENTS AGAINST PUBLIC POLICY—CONTRACT GIVING FOR CONSENT OPTION ON PURCHASE OF BONDS AND STOCK NOT ENFORCEABLE.

Montclair Military Academy vs. North Jersey Street Railway Co. (N. J.), 57 Atl. Rep. 1050. May 13, 1904.

The right to construct and operate electric railways, with their incidental poles and wires, within the lines of public streets, for municipal travel, the court of errors and appeals of New Jersey holds, is included in the ordinary public easement, and imposes no additional servitude on abutting property. Consequently, it goes on to say, when the legislature by act of April 21, 1896, required the consent of a certain portion of the abutting owners to be obtained before such a railway could be built in front of their property, a gratuitous privilege or power was delegated to them. The reason for such delegation is not obscure. Abutting owners have a certain relation to the public streets in front of their property, which, while it is subordinate to the public easement, yet places them on a footing unlike that of the rest of the community. Because of this relation, special advantages and disadvantages accrue to them from street railways, and the legislative design clearly was that, unless it should be rendered probable that these advantages would exceed the disadvantages with regard to any proposed street, the railway should not be there laid. This probability was to be indicated by

the consent of the owners of at least one-half of the abutting land. For the decision of the matter thus contemplated, the legislature treated these owners as a class, every member of which had similar interests to subserve; interests that in some degree were common to all. Properly to meet the confidence thus reposed, it was incumbent on each member to bear in mind and be influenced by these common interests only, so that his judgment would be as fair toward his neighbor as it was toward himself. To permit any one of the class to barter for private and exclusive gain this power over the concerns of his fellow would be subversive of the benign purpose of the legislature in delegating it. So the court holds that, where, in order to obtain the consents required for the construction of an electric railway in a public street, the railway company agreed with an owner of land abutting on the street to give him, for his consent, a valuable option on the purchase of the company's bonds and stock, the agreement was in violation of the public policy established in the statute, and could not be enforced.

NOT AUTHORIZED TO LEAVE UNPROTECTED CUT IN HIGHWAY—FAILURE OF AUTHORITIES TO PROTEST NO DEFENSE TO LIABILITY.

Kaiser vs. Detroit & Northwestern Railway (Mich.), 99 N. W. Rep 743. May 17, 1904.

The street railway act authorized the defendant to construct its railway along the highway upon such terms and conditions as might be agreed upon between it and the township board. The only provision of the franchise granted by the township bearing upon the method of construction was as follows: "In the construction of track, or tracks, of said railway, the grade shall be made to conform as near as is practicable with the grade of the highway, or highways, where they may cross." The supreme court of Michigan holds that the general language of the franchise did not authorize the defendant to make a cut or excavation upon a part of the traveled portion of the highway without protection. Neither did it authorize the defendant to construct its roadbed so as to be dangerous. The fact that the township authorities did not protest against such construction was not a ratification of the act, so as to relieve the defendant from liability if such construction was dangerous to travelers. If, in such construction, it left an excavation so near the traveled portion of the highway as to be dangerous, it was its duty to protect it.

COMPANY NOT AN INSURER—LIMITS UPON CARE REQUIRED AND LIABILITY FOR INJURIES—CARE REQUIRED TOWARDS PASSENGERS—CARE REQUIRED TO ASCERTAIN WHETHER A PERSON DESIRES TO BECOME A PASSENGER—INTENDING PASSENGER COMING UP FROM REAR.

Foster vs. Seattle Electric Co. (Wash.), 76 Pac. Rep. 995. May 31, 1904.

It is not the rule, the supreme court of Washington says, that a street car company is an insurer of the safety of its passengers. There are dangers attending on their transportation which it seems no human prudence can foresee, while there are others which can be foreseen, but which cannot be effectually guarded against, because to do so would make the conduct of the business so burdensome as to prohibit it altogether. Hence, when a street car company exercises towards its passengers the highest degree of care consistent with the practical conduct of its business, it performs towards them its full legal duty, and is not liable even for injuries which might have been foreseen and prevented, if the means required to prevent them would involve a burden amounting to a practical prohibition of the business.

Again, the court says that an instruction given the jury was [illegible] that it reduced the degree of care required of the company's servants to that of ordinary care, while the true rule is that the highest degree of care reasonably practical under the circumstances should be exercised. But the court says that the rule contended for is applicable only after one has become a passenger. The company is not required to exercise the highest [illegible] whether or not a particular person walking or standing on a public street desires to become a passenger [illegible] Ordinary care is all that is necessary in such a case. The instruction here complained of was intended to define the degree of care required of the company's servants in ascertaining whether or not a particular person desired to become a passenger, and was a correct statement of the rule in that regard.

Another instruction was: "If you believe from the evidence that plaintiff came up to the said car from the rear, and was in a position where the conductor, in the exercise of ordinary care in looking for intending passengers at the rear entrance of his car, would not ordinarily see plaintiff; and if you further find that the said conductor, in the exercise of such care, did look, and did not in fact see the plaintiff, and at once gave the signal to go ahead, and the car thereupon started—then there can be no recovery in this case, and your verdict will be for the defendant." The court thinks that this instruction was without error. Under the conditions described in the instruction, plaintiff, it says, had not yet become a passenger, and, as said above, the servants of the company owed her only the duty of ordinary care.

INJURY TO PASSENGER BY COLLISION WITH CAR OF ANOTHER COMPANY USING TRACKS, DUE TO MISPLACED SWITCH—CARE REQUIRED OF EACH COMPANY—DOCTRINE OF RES IPSA LOQUITUR APPLIED—CARE REQUIRED IN MAINTENANCE AND USE OF TRACKS AND SWITCHES—USING SWITCH RUNNING AGAINST POINT OF TONGUE—SPEED OF 3 OR 4 MILES AN HOUR.

Klinger vs. United Traction Co. and Schenectady Railway Co. (N. Y. Sup.), 87 N. Y. Supp. 864. Mar. 2, 1904.

The plaintiff was injured while a passenger on one of the traction company's cars by reason of a collision between that car and one operated by the railway company, which was using the traction company's tracks. The primary cause of the injury was the misplacement, or the failure to remain where it was placed, of the tongue of a switch maintained and operated by the traction company, which misplacement, it was a fair inference from the testimony, was caused by the concurring negligence of both companies. Each of the latter endeavored to cast the blame for the plaintiff's injuries upon the other.

The case must be considered, the third appellate division of the supreme court of New York holds, having regard to the difference in the degree of care which the defendants were bound to exercise in relation to the plaintiff, under the law. He having been a passenger on one of the traction company's cars, that company was bound to the exercise of the utmost human skill and foresight with reference to maintaining, operating, and keeping in repair its tracks and switches, in order to save him from harm. And the tongue of the switch having failed to remain in position or having been misplaced because of some unexplained or unascertained cause, it was not incumbent upon the plaintiff, as against the traction company, at least, to show the cause of its being misplaced; but, under the doctrine of res ipsa loquitur (the matter speaks for itself), that company was required to explain its cause in order to relieve itself from the presumption of negligence in causing the accident.

The railway company, on the other hand, was bound to the exercise of reasonable and ordinary care only under the circumstances which confronted it at the time. It bore the same relation to the plaintiff as if he had been driving his own horse and wagon upon the street, instead of being a passenger on one of the traction company's cars. Its motorman saw the traction company's car standing at the other end of the switch, 75 or 80 feet away. He knew that he was running against the point of the tongue of the switch, and that it had no rubber or block to hold the tongue in place. His car was a heavy one. It was a heavy down grade. Under such circumstances, reasonable and ordinary care, the court holds, would require him to proceed very slowly, and to keep his car under control, so that the weight and the speed of the car would not jar the tongue from its position or misplace the switch, or, if it did do that, so that the car might be stopped before injury had been done to a car standing so near upon the other track. While, under other circumstances, a rate of speed of three or four miles an hour could not fairly be regarded as evidence of carelessness, yet, with the situation presented here, it could not be said that the conclusion that the railway company was negligent was unsupported by the evidence.

The only inference from the testimony being that the switch was

operated by the traction company's own employes, it was bound to the highest degree of care in this respect. In using the switch in a way it was not intended to be used, in order to facilitate repairs to its tracks, if the tongue would not remain in place without some mechanical means for holding it there, it was its duty to provide such means. When the plaintiff proved that the accident happened in the way it did, the presumption was that the traction company was negligent, and it was not incumbent upon him to show the cause for the switch being misplaced.

Judgment against both defendants affirmed, with costs.

COMPANY NOT LIABLE FOR INJURY BY OBSTRUCTION REMOVED FROM TRACK AND LEFT IN HIGHWAY—COMPARISON WITH REQUIREMENTS AS TO REMOVAL OF SNOW

Howard vs. Union Railroad Co. (R. I.), 57 Atl. Rep. 867. Feb. 18, 1904

About 10 o'clock one evening, near the middle of June, some vicious boys or young men carried a mortar bed from a new building, placed it upon the company's track, and put out the electric light which was near by. Soon afterwards a car came along, and, being unable to get by without removing the obstruction, the conductor and motorman pulled the mortar bed off the track, and left it in the highway, about 20 inches away from the nearest rail, the car then proceeding on its way. Shortly afterwards the plaintiff, who was riding to his home on his bicycle, not being able to see the obstruction on account of the darkness, ran into the same, and was thrown from his wheel and injured. The supreme court of Rhode Island holds that the company could not be held for the injury which the plaintiff sustained.

The plaintiff contended that the railroad company owed him the duty of either removing the obstruction out of the highway, or of giving him some warning of its presence in the highway by means of a light or otherwise, and that the case, for all practical purposes, stood the same as it would if the company had originally placed the obstruction in the highway. But the court holds that this contention was untenable. It says that in removing the obstruction from the car track the company was doing what it clearly had the right to do in the management of its business and in the discharge of its duties to the public under its charter and the laws of the state. It was conveying passengers from one point to another for hire, and it could not legally be called upon to even temporarily suspend its business for the purpose of clearing a highway of obstructions so that travelers thereon might not be inconvenienced or injured. Having found an obstruction upon its tracks, it had the right to remove it therefrom; and the mere fact that it did no more than remove it from its track did not have the effect to render it liable because some one else was subsequently injured by reason of the presence of the obstruction in the street. All that it did was to remove the obstruction from one part of the highway to another part thereof. It was in no way responsible for the presence of the obstruction in the highway; and its removal from the track, so far as appeared, did not add to the danger incident to its presence in the street. But, even if it did, the court fails to see that any liability attached to the company. Meeting with an obstruction in the highway, it had the same right that any ordinary traveler would have in similar circumstances. And who can doubt that such a person has the right, upon meeting with an obstruction in the highway which prevents his lawful progress thereon, to move it aside so as to enable him to proceed? Such a state of things very frequently happens.

Take this illustration: A box or package of merchandise accidentally falls from an express wagon upon one of the rails of the street railway company in the nighttime, and, being unnoticed by the driver of the team, he passes on and leaves it there. Soon afterwards a car comes along, and the motorman, seeing the object on the track, and seeing that it is of such a size and in such a position that it can be readily pushed from the rail by pressing the fender of the car gently against it, does so, and the obstruction is so far removed as not to interfere with his progress, and he goes on. Shortly afterwards a carriage comes along, and, it being dark, the driver fails to see the obstruction, and his horse takes fright therefrom and runs away, whereby the driver is thrown from the carriage and injured. Would the street railway company be liable for his injuries? The court thinks not, for the company would owe the driver no legal duty in the premises.

It was contended, however, that while no case had been found which was directly in point, yet those cases which hold that street railway companies are liable for injuries to travelers caused by removing snow from their tracks and piling it up on other parts of the streets so as to render the same unsafe for travelers were closely analogous to this case, and that the principle of those cases should be held to be controlling in this. But, while recognizing the correctness of the decisions in the cases cited in support of this contention, the court says that it fails to see their applicability to the case at bar. The difference between those cases and the present one is a vital one. The obstruction to the track caused by the presence of snow thereon is not a nuisance. It is not placed there by human hands, but is the act of God. Being an obstruction to travel, however, the railway company has the right to remove it, and, indeed, is under obligation to remove it as soon as may be, so that the rights of the traveling public may not be interefered with. And just here arises its duty to the public who have occasion to use the highway, viz., that in removing the snow the company shall not create a nuisance on the highway.

RIGHTS OF TOWN INCORPORATED AFTER COMPANY HAS BEEN GIVEN RIGHT TO DOUBLE-TRACK ROAD—WHETHER DOUBLE TRACKS IN ADDITION TO SINGLE TRACK WILL UNDULY OVERCROWD STREET FOR PUBLIC TO DEAL WITH—FORFEITURE ONLY ENFORCEABLE AT ELECTION OF STATE.

Newport News & Old Point Railway & Electric Co. vs. Hampton Roads Railway & Electric Co. (Va.), 47 S. E. Rep. 839. June 16, 1904.

The Newport News Company obtained from the board of supervisors of Elizabeth City county, in May, 1899, the right to double-track where there had been a single track over certain county roads and streets a portion of which, on April 1, 1900, became part of the town of Phoebus. But it did not double-track the bed of Mellen street in said town, as it had leased a piece of track on a street one block from Mellen street which it used for the return route for its cars; and, in December, 1900, the council of the town of Phoebus granted to the Hampton Roads Company the right to construct and operate a double-track street railway system on Mellen street. The supreme court of appeals of Virginia does not consider that the Newport News Company, by reason of the grant to it by the board of supervisors of Elizabeth City county, had a prior and exclusive vested right to use and occupy Mellen street with a double-track system of electric railway; the court holding that the right of the board of supervisors to control Mellen street after it had been severed from the county of Elizabeth City and became a part of the territory within the limits of the town of Phoebus ceased, and the control of Mellen street was from that time as absolutely under the control of the town authorities of Phoebus as if the town had been incorporated before the charter of the Newport News Company was granted. Whether the establishment of a double-track system of electric railway in a street in addition to a single-track system there, would unduly overcrowd the street and render it unsafe to travelers thereon, is a matter for the public to deal with, and not a competing corporation seeking to maintain a monopoly in the street. Again, the court says that for about 18 months the Newport News Company had used only a single track on Mellen street—the cars thereon running but in one direction, and returning, as has been remarked, upon another street—and did no act indicating an intention to furnish reasonable facilities for the accommodation of the public on Mellen street, until the Hampton Roads Company, in the exercise of the right conferred upon it by its charter and the ordinance of the council of Proebus, began work in locating its tracks upon Mellen street, etc.; and that, under the circumstances, the council of Phoebus was well warranted in the exercise of its right to promote the welfare of its citizens by conferring upon the Hampton Roads Company the right to occupy the street with its tracks. If from any cause the latter company had forfeited its right to lay its tracks and operate its cars on and over Mellen street, such forfeiture could not be taken advantage of in a private action, and could only be enforced on behalf of the public at the election of the state.

Double Deck Cars with Covered Tops.

A Review of Current British Practice.

For nearly two years the tramway managers of Great Britain, especially those operating municipally owned lines, have been much interested in the subject of covers for upper decks of tram cars and the result has been the perfection of a number of designs and the wide adoption of top covers by British tramways. From the point of view of the American manager the double deck car has never been popular and in the last eight years we believe the only American road to experiment along this line is the Twin City Rapid Transit Co., of Minneapolis, which this last summer put in operation between Minneapolis and St. Paul the car illustrated in the "Daily Street Railway Review" for Oct. 13, 1904. This car is provided with roof covering and canvas side covers which extend only to the hand rail. The car being intended for use in pleasant weather only, the idea of enclosing the upper deck, or what is properly a second car body, was not considered.

Mr. Bellamy of Liverpool, and is referred to at some length in the description of the Liverpool cars. The disadvantage is the extra cost of maintenance and possibly the extra cost of power, which may be due to the greater wind resistance of the upper deck.

We desire to express our appreciation of the courtesies shown by the tramway authorities of the various municipalities whose double deck cars are illustrated herewith.

GLASGOW.

The management of the Glasgow Corporation Tramways has been experimenting with top covers of different types which we are enabled to illustrate by courtesy of Mr. John Young, who until last month, when he resigned to go with the Yerkes lines in London, was general manager at Glasgow.

Fixed Roof Type.—The roof of this top cover is fixed; that is,

[illegible] CAR WITH OPENING ROOF CLOSED

END VIEW SHOWING ROOF OPEN

Doubtless to the majority of American readers the double deck car in its simplest form appears impracticable and the cover for an upper deck may be considered as a device which makes a bad matter worse. In Great Britain, however, the covering of the upper deck has proved to be a very popular step and a great many systems besides those whose cars are described in this article have ordered top coverings or are experimenting with various designs.

There seems to be a tendency to carry this matter to extremes [illegible] operated over roads of only [illegible] The end view of such a vehicle shows a structure of most unmechanical appearance, the immense height being out of all proportion to the width, and the car appears as if it might easily be overturned were it to encounter a moderate wind on a piece of road that was not in perfect condition.

The principal argument in favor of the top covered cars is that during the winter, and in inclement weather at all seasons, the passengers occupying the upper deck are sheltered. This phase of the question is one which has been given a great deal of attention by

it has no opening panels. It is constructed in the usual car roof style with ash roof ribs, machined to a 20-ft. radius, specially strengthened in the center to carry the trolley base. The ceiling is of birdseye maple three-ply veneer with teak or mahogany moldings.

There are five windows on each side, arranged to raise and lower with ordinary window sash chains and balanced to remain in any position. The total height inside is 6 ft. 1 in., with a seating capacity for 40, making the total seating capacity of the car 64.

Opening Roof Type.—This roof is divided longitudinally into five sections. The middle portion has no sliding panels, and is specially strengthened to carry the trolley base. The two end sections are fitted with sliding panels, closing towards the center line of the car. When panels are open, the clear space is equal to about half the area of the total roof. The side windows are fixed, but hinged ventilators are arranged along the side of the car above the windows, and are geared to open and close simultaneously.

Second Opening Roof Type.—This is the latest type of car built

by the Tramways Department of the Glasgow Corporation. A feature of this car is the extended platforms which allow of the controller and hand brake gear being mounted between the dash-board and the stair, providing a weather protection for the motor-

LATEST TYPE OF GLASGOW CAR.

man if found necessary, and the erection of a stair of the half-turn type, which gives passengers better facilities for boarding and leaving the car. It will be observed that the top cover is the same length as the under body, otherwise it is of the same construction as the other opening roof type.

BIRKENHEAD.

The Birkenhead Corporation Tramways Committee has for some time past been running on trial four cars fitted with top deck covers, and as these proved to be entirely satisfactory from a traffic point of view, it was decided recently to fit twelve more cars with covers. It has been found that the cars with covered top decks save a considerable amount in working expenses, doing away with the necessity for running relief cars during rush hours in inclement weather.

Of the first four sample cars two were fitted up by Milnes, Voss & Co., of Birkenhead, and two were built in the corporation's workshops. The twelve additional covers referred to, will be built in the corporation shops, and after its own design.

It has been found that the double truck cars are much more suit-

EXTERIOR OF TOP COVERED CAR, BIRKENHEAD TRAMWAYS.

able for top deck covers than are the ordinary single truck cars, and in consequence, the twelve new covers are to be placed on double truck cars. Each of these cars has seats for 76 passengers completely under cover.

The top covers the whole length of the car, the top railings and trolley standard being done away with. It is fixed on existing cars without any alteration in the original car body or platforms.

The roof of the top cover is of the monitor type.

There are six windows of ¼ in. polished plate glass on each side of the cover, two of these being fixed, and four sliding. These latter are so balanced that each can be opened or closed independently of the others by passengers or by the conductor, and will remain in any desired position.

There are three fixed curved windows at each end. The window frames are of teak, the bearers of ash, and the inside roof is finished in ash boarding and painted white.

The staircase is enclosed by a wood and glass partition with a sliding door, completely enclosing the staircase and obviating the

INTERIOR BIRKENHEAD COVERED TOP DECK.

discomfort caused to passengers by the drafts which generally accompany this form of cover.

The trolley base is fixed on the outside of the roof, as in the single deck type of car, and by the removal of the trolley standard additional seating accommodation is obtained for one passenger.

The measurements are as follows: Length of cover, 33 ft. 6 in.; width of cover, 7 ft. 3 in.; height inside, 6 ft.; over-all height of car (including trolley base), 17 ft. 1½ in.

SHEFFIELD CAR.

SHEFFIELD.

The covering in Sheffield consists of a roof boarded on the underside with tongue and groove pitch pine boards, highly varnished, and with "Eros" ventilators fixed in a manner similar to those in

steam railway carriages. The ends of the covers are specially arranged for the type of staircase which is known as the straight stairway, and in order not to affect the seating capacity the doors are in two halves arranged to fold up against the side of the cover. The ends consist of narrow pitch pine boarding with a large window fitted in and the canopies of the roof are extended over in order to give the roof an improved appearance. The sides are worked on the Magrini patent principle which is adopted by the majority of municipalities in Great Britain, and they are worked by means of pinion wheel, rack and spindle; they slide down behind the screen-board in one length. A very considerable advantage in this method in preference to separate windows is that the control of the ventilation is entirely in the hands of the management, and the sides are let down or run up by the conductor, thus doing away with all disputes between passengers as to whether windows shall be up or down. Further, in the case of separate drop windows, in order to balance these properly it is found necessary to have such large lead weights that the weight of the cover is very considerably increased. The Sheffield Corporation has found this method of operating the windows so satisfactory that it has decided to have 42 more covers fitted in a similar manner. The number of windows and their shape are arranged to harmonize with the car body. The only alteration required in the car is the removal of the side and end handrailings, and the trolley standard is slightly lengthened in order to be carried through the roof. On cars with reversed stairways the main difference is in the ends which are fitted with end framing and sliding door in the center, and access and egress are similar to those of the inside of the car body.

LIVERPOOL.

Mr. C. R. Bellamy, general manager of the Liverpool Corporation Tramways, has long taken the view that public requirements could not be adequately met during inclement weather without the provision of top covers for cars, and in dealing with this subject in a paper read at the first meeting of the Municipal Manager's Association in London in July, 1902, he submitted the proposition that it was desirable to provide a method of rapidly covering the upper deck of tramway cars, when weather conditions rendered it desirable. He also pointed out that the covered seating capacity of an ordinary car was little more than one-third its total capacity, which has led to the practice in most towns of allowing passengers to stand inside with the result that managers are frequently charged with overcrowding when the cars are carrying little more than half the licensed number. These charges are most frequent during the winter, when it is often found necessary to run a maximum service of cars during inclement weather to provide inside seating accommodation for passengers though the traffic is at its minimum.

A tram car should not have a variable capacity dependent upon the vagaries of the weather. All passengers should be carried in comfort and with the utmost freedom from risk of any sort, and to secure this the total seating accommodation must always be usable without discomfort. These conditions cannot be obtained without a top cover which, it will be admitted at once, secures them.

At the same time it must be recognized that outside traveling during a considerable portion of the year is both pleasant and beneficial, and that a large number of people in the summer months avail themselves of it purely for constitutional or pastime purposes. It is therefore very necessary to safeguard outside traveling as far as possible.

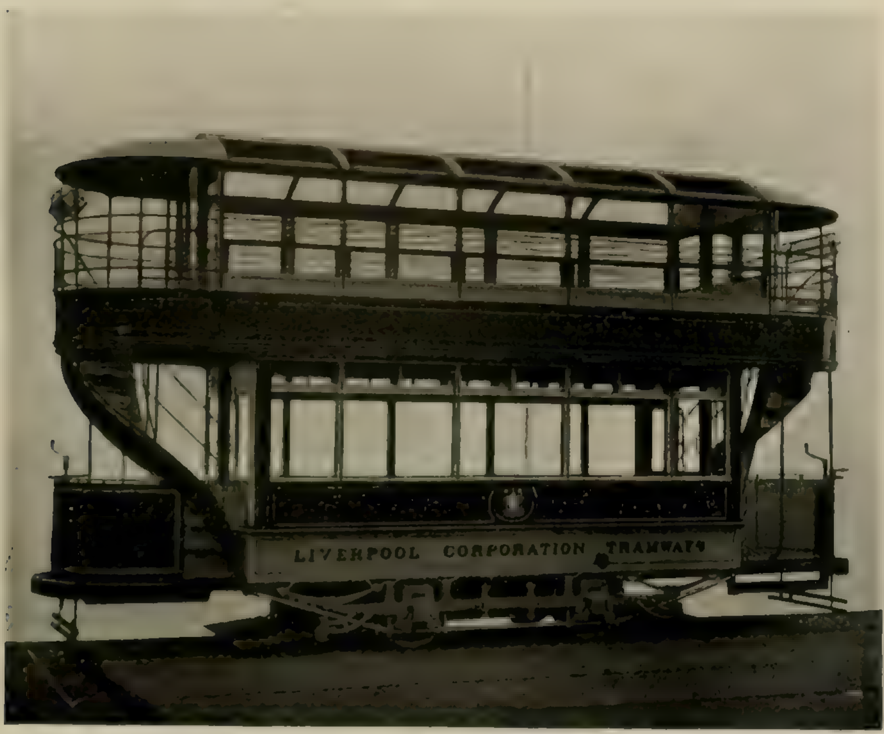
By studying the meteorological reports supplied specially in Liverpool it was found that half the days of the year have a temperature of 50° F. or over, and are dry, and for this period at least a top cover may become worse than useless, since it may rob outside traveling of its attractions.

It is well known that the top covered decks of the steam cars were very objectionable during the greater portion of the year, and care must be taken that their disadvantages are not repeated.

The chief requirements of a top cover therefore appear to be: That it can be readily removed when not required, and that it can be brought into use with equal facility when atmospheric conditions render it necessary.

The top covers in use on the steam cars in Great Britain and on the continent did not comply with these conditions; they were provided with permanent roofs and ends, and glazed sides capable of being raised or lowered.

The worst form of ventilation was considered to be the open window, especially when traveling at high speeds, and therefore Mr. Bellamy attempted to provide sufficient ventilation between the top of the window when up and the roof, to make the roof as well as the sides collapsible. He found that in very fine weather outside traveling with a cover is far pleasanter with the roof open as well as the sides. With the sides alone open there is nearly always an objectionable draft, smoke from smokers is blown through or across the car and the sun is largely excluded. With a roof that is col-



LIVERPOOL CAR—TOP OPEN.

END VIEW.

lapsible outside riding with perfect ventilation and great comfort can be secured for several months in the year, with an open roof and the side windows raised forming a high glazed screen around the passengers.

The first form of cover used in Liverpool consisted essentially of a framework with closed end screens, and one-third of the roof (the central portion) permanent, the other two-thirds of the roof and the sides being closed at will by a series of spring blinds of the American type. The desire was to make the cover provide for the outside passenger what a mackintosh affords the pedestrian—something that would meet the immediate requirement but must necessarily be dispensed with at other times.

Forty of these cars were run in Liverpool during the winter and summer months, and were a marked success, the best measure of public appreciation being their increased earnings which averaged 1½d per car-mile. The capacity of the curtains and the difficulty in drying them were, however, found objectionable, and it was found that wood slides for the roof and glazed framing for the sides could be adopted without serious departure from the principles laid down.

The number of these cars in service was rapidly increased and it is expected that there will be 300 of them in use during the coming winter.

Standing in these cars has been limited to 9 inside and as no one is allowed to stand until the upper deck is occupied, instead of the 23rd passenger standing as in the case of the ordinary car it is the 59th, and it is found in practice that this requirement seldom arises, a standing passenger in these cars now being a rarity.

Notwithstanding the large increase in the number of these cars the extra earning power is still maintained and as having a bearing on the advantage of top covers it may be mentioned that while for the first four months of the present year the passengers in Liverpool have increased by 3 per cent they have been carried with 5 per cent less cars in the service.

With reference to the extra expense with this type of car, there is naturally more energy used, but a reliable figure cannot at present be given as it would obviously be unfair to charge these cars with the total increased expense which is effected largely by track conditions. Mr. Bellamy is experimenting with various forms of wattmeters and hopes shortly to be able to give an accurate figure, but he is convinced that it is small and is probably in the ratio of the increase in weight which is 5 per cent. There is also the question of cleaning, the cost of which has been increased by 19 per cent, that is from 1 shilling 4½ pence to 1 shilling 7¾ pence per car per day.

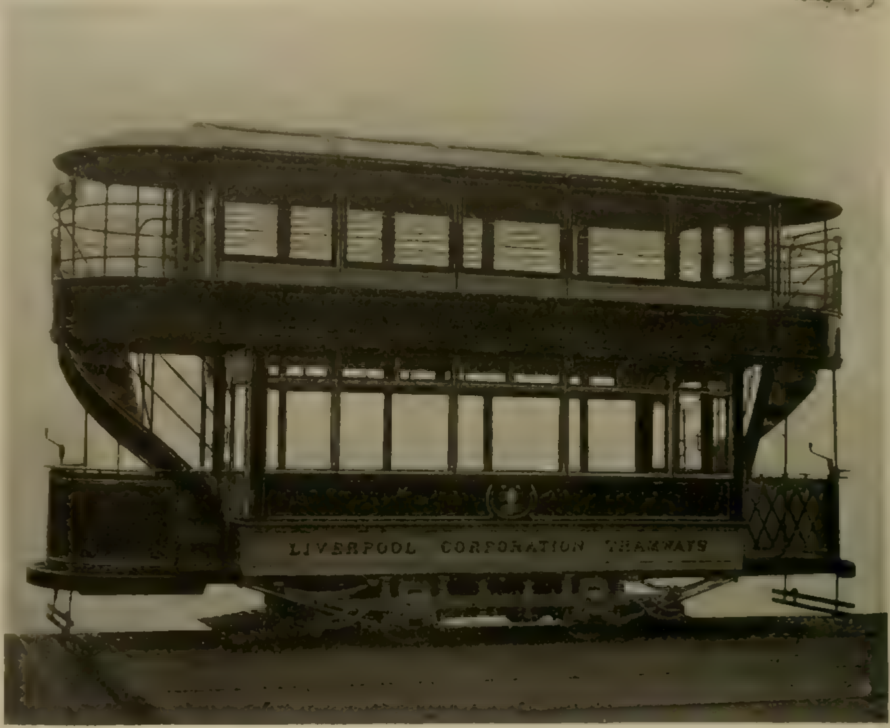
This includes the additional disinfecting. For a long time it has been the practice in Liverpool after thoroughly cleaning the cars to disinfect the inner surface with a solution of perchloride of mercury which is applied with a sprayer. This disinfection is now extended to the upper deck which adds largely to the cost.

WALLASEY.

The Wallasey Council started an investigation of the advantages of top covers some 18 months ago, and after inspecting various types, finally decided to have a sample cover built, mainly after its own design, but fitted with side windows in one length operated on the Magrini principle. An illustration of this cover is shown. It is considered that this car is unique as regards the design and shape of roof. It was particularly constructed to give the greatest possible amount of headroom and the best ventilation, and a large number of corporations have since adopted it.

The inside of the roof is boarded with narrow pitch pine boards handsomely varnished, and in order to keep the top clear from smoke when the cover is closed, two ventilators are provided. At night the covered cars look well as the covers are well lighted by lights arranged along their sides. The ends, which are of oak and ash handsomely panelled, are fitted with sliding doors similar to those on the inside of the saloon.

The sides, which are of mahogany, are fitted with three windows



LIVERPOOL CAR—TOP CLOSED.

to harmonize with those in the car body, and, as already mentioned, are operated in one length by the conductor by means of racks, pinion wheels and spindle. This method has proved very satisfactory, as it entirely does away with the disputes which so constantly occur between passengers when windows are worked independently, and there is claimed for it the additional advantage of being the lightest arrangement of roof covering of a permanent type yet constructed. There is no rattling and jamming of windows and consequent breakage.

The double deck trolley standard is removed and one of a specially

WALLASEY COVERED CAR.

designed single deck type substituted, and this, together with a slight re-arrangement of top seats gives room for four additional passengers on the covered cars compared with the uncovered ones.

The committee finding the sample car gave satisfaction to pas-

sengers decided to have 14 more cars covered in a similar manner and an order for this number was subsequently placed with G. C. Milnes, Voss & Co., Cleveland St., Birkenhead. All of the covered cars are now in service and it is reported that there is a marked increase in the earnings as compared with uncovered cars. The

BRADFORD COVERED CAR

average increase is estimated at 1.5d. per car mile, a result which quickly repays the initial expense.

BRADFORD TRAMWAYS.

The Tramway Department of the Bradford Corporation has 100 cars fitted with tops as shown in the accompanying illustrations, but reports that it is too early to state definitely what the increased earning capacity of the cars will be in bad weather. The general manager, Mr. Clive J. Spencer, stated that on wet or cold days these cars carry a greater number of passengers than do the others, the earnings per car mile being about 1d more than the open top type, but that it is impossible to say to what extent the other cars suffer as a result of the competition with the covered type. It is considered, however, that the effect of this competition is very slight and

INTERIOR OF BRADFORD COVERED CAR

the management assumes that the car tops mean an increased revenue in bad weather of about 1d per car mile. It is also considered that the car tops are economical in that fewer cars need be run in wet weather, giving a corresponding saving in operating expense. On the other hand, the cars with tops are more expensive to operate, this being especially true in Bradford where the grades are heavy and the line is located so that the cars are exposed to the action of the wind. The results of experiments so far made indicate that the consumption of current is increased from 15 to 20 per cent by fitting the cars with tops. The cost of cleaning is also increased

LONDON COUNTY COUNCIL COVERED CAR

It is the opinion of Mr. Spencer that the car top has, all things considered, come to stay and has been found of considerable service in solving the difficulties of providing adequate seating capacity for passengers without running an extra number of cars.

LONDON.

The accompanying illustration of the top cover in use on the London County Council lines is reproduced from a photograph taken by special permission of Mr. A. L. C. Fell, chief officer of the Tramways Department, and this is, we believe, the first publication in which this car has been shown. The top covers were built by the London County Council workmen in conjunction with the firm of

CAR FOR EAST LONDON MUNICIPAL TRAMWAYS

Milnes, Voss & Co., of Birkenhead. About 100 covers have been ordered in addition to the first lot put on and the cars fitted with these will soon be put in operation on the conduit tramways in South London. Mr. Fell states that the cover has been very satisfactory. The cars so fitted accommodate a large number of people

who during wet weather would be compelled either to walk or wait for another car. It is believed that but little additional current is required for the operation of these cars and the management is very enthusiastic regarding them. The illustrations serve to show the construction without detailed description.

EAST LONDON CO. (SOUTH AFRICA.)

The East London car shown was built by the Electric Railway & Tramway Carriage Co. of Preston (Dick, Kerr & Co.). This car is noteworthy as showing to what extent some managers are willing to go to get desired results. In this car the wooden panelling is of ash, the general construction of the car being evident from the illustration.

LEEDS.

The general appearance of the top covered cars used in Leeds is shown in the illustration. The length of the body corresponds to the length of the lower saloon, the ends being covered by a canopy. The principal dimensions are: Length of body outside, 16 ft.; length of body inside, 15 ft. 4 in.; length of platforms, 5 ft.; length over platforms, 26 ft.; width over side panels, 7 ft. ½ in.; clear height inside at center, 6 ft.; clear height inside at sides, 5 ft. 10½ in.; height of end door opening, 5 ft. 9½ in.; height from rail level to top of cover, 15 ft. 8½ in.; height from rail level to floor, 9 ft. 6 in.; gangway between seats, 14 in.; height of lower saloon (floor seats to roof veneer), 6 ft. 4½ in.

LEEDS COVERED CAR.

The seats are the usual garden type with reversible backs, for 28 inside, and for 4 on each platform, 36 altogether, which is a gain of two seats over the open top decks.

The side and end walls of the cover are solidly constructed of oak and are trussed to the lower canopy bend. The inside is handsomely finished with mahogany molding and maple veneer roof to match the lower saloon. The four windows on each side are raised and lowered simultaneously by racks and pinions; the end windows are not arranged to open. The upper saloon is lighted by five 16 c. p. lamps, and the stairs by the lamp under each canopy.

On account of the low bridges under which the Leeds cars pass—the lowest being 16 ft. 4½ in.—care has been taken with the construction of the roof in order to obtain as much headroom as possible. Ventilation is provided when windows are closed by four "Hit and Miss" ventilators fixed in the roof. The cover is secured to the side walls of the lower saloon by strap bolts.

The car rides very steadily, any tendency to undue oscillation owing to the additional weight of the cover, 2,016 lb., having been overcome by the use of stronger truck springs.

The management at Leeds states it considers it has gained by not being among the first to adopt top covers, as it has avoided some of the earlier and objectionable forms which top covers took. It considers that Leeds now has a very practical solution of the difficulty which is experienced in the handling of traffic during unfavorable weather conditions.

The management has arranged for this form of car cover to be

KENNINGTON COVER CLOSED.

placed on 25 new cars recently purchased, and the Department in as smoking will be allowed within it it must be particularly well ventilated; also it must be well lighted and have a roof as nearly as possible 6 ft. in height.

A large proportion of the Leeds cars for the winter season have been supplied with an upper saloon of the type shown, which has been adopted as the standard.
addition is preparing to cover over a considerable number of the cars which are already in the service.

The choice of a fixed instead of a movable cover was made after careful investigation and it is felt that if there is to be a cover at all it must be one which is absolutely rain and wind proof, and that

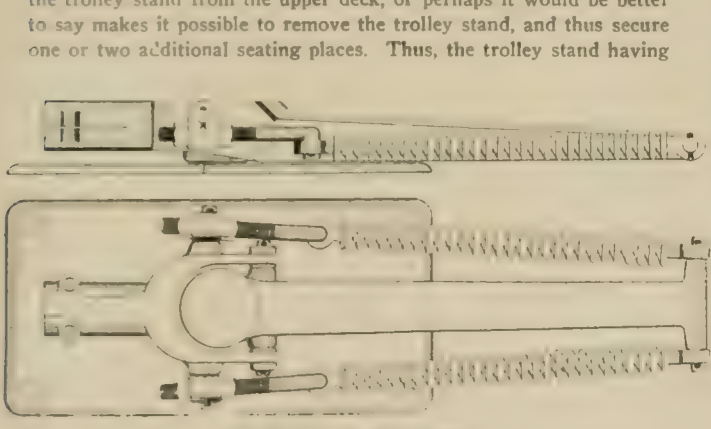
KENNINGTON COVER OPEN.

THE KENNINGTON TOP.

Two of the views show illustrated cars of the Hull tramways, which are fitted with the Kennington patent collapsible electric tramcar covers. This cover is manufactured by the Kennington Syndicate, of Victoria Chambers, Leeds, and is presented as an effective device of its kind, combining durability and simplicity with a good appearance. The framework is of light material, but strongly built, and forms a symmetrical arch, which does not detract from the appearance of the car and which it is considered presents much less resistance to wind than would a square-shaped cover. The cover is divided into four sections, any one of which may be brought into use separately if desired. The arches of the framework carry the center plank on which are supported the trolley base and the sliding shutters. The shutters are guided into position by channels in the framework and are drawn down much as the cover of a roller top desk, on the same principle of which they are constructed. The windows are of the railway carriage type and when raised and the shutters are drawn down, the whole forms a water tight compartment. Provision for ample ventilation has been made by placing along the length of the roof two cylinders, which form ventilators, and a casement for the shutters when not in use. One advantage particularly claimed for the arched framework of the covers is that broken wires falling on the roof will more readily roll off upon the ground. The view showing the cover open brings out strongly the light appearance of the structure and the additional seating accommodations which are gained by the Kennington system.

SPECIAL TROLLEY STANDS.

The adoption of the top cover cars makes it necessary to remove the trolley stand from the upper deck, or perhaps it would be better to say makes it possible to remove the trolley stand, and thus secure one or two additional seating places. Thus, the trolley stand having



TROLLEY BASE FOR TOP COVER.

been removed from the upper deck a trolley base must be placed upon the roof of the top cover. This is in most all instances somewhat higher than the top of the stand and where overhead obstructions such as bridges have to be considered it means that a special design of base must be used. A recent design to meet the requirements of a canopy trolley stand that was developed by S. Dixon & Son, Ltd., of Leeds, is shown in the drawings. The working height for the standard above the extreme top of the car is only 4 in., thus making the space between the top of the car and the roof of any bridge the minimum.

Work Near Motors Healthful.

Mr. J. W. Greer, of Yoakum, Tex., who was formerly superintendent of the San Antonio Street Ry. (and at that time an occasional contributor to the "Review") and is now secretary of the Yoakum Improvement Co., recently addressed a letter to the Scientific American refuting statements made in that publication claiming that the use of electricity as a motive power is unhealthful. We quote part of Mr. Greer's letter as follows:

"The writer well remembers the many cats killed by the electric cars on the first roads equipped, while taking their evening electrical bath by rolling along between the rails of the roadbed.

"Pussy, like man, has grown wise to the fact that the cars sometimes kill, and while she may yet be seen in the early evening disporting herself near the rails it is rare indeed nowadays to find one which has been killed by the cars on the older roads. The writer having been a horse-car man previous to the advent of electric traction, was quick to note the antics of the cats, and was led to investigate the influence of electric traction on man. After transforming several horse-car lines to electric lines, and converting the drivers into motormen, it was noted that invariably the health of the men began to improve and they began to take on flesh. As they were running over the same route as formerly, and were exposed to the same weather conditions (the vestibule not having been invented), there was no way to account for improved health, snap, and vigor, except as the result of the imperceptible magnetism of the motors, or the proximity of heavy electric currents.

"While the writer was superintendent of the San Antonio (Tex.) Street Ry. in the early nineties he called the attention of Dr. F. M. Hicks, the company's surgeon (and one of the most noted practitioners of Texas to-day), to his observations as above. Shortly afterward Dr. Hicks requested me to take on two consumptive citizens from Illinois as motormen. They were accordingly installed, and in a few months were both apparently restored to robust health. It is true that San Antonio is a healthy resort for this type of disease, and if there was no sequel to my story it would lose its point. Now for the sequel! After about two years' service one of these left the employ of the electric railway and retired to a farm on the outskirts of the city; within a year his disease returned and he died. The other continued in the service for several years, and when the writer saw him last, he seemed still to be in the same robust health; he informed me, however, that he quit the road for about six months, at one time, and returning ill health warned him to again go back to the service, which he did and is now at work in Houston. Another horse-car conductor in a poor state of health was changed to the electric cars and after running for two years his highly nervous, emaciated form had rounded out to magnificent proportions at the time he left the service to embark in the cattle and horse business. In less than two years after abandoning the motor cars he died from nervous debility and exhaustion. An engineer from Indianapolis, Ind., who came south for his health, was recommended by the writer and put in charge of the press-room plant of the Daily Express operated by electric motors. The Daily Express building is a magnificent example of the modern publishing house, and its press rooms as well as all other parts of the building is thoroughly ventilated, and although the work was wholly night work, and he was thrown continually in close proximity to the motors, belts and presses, of such an establishment, in two years he was thoroughly sound and well, and returned to the north to again take up his occupation of steam engineer.

"Many instances could be cited and substantiated of the above nature which have come under the observation of the writer if space permitted, but as it does not I will content myself by calling attention to the fact that the census reports show that during the last decade the health of the principal cities greatly improved and the death rate was considerably lower than formerly.

"As the period between 1890 and 1900 witnessed the almost universal adoption of electric traction, and the electric motor in our cities, and millions of our citizens were thrown within the gentle and stimulating (although imperceptible) influence of the motors in their daily rides on the cars, or in the various occupations operated by motors—is it not worth while to consider whether or not the adoption of electricity as a motive power has not had as much to do with improved health conditions in our cities as 'improved sanitation,' which is usually given all the credit?"

Surveys have been made by the engineering corps of the York County Traction Co., York, Pa., for the proposed new trolley line that will ultimately connect York with Loganville and Glen Rock to the surburban electric railway system. It is stated that construction work will commence early next spring.

Many rumors concerning the electrification of steam roads include the Battle Creek Sturgis branch of the Michigan Central Railroad Co.; 50 miles of track for the surburban service of the Erie Railroad, with a central power station at Paterson, N. J., and the line of the Colorado Midland R. R. between Colorado Springs and Woodland Park.

October Meeting of New England Street Railway Clubs.

Interesting Discussions on Track Construction and Maintenance.

The New England St. Ry. Club held its regular October meeting on the evening of Thursday, the 27th, with President Neal in the chair, at Wesleyan Hall, Broomfield St., Boston. The meeting began at 7:30 and the first half hour was devoted to routine business, including the report of the last meeting, election of new members, etc. The proposed change in the date of the annual meeting was tabled until February, on account of the prospective visit of President Ely of the American Street Railway Association in January. No action was taken in the way of changing the by-laws and constitution.

The subject of the evening was "Track Construction and Maintenance." The first speaker was Gilbert Hodges, consulting engineer, of Boston. Mr. Hodge's paper sketched the development of track from the parallel rows of flat stones laid in some of the Roman roads to the practice of today. Street railway track has passed through an evolution as well as that on steam roads. In the last part of the 17th century timber was used in England for rails. In 1826 a road was built in Quincy, Mass., in simple T-rail form. The rails were only 12 ft. long, and were set in cast iron chains, which were in turn fastened to the ties, the latter being of stone. Other early sections of rails in Massachusetts consisted of angle or U-shaped pieces of iron that were spiked to the timbers; after this a flat or tram rail 4 in. to 5 in. wide was used. Sometimes the heads of the rails were off center, and they weighed from 30 to 50 lb. per yard all told. These rails were spiked to the timbers and beneath the joints were placed flat iron plates with holes elongated to provide for expansion and contraction. Usually the ties were of spruce, but often hemlock was used. The dimensions of the ties were 4 in. by 6 in. by 6 ft. 6 in., and they were ordinarily spaced from 4 to 5 ft. apart on centers. At times the spacing extended as far as 12 ft. Railroads for horse traction have even been built without either ties or brace rods, but in the early days brace rods of iron were used on the best roads.

Even before the advent of electric cars girder rails came into play. Naturally the first forms were shallow and light. They were spaced from 3 to 5 ft. apart and supported on cast iron chairs. In Providence, R. I., one of the first forms of girder rail was put down. It was called the "Longstreet;" it had a T-rail head and rested on steel chairs sunk in concrete. It was from 6 to 7 in. deep. Mr. P. F. Sullivan, now president of the Old Colony Street Railway Co., conceived the idea of a tram head with a wide bottom flange, and the rail which he designed was made by Wm. Wharton of Philadelphia and laid in Lowell, Mass. This was the first true 9-in. girder rail.

In modern practice the Boston Elevated Ry. is now installing an 80-lb. T-rail 8 in. deep in one of the suburban towns near Boston. It is spiked to ties 8 ft. long, spaced 24 in. on centers; the ties are tamped with gravel, after which two layers of concrete are put down; this is followed by granite blocks, grouting of small stone and a filling of bitumen for the finished surface. Tie rods are placed 5 or 6 ft. apart.

Sixty-foot rails are satisfactory for deep T and girder rails in paved streets, but where a shallow rail is required it is not desirable, according to Mr. Hodges, to use longer than 30 ft. T rails. A durable and economical track can be made with 70-lb. T rails, carefully jointed and spaced 2 ft. in tie centers.

Although great progress has been made in the manufacture and design of rails the deep girder rail of today is not entirely satisfactory. Its initial cost is high, and a large portion of the rail is superfluous metal as far as the points of wear and tear go. In large cities these rails often have to be renewed every five years, and their value is little more than scrap when they are taken up. Operating expenses must necessarily bear the cost of these renewals. A design with less unused metal is much wanted.

In a modern track the weakest part is of necessity the joint between the rails. Fairly good joints are now on the market, but there is room for large improvement still. A good joint noticeably increases the life of a rail, and especially has this been accomplished by welding improvements. Great progress has also been scored in the design and manufacture of special work. In the old days switches, frogs, rivets and curves were made of cast iron in lengths not exceeding 10 ft. This was the limit in the size of good castings. The old types of switches were straight, and they made an angle of about 4 degrees with the main line. The predecessors of the present Barbour-Stockwell Co. of Cambridgeport, Mass., turned out some of the earliest switches and frogs in New England, and the curves were made by Wharton. Excellent switches and frogs are now built with good steel and hardened centres, and the economy of modern special work is very high. Of course, the end is not yet reached in the way of good designing, and in all things connected with track work one should study to learn what is best; strive to have things better and struggle for the greatest ultimate economy.

A brief discussion followed the reading of Mr. Hodge's paper. R. W. Conant, of Cambridge, asked why the steam roads had found 60-ft. rails troublesome, and Mr. Hodges replied that the most serious factor is the difficulty experienced in maintaining good alignment under all conditions of weather and especially in varying temperatures. On a western road which was equipped with 85-lb. rails carefully laid for interurban service it was found in hot weather that all the joints in the track could be seen on looking along its length, and where the joints were staggered, the cars lurched violently in passing over them. Mr. Conant emphasized the point that the 60-ft. rail reduces bonding troubles by 50 per cent, although fairly satisfactory bonds are now in use. Mr. Hodges said that the saving in bonds was really the only excuse for using a 60-ft. rail.

The next speaker was David Curtin, roadmaster of the Old Colony and Boston & Northern systems. He described at length the practice of the Twin City Rapid Transit Co. in track work. The Boston Elevated is now putting down a line of double track in renewal work in Boylston St. that resembles the standard practice of the Twin City company, and there is also a line in Medford, Mass., of the same general character. The Twin City lines were first operated as a street railway about 1873-4 as the St. Paul & City Ry. and the Minneapolis Street Ry. In Providence, R. I., twenty-seven different rail sections were tried, and a considerable number were also put down in the Twin Cities. One of the early rails was a T weighing about 25 lb. per yd., then a 36 and 44-lb. rail were used, followed by a 45-lb. girder rail. The weight of these went up from 45, 51, 52 and 54 to 78. About this time the company began to use T rails, and it finally settled on a 74 lb. 8 in. rail, which was later superseded by the 79 lb. rail in use today.

In cities like St. Paul and Minneapolis where the streets are wide the rails are not as a rule badly worn by street traffic. The conditions which govern track construction are much different in the east from those in the west. All the cars on the Twin City system are single ended, so that when a car starts on a trip it has to run until it comes to a Y or a loop before it can be turned homeward. In new cities like St. Paul and Minneapolis much trouble arises from the fact that the sewer gas and water connections are not put in as a rule until after the street is paved.

Crushed rock, cement and sand are hauled by the company's cars from its own sand pit. There is no record of the company's ever having bought sand. The work cars carry 60 ft. rails, are 37 ft. long, and hold 15 cu. yds. of stone. All material is dumped directly on the work.

The first welding of the Twin City Co. was done in 1894, and the rail weighed 78 lb. per yd. It was on Washington ave., Minneapolis, and had been in use about 5 years. In many cases the joints were badly damaged, but the rail lasted until last year. This shows what cast-welding will do to prolong the life of a piece of track. The cost of cast welding depends greatly upon local conditions, as does track construction. In one section of the city track was cast-

welded and while the work was going on traffic was abandoned on the line. The difference in cost between this and a case where the cars were run during the period of construction amounted to from \$2 to \$3 per lineal foot. The company soon bought its own welding machine and now has between 75 and 85 miles of welded track; great care is used in the work. The joints are tested by looking under a steel straight edge to see daylight. As for the conductivity of cast-welded joints, Mr. Albert B. Herrick has found some of the joints to exceed the rail section by 25 to 50 per cent.

In the actual work of welding the shimming of the joints has to be watched most carefully. Temperature changes cause trouble, and the hot metal is poured around the rail. The percentage of joint breakage was not over 1 to 1½. Breaks generally occurred in the fall or in the spring. Additional care is needed in watching the concrete mixers. The Twin City company usually puts concrete into a depth of 10 in. below the base of the rail, and then carries it up to about 1½ in. to 3 in. from the top. Domestic concrete, like Milwaukee or Mankato, is used between the tracks. Care is used in tamping and grouting. Longitudinal wooden blocks are used to a large extent in the Twin Cities, costing 6 cents each for cutting. The small groove formed at the side of the rail is useful in keeping teams out of the track. The blocks are used for flanging, as the asphalt and concrete became quickly worn out.

On the interurban and suburban lines an 80-lb. T rail of the A. S. C. E. pattern is used, with 8 ft. ties and "Continuous" joints. At present there are two interurban lines of 10 and 11 miles length between St. Paul and Minneapolis. Two other lines are also projected, one via Marshall Ave., and the other via Fort Snelling. The University Ave. line, which is the most direct has a 5 minute service except in rush hours, when the interval is cut to 2½ minutes.

Mr. Curtin closed by describing at length the counterweight equipment used to operate cars up and down the Selby Ave. line on the 16 per cent grade near Summit Ave., St. Paul.

The last speaker of the evening was Mr. H. M. Steward, roadmaster of the elevated division of the Boston Elevated Railway Co. He said that he would devote his time to saying something about the track on the elevated division and some of the difficulties which have to be contended with in maintaining it.

The main line runs from Dudley St. to Sullivan Sq., a distance of 6½ miles. The Atlantic Ave. section is used by loop trains only, and the total length of track including sidings is 16.015 miles. Over 40 per cent of this distance is curved, with radii varying from 82 to 5,000 ft. There are 18 curves of less than 100 ft. radius and 16 others with less than 150 ft. radius. A train going from Dudley St. to Sullivan Sq. and return makes 9.43 complete circles. On the entire division the curves added together total up 13.4 complete circles. The track is far from being level. For example—there are two up and two down grades of 5 per cent and one down grade of 8 per cent, with a reverse curve at the foot having 90-ft. radii. The subway is the worst part of the division, both as to curves and grades. As President Bancroft has said, many of the curves in the subway are called curves only by courtesy.

The subway is a poor place to run elevated trains. It was never intended for them, and riding through it is far from pleasant. Nevertheless, the track is kept in as good condition as is possible under the [illegible]. In many places it was necessary to cut away the concrete on the walls and roof of the subway in order to make room for the cars. Consequently the company is not able to have just the line and super-elevation that it would like.

The track on the elevated structure is laid on hard pine ties which are fitted or dapped to the track girders. Each tie is further fastened to the structure by two hook bolts. There are four wooden guard rails, two inside and two outside the steel running rails. The outside guard rails are notched and fitted to the ties, and there is a bolt or log screw fastening each guard rail to every tie, binding the whole firmly together and to the structure. On this very strong and solid roadbed the rails are laid. The tracks are laid 24 ft. on center where possible, and where the streets are narrow they are laid on 12 ft. centers. The running and third rails are of the A. S. C. E. standard 85-lb. section. The steel guard rail, used next the inner rail on curves, is the Pennsylvania Steel Co. 100-lb. rail. The running rail is [illegible] Goldie tie plates on every tie and is fastened to the ties by Goldie spikes. Articles have recently been printed in the engineering journals advocating the use of screw spikes, similar to those used almost altogether in Europe. Some of the Elevated's foreign visitors have expressed their doubt to Mr. Steward, in regard to the holding power of American spikes. Mr. Steward said that if some of these advocates of the screw spike could go out with the Elevated track crew some night and attempt to pull a few spikes under the conditions obtaining, their doubts would be removed at once. It takes two men on a claw bar to pull one of these spikes. While screw spikes have greater holding power, they could not be used to advantage on the Elevated division, as it takes too much time to place or remove them.

The rails are joined by means of the "Continuous" joint fastened by four bolts. Both running rails are bonded, one with 300,000 c.m. copper bonds to carry the return power current, and the other with galvanized iron wire, to carry the signal current. The signal rail is considerably cut up by numerous insulation joints, which are put in at the beginning and end of each block. The rails are held together at these joints by wooden bars. Between the ends of the rails are placed fibre end posts of the same section as the rail. Directly under the joint is placed a block of lignum-vitae. This is essential, as iron or steel tie plates cannot be used.

The steel guard rail is fastened to the running rail by means of ⅞-in. steel bolts spaced from 2½ to 5 ft. apart, according to the degree of curvature. It is kept at a proper uniform distance from the running rail by means of malleable iron filler blocks. There are also large washers at either end of the bolt which closely fit the rail. This method of support holds the two rails firmly together, although on many curves it has been found necessary to further support the guard rail by braces.

The third rail is supported by an insulator fastened to the ties and is 19⅛ in. from and 5 15/16 in. above the running rail. This rail is joined by a special angle bar and two bolts. It is bonded at each joint with two copper bonds. In places it changes from one side of the track to the other, and to the ends of the third rail are fastened cast iron risers or inclines to engage the shoe and prevent its being torn off.

The running rails are prevented from creeping by means of anchor plates bolted to the rail and spiked to the tie. They are made to fit the rail and the top of the tie plate closely and the results obtained are very satisfactory. These anchor plates are freely used.

On curves the super-elevation varies up to 4 in., according to the degree of curvature. Nearly every curve has a spiral or transition curve at either end, and the elevation begins or runs out at the tangent. This super-elevation was decided on and fixed when the road was built. Since it has been in operation it has been found that some curves would ride better for a little more or less elevation as the case may be. The expense of making a change in elevation mounts up so fast that in general the plan is to wait until the ties need renewal before attempting any very extensive modifications. On a steam road, if the elevation of a line or curve does not quite come up to the roadmaster's ideas, he sends out a small crew, and the curve is changed, if of ordinary length, in a few hours. Mr. Steward then stated that in a few days he would have occasion to lower the elevation on a curve from 4 in. to 2 in., the total length of which is 300 ft. By using all the men he could work readily, he hoped to be able to complete the job in six nights.

The elevated switches and frogs are patterned after those used on steam roads; that is, they are made from T-rail of the same section as the running rail. In all there are 120 frogs and 86 switches. Of these switches, 55 are operated from towers; the rest, being in yards or on sidings, are thrown by hand. Nearly all the frogs and switches are special work. On steam roads only a few different kinds of frogs are used, and only two or three different lengths of switches. On the elevated division it was possible to do this in a few cases only, on account of lack of room; consequently a large percentage of the frogs and switches are different, and can be used only in the places they were built for. This necessitates keeping at least one spare part for each in the immediate vicinity, so that it will be available instantly in case of breakage. Turning to the maintenance question, Mr. Steward said that the builders of the road hoped it would be strong enough to last a long time. As a matter of fact, however, the rails began to wear out at a surprising rate as soon as the division was opened to travel. Nothing like it was expected, as all previous experience on elevated roads showed nothing alarming in the way of rail wear. It was true then and it is true today that there is no railroad in the world where rail wears out as

quickly as on the elevated division. The large percentage of curved track, the sharp curves and steep grades, and the combinations of curves and grades constitute the reason for the excessive rail wear, together with the combination of a large number of motor cars to a train and the comparatively small driving wheels. The rail wear is almost all on curves. On tangents the rail as yet shows comparatively no wear. On other elevated, steam or surface roads the conditions are altogether different. Here the grades are such that each car has to be a motor car. Each is capable of pulling a light trailer, perhaps, but it is not considered safe to do so on account of the liability of motor cars breaking down and the train in consequence being stalled on grades. On elevated roads operated by steam the propelling or pulling power is centered in the locomotive. The cars are all trailers, and consequently the rail is subjected to grinding friction only from the drivers, which are comparatively large. Other elevated roads operated by the third rail system have at least one trailer to each motor car, and the rail is subjected to only half the grinding friction that it must stand on the Boston Elevated.

When the excessive rail wear first became apparent it was necessary to put on large crews of men and renew the worn rail as quickly as possible. About all the curves wore out at once. The road department was on the jump to get the new rail in, and organization and improved methods for doing work were not considered at first. When it was found that it was possible to take care of the rail renewals, the men then in charge had a little time to think and plan, and new and improved methods were and are still being adopted. The large crews have been cut down to a solid working basis and at the present time the system is being maintained at a comparatively reasonable expense. This is partly due to the way the work is handled and the up-to-date tools; but is largely due to the different kind of rail used. The original rail is the rail used by about all steam roads, and manufactured and sold by all steel companies unless something different is asked for. The Elevated division calls this a soft rail. It has a low percentage of carbon and other hardening elements. About two years ago it was noted that certain rails in the same curves wore much better and lasted longer than others. This difference in wear could only be due to the rails themselves, as they were subjected to the same wearing forces. Some of these rails which showed the most marked differences were analyzed, and after considerable study and consultation with various steel experts, specifications were drawn with the idea of getting a very hard rail as tough as possible. As a result the road is now using almost altogether a rail rolled especially from these specifications. On the average this rail wears about three times as long as the ordinary commercial rail, and the cost of it is practically the same.

When the great amount of rail wear was first made known many ideas were prevalent among manufacturers and railroad men as to the cause and remedy. All kinds of plans were tried, none of which was over-successful. The only thing to do was to change the kind of rail used. Several different kinds were tried, as the company was willing to try anything that was safe. Experiments are still being carried on today. The only rails which showed any practical results were those of nickel and manganese steel. Nickel showed up fairly well as compared with ordinary steel, although it cost several times as much. A final test of nickel steel was made by placing a rail of that material between two hard steel rails on the curve at the corner of Causeway and Haverhill Sts. Measurements were then taken regularly every four weeks until it became necessary to remove the nickel rail on account of the great difference in wear. It was in the track 204 days and in that time it wore down .044 ft. as compared with .015 ft. wear on the hard steel rails on either side of it. This was reported to the manufacturers of the nickel rail; they could not believe it, as they were sure nickel steel rail was the best on the market. They were not satisfied until they had sent their experts to look at the rail, and were not sure even then that a mistake had not been made at the mill and a softer rail sent the Elevated. They were convinced only when a piece of it had been analyzed.

On the southbound track at Park St. subway station there is an 82-ft. radius curve. Ordinary commercial rails lasted on the average just 44 days on this curve, and measurements showed a wear of from .05 to .064 ft. in that time. A manganese steel rail was put into the track at this place in April, 1902, and it is still in. After nearly 1,000 days of service it shows a top wear of only about .016 ft. The manganese rail has a large amount of side wear as compared with top wear. While manganese steel will stand rolling friction indefinitely it will not stand up under the grinding or cutting friction from the flanges nearly as well. When this rail was first put in it was allowed to take the flange wear, but is now protected by a steel guard rail, which, as it is greased several times daily, wears long enough to warrant its taking this wear.

There are now about 475 ft. of manganese steel rails in the elevated track, three sets of manganese steel crossing frogs and several ordinary frogs. They are very satisfactory if protected from side wear. The average life of frogs and switches on the elevated division varies from four to six months. On the tangents they show about as little wear as the rail. Manganese steel rail costs about $5.00 per ft. as compared with 38 cents per ft. for ordinary steel rail. Even at this high price it is, in the end, a cheaper rail to use.

In 1902 about 6,100 ft. of running rail was laid each month. This has now been reduced to about 3,500 ft. per month, although the number of trains per day over the track is greater. No tool has yet been made which will make an impression on Manganese steel. Although the metal is too hard to machine, it is capable of being readily bent without breaking.

On curves with radii up to 500 ft. the rail wears down smoothly. Above 1,000 ft. radius the rail does not wear entirely out as the road department is obliged to remove it before it is worn to the limit on account of the waves or corrugations which form. These waves make a very hard and rough riding track. Several things combine to cause waves, such as the skidding of the inside wheels and probably the steel guard rail. These waves are often noticed or felt on surface roads. They appear on almost every curve of the surface road where a grooved rail is used, and never appear on a steam road. The cause and remedy are not as yet positively determined. On surface roads they are short, but on the Boston Elevated they vary in length, many of them being quite long and deep. If they appear on one rail they are soon transferred to the other. Otherwise waves from the rail left in will transfer to the new rail. Anything which causes a wheel to jump, or diverts it from its path, will result in a hole being cut in the rail.

On the Elevated the receiving ends of the rails are not battered down, but a hole is cut in the rail instead. An engine driver can be spun or turned in the same place for some time without injuring the rail, about the only perceptible result being that the rail becomes case hardened at the point where the driver was turning. If the motor wheels on the elevated cars are kept turning in one place for any length of time, they will cut an 85 lb. rail in two. This instance shows the different effects which locomotive drivers and the driving wheels of an elevated car have upon rails. There have been cases where trains have been stalled on grades, and in endeavoring to start the train the motor wheels have been revolved in the same place for a short time with the result that deep holes have been cut in the rails. When this has occurred, the trains could not be started by their own power, but were obliged to remain where they were until pulled or pushed out of the holes.

On account of the excessive rail wear it is necessary to inspect the track more closely than on any other road. The rails on every curve are measured at least once a month. This record is kept in the office, and the monthly measurements carefully studied. As a rail nears the limit of its usefulness it is measured oftener and is taken out when it reaches the limit agreed upon. Care is taken not to remove a rail that will wear even a few days longer, but the greatest care is observed to remove a rail before it becomes unsafe. Anyone who has had charge of the maintenance of track on surface or steam roads can probably cite cases where he has decided that the rail on a certain part of his road has reached the point where it must be relaid. He puts the matter before his superiors and they tell him he can have new rail next year, but when next year arrives, on account of lack of money or because rail is needed more at some other place it is decided to leave the old rail in another year. Mr. Steward said he had known this thing to occur several years in succession, and the old rail left in the track. In the case of the Elevated it is not a question of years when a rail must come out, but rather of weeks or days. When a rail is worn to a certain point it must be removed at once. A week or so more may so weaken it as to make it unsafe. Rail wear is measured and the result plotted carefully. Mr. Steward knew of no other road that finds it necessary to do this. On a steam road, when a rail is considered worn out or unfit for the main line it is removed and laid on branch roads, and after that it is used on

sidings. Mr. Steward doubted if he ever saw a rail on a steam road so badly worn that it could not be used for some kind of track. When a rail is worn out on the Elevated it is fit only for scrap and is sold as such.

During daylight hours the track is inspected by eleven track walkers divided into two crews, under competent foremen. The position of track walker requires a careful man, as he has considerable responsibility placed upon him. He is also constantly in danger, as he has to look out for the trains and the third rail at the same time. He cannot be too careful, for, while he is keeping clear of the one, he is liable to come in contact with the other. These men can do practically no repairing beyond replacing and tightening up bolts, replacing worn spikes, greasing the guard rails and other small jobs. Mr. Steward has however thus far found work enough to keep them busy. Any defects which cannot be repaired by them are reported immediately on special blanks and are attended to at night.

For some time after the Elevated division was opened all the running and guard rail was curved, drilled and assembled at Barbour-Stockwell Co.'s works in Cambridge. The Elevated road hauled the work to Cambridge, hauled it back, and hoisted it upon the structure with a derrick. This method was very slow and expensive, so that now practically all this work is done at Sullivan Sq. in the yard. The rails are unloaded directly from the cars they were shipped in and stacked in the yard. Here they are all cut, curved and drilled, practically no work being done on the rail by outside parties. This work is done in the daytime by a crew of six men and a foreman. The rail is curved by a hand rail bender in preference to a power bender as the rail would be liable to break on account of its hardness if curved by power. The rail and all other material needed by the night gang is loaded on flat cars during the day. Practically all the repairs are made at night between the hours of 1 and 5 a. m. Everything as far as possible is carefully prepared during the day so that the night gang can put in the whole of this time, limited as it is, in actual rail laying, etc.

A large crew is kept at work repairing the track six nights of every week. While this crew is large it is small compared with the former force used. It is as small as it can be and will probably grow larger in the future as other things than the rails are beginning to show signs of wear.

The men, tools and material are taken out every night on a work train, consisting of a motor car and one or more flat cars. One-half of the motor car is housed over, and in it are the tools for making all kinds of repairs. The other half of the car has a derrick with a boom 20 ft. long for handling rail and other heavy material. The derrick is operated by compressed air, the compressors being carried on the car. The motor car can be operated either by the trolley or the third rail. As much as possible the third rail is made dead when any track work is going on, as there is everywhere a trolley under the structure and in the subway over the tracks. It is thus very convenient to move the work train, even when the third rail is dead.

The track repairing is done at night because during the day it is impossible to do anything which will obstruct traffic. This traffic cannot be diverted as on surface roads, and such a thing as renewing rail or ties during the day cannot be considered for a moment.

All the drilling is done by machines operated by compressed air. A 2-in. air pipe extends the entire length of the structure and through the subway. It was originally intended to operate the signals. It is still used for this purpose, but in addition the road department uses the air for operating drills, cutters, riveting and chipping hammers, grinding machines, and for blowing out or cleaning the switches on any part of the structure. There are taps at convenient distances and this power is made use of by all departments having business in or about the elevated structure. A pipe line 7¾ miles long is out of the ordinary, and requires considerable attention itself. The best twist drills which can be purchased are practically of no use with the hard rails on the Elevated. They can only drill one or two holes before they need regrinding. Mr. Steward has found it necessary to make his own drills out of a special brand of steel and of a peculiar temper. He now uses flat diamond-pointed drills. Some of these flat drills will put in fourteen 1⅛-in. holes and become hardly dulled.

Between the hours of one and five a small amount of work can be done by a crew of 25 men when compared with the amount that a crew of equal size can do on a steam road. Relaying 20 rails is a good night's work for a crew of this size. Every spike has to be pulled with a spike puller used in conjunction with a claw bar, and it takes two men to each claw bar. The men have to be very careful where they step and also to see that nothing falls into the street. All the work must be done while standing between the rails, as there is not room to stand outside the track. This, together with the care that the men must use, necessarily retards the pace. Although it is necessary for the track to be very strong one sometimes wishes when it comes to making repairs that there was not so much to it. Before a string of rails can be put in it is necessary to remove so many bolts, spikes, plates, filler blocks, etc., that there is a carload of material in the way before anything can be done to change the rails.

The one thing impressed on the minds of all the men in the Road Department is, that no matter how big a job is undertaken, and regardless of what may happen, the track must be ready for trains in the morning at the time they are scheduled to start. If the weather turns out badly after the work has started, the men keep at it until completed. When the weather is bad at midnight work on the structure is not attempted unless absolutely necessary. Instead, the men work in the subway, as there is always plenty to be done there. Without the subway the night crew would be idle a considerable portion of the time.

Thus far the third rail has required less attention than the running rail. The insulators have to be looked after pretty sharply in order to prevent short circuits, which, when they occur, tie up the road for a time. The shoes are wearing it some, but not as much as the snow brushes that are used during the winter. These are made of steel wire, and they actually gouge places out of the rail. During the summer the shoes wear these rough places smooth. Considerable trouble is experienced from vibration. Nearly everything on the structure has been loosened on account of this. Some of the spikes and bolts have been nearly cut in two.

The meeting closed with a unanimous vote of thanks to the speakers of the evening.

A Hanger Relic.

By courtesy of Mr. C. E. Flynn, formerly general manager of the Wheeling Traction Co., Wheeling, W. Va., we have received an interesting relic of the early days of electric railways, which is shown in the accompanying illustration. This hanger was made of hard maple, turned to a conical shape in a wood lathe, with open eyes of wrought iron screwed into the top and bottom, these eyes being pinched shut after the hanger was put in position. The conical surface is covered with asbestos paper. This type of hanger

AN OLD-TIME HANGER.

was, we believe, first made in 1887 and was used among other places in Wheeling, W. Va.; Atlanta, Ga., and Boston in the latter part of the 80's, replacing 2 x 3 in. x 3 ft. hardwood hangers and hangers covered with tar paper. The wooden hanger illustrated is one of the many used at Wheeling and afterward replaced by those of more modern design. It was found, together with some other relics, in tearing down an old carhouse at Wheeling in the summer of 1902.

British Municipal Tramways Accounts.

At the third annual convention of the Municipal Tramways Association the executive committee reported a suggested Standard Form of Tramway Accounts, which was prepared by a joint committee of the Institute of Municipal Treasurers and Accountants, and the Municipal Tramways Association of Great Britain. Mr. James Dalrymple, chief accountant for the Glasgow Tramways, it will be remembered, presented the Classification of Accounts and Form of Report at the 1903 convention. Our readers are familiar with the report presented by Mr. Dalrymple through the discussion of it, and the comparison with the Street Railway Accountants' standards, made by Mr. C. N. Duffy at the Saratoga convention and published in the "Street Railway Review" for Sept. 20, 1903, page 750.

Comparing the 1904 report with that of 1903, we find that the Dr. side of the revenue account is comprised in 27 items placed under four general heads instead of 46 items placed under six general heads as in the 1903 report. To take up this classification more in detail, Traffic Expense (which corresponds to the Street Railway Accountants' Transportation) comprises the same items as in last year's report excepting that that of "Lighting Cars" has been omitted, making nine subdivisions under this head instead of ten.

General Expense is the same as in last year's report except that No. 17, "Auditor's Fee," and No. 19, "Rent of Office," have been eliminated, Rent and Taxes being divided as two items instead of three, and Insurance (fire, accident, etc.), divided between two items instead of three.

Instead of Repairs in the 1903 report we find General Repairs and Maintenance in that of 1904, and this year there are only seven items under this head, "Repairs to Steam Plants" and "Repairs to Electrical Plant" having been transposed to the Cost of Power.

The Permanent Way Renewal Fund, being item No. 38 and one of the six graded divisions of the 1903 expense classification, is omitted in the 1904 classification.

The fourth head is Power Expense, under which is the single item "Cost of Current at —— per Board of Trade Unit."

The sixth general division of the 1903 classification, that is, Depreciation with its eight sub-divisions, is omitted from the 1904 classification.

A foot note explains that the Power Expense item is to be replaced in the case of a municipality having a separate tramway power station by the total of the Abstract of Power Expense, which appears at page 7 of the 1904 report. This abstract of power expense includes "Salaries and Wages," "Fuel," "Water," "Oil and Waste," and "Miscellaneous Supplies" (these comprises the Power Expense shown in the 1903 classification); "Repairs to Steam Plant" and "Repairs to Electrical Plant" (these appear under Repairs in the 1903 classification); "Repairs to Ducts, Feeders, Cables, etc., and Repairs to Power and Sub-station Buildings" (these items in the 1903 classification were included under similar heads under the general division Repairs). Besides these nine numbered items of depreciation, the power expense abstract calls for its proper proportion of Rent, Taxes, Insurance Premiums and General Management, the amount laid aside to meet depreciation and renewal, the interest on capital and the credit to sinking fund.

It would seem from comparison of the Power Expense Abstract with the Expense Account Classification that the various items of general expense shown in the latter are not totals, but instead are the totals less the portions of each that should be charged to power.

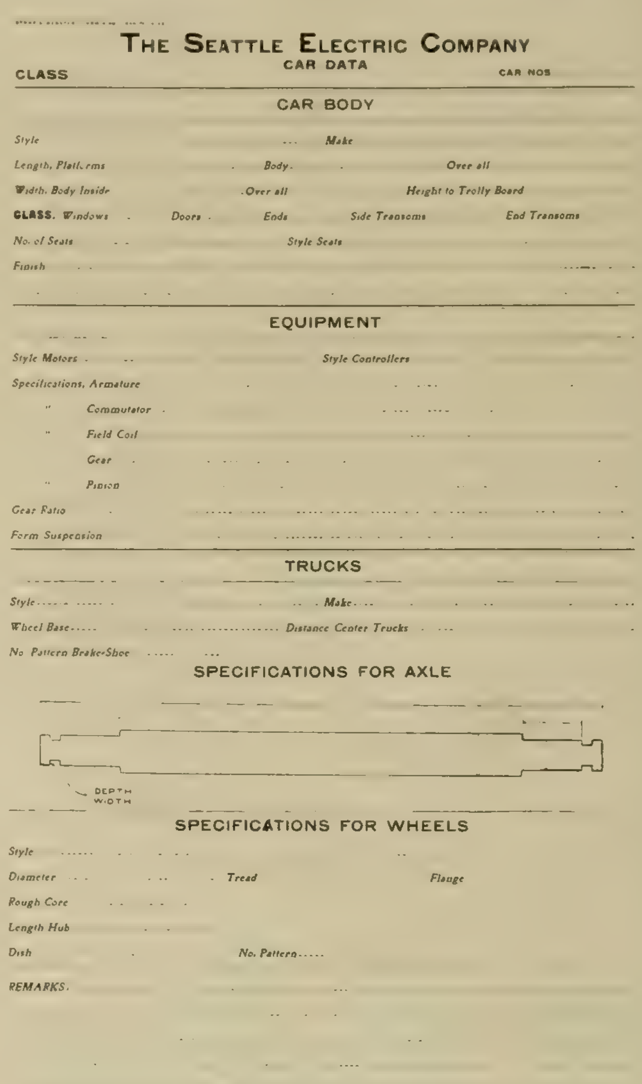
The Net Revenue Account, Appropriation Account, Reserve or Renewals Account, Sinking Fund Account, Capital Account, and Balance Sheet contain nothing of particular interest that was not covered by Mr. Duffy in his discussion of the 1903 report.

Under the head of Statistical Information is repeated the sundry information of the 1903 report excepting that the "Ratio of working expenses to receipts" and the "Average working expenses per car-mile" each replace two items showing each of these values, excluding depreciation and also including depreciation, and that there have been added blanks calling for the average working expenses per car-mile, excluding power, and the corresponding figure, including power, and also a blank for the energy consumption per car-mile.

In discussing the report presented for 1904 Mr. Dalrymple presented objections as to some of the forms of accounts, chief of which concern the Net Revenue and Appropriation Accounts. His contention was that the contributions to the Sinking Fund and to Renewal Fund should be included on the Dr. side of the Net Revenue Account, at least, and if he had his way they would be made a charge against Gross Revenue. He objected to the Reserve and Renewals Funds being united in one item because Reserve and Renewals were quite distinct matters. Mr. Bellamy, president of the association, urged that if Mr. Dalrymple's suggestions were followed it would result in statements that would compare unfavorably with the results shown by private companies and that the loss would be attributed to the municipal tramways when no real loss existed.

Rolling Stock Record.

The Seattle Electric Co. uses for a record of its rolling stock a form which is reproduced herewith. The size of the original is


THE SEATTLE ELECTRIC COMPANY
CAR DATA
CLASS
CAR NOS
CAR BODY
Style Make
Length, Platforms Body Over all
Width, Body Inside Over all Height to Trolly Board
GLASS, Windows Doors Ends Side Transoms End Transoms
No. of Seats Style Seats
Finish
EQUIPMENT
Style Motors Style Controllers
Specifications, Armature
" Commutator
" Field Coil
" Gear
" Pinion
Gear Ratio
Form Suspension
TRUCKS
Style Make
Wheel Base Distance Center Trucks
No. Pattern Brake-Shoe
SPECIFICATIONS FOR AXLE
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Diameter Tread Flange
Rough Core
Length Hub
Dish No. Pattern
REMARKS.

CAR DATA SHEET. (SIZE OF ORIGINAL 8¼ x 13¾ IN.)

8¼ x 13¾ inches, and in connection with the data sheet is filed a photograph of the car. The data sheet is perforated at the top for convenience in filing between covers.

The Auburn & Syracuse Electric Railroad Co. has decided to expend $100,000 in double tracking five miles of its road and in the purchase of new cars and other equipment. The work will be done in connection with the establishment of a park and summer resort on the highlands overlooking the valley and Onandaga lake.

Reinforced Concrete Construction.

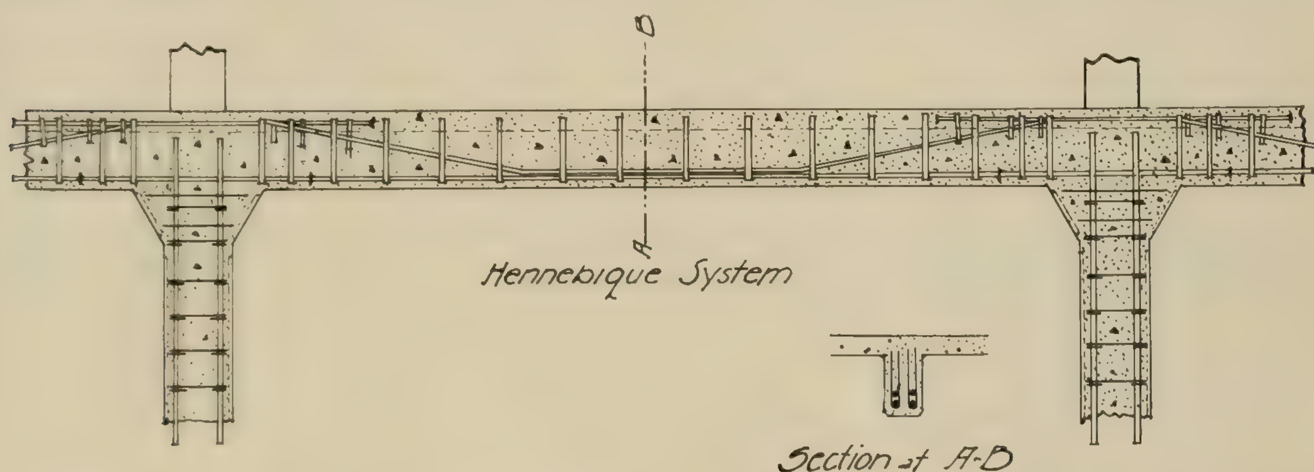
BY JOHN O. DE WOLF, OF W. B. SMITH WHALEY & CO., BOSTON, MASS.

On account of the destructive action of the forces of nature there has always been an effort on the part of builders and engineers to obtain such material and use such form of construction as will most suitably serve their porposes and best resist the destroying agents. In many cases the natural supplies of material have been such as to entirely outweigh all other considerations, with the result that much construction has had for perhaps its only merit the economy in first cost without durability. These defects are great in the wooden construction which has been so common in this country on account of the abundance and cheapness of that material. This article is not intended to decry the value of wood nor to diminish the importance of the services it has rendered, for if it had been scarce and expensive it would have greatly handicapped our building operations and limited our projects in almost all directions. But for many purposes for which it has been commonly used it is manifestly less fitted than other materials which are now available.

Brick and stone have been commonly used and have proved their ability to stand for ages. These materials when used in buildings have been principally in the walls and foundations, and the modern industrial buildings in this country have had a great deal of wood in them. While adding to the danger of destruction by fire, there is also the difficulty of obtaining the rigidity and strength necessary to sustain heavy loads or accommodate vibrating machinery. A heavy timber and plank floor construction goes far towards overcoming both of these defects and for many purposes at the present time it is probably still the best when suitability and cost are considered.

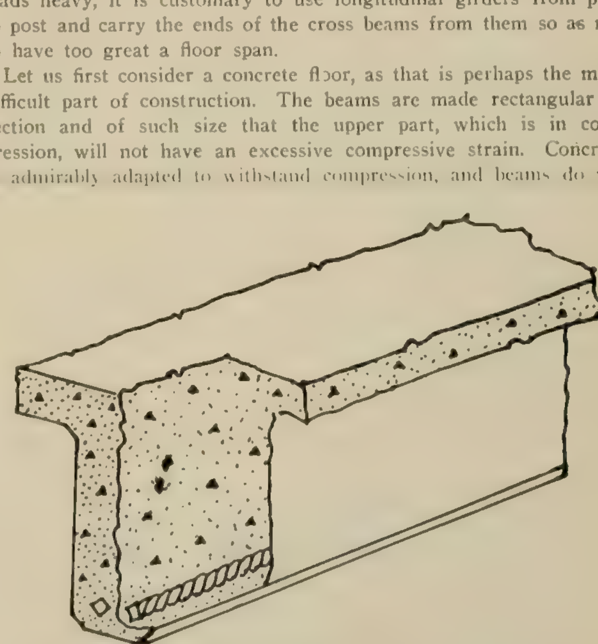
The use of structural steel is constantly increasing, and in many cases it is undoubtedly the best material that can be used. In combination with stone, brick, terra cotta and concrete, it seems to leave little to be desired, but in many places a concrete construction is even better, and with the recent experience and progress in that line it has shown itself to possess merits that must lead to its extensive use. As a material for structures, or parts of them, concrete has had, as is well known, an extensive and growing application, and has shown that it possesses advantages of stability, fireproof qualities, ready adaptability to different forms, and low cost of manufacture. But its resistance to tensile and shearing stresses is so slight compared with other materials commonly used that its use was much restricted until complete concrete structures were made possible by the work of French and German engineers, who found that iron imbedded in concrete acted with it and strengthened it. This forms the basis of concrete buildings and is called "reinforced concrete," "armored concrete," "concrete steel" and other similarly descriptive names.

It is not the purpose of this article to go into the details of the development of the different systems in common use, nor to attempt to give rules and formulæ for the calculation of reinforced concrete beams, columns, floors, etc., as such calculations are rather complex and at the present time to a considerable extent empirical, though a great deal of experimental work is being done on the subject, and we may expect it will result in as complete an understanding of the stresses in concrete as we have in regard to iron and steel. Attention will simply be called to the suitability of reinforced concrete and the fact that it can be properly used to accomplish results not obtained as well by any other material.



In the practical applications of reinforced concrete, we find about the same arrangement of posts and beams as would be used in slow-burning mill construction. In fact, it has been described by saying that if we consider wooden construction as petrified, we obtain concrete construction. If the distance between the posts is great and the loads heavy, it is customary to use longitudinal girders from post to post and carry the ends of the cross beams from them so as not to have too great a floor span.

Let us first consider a concrete floor, as that is perhaps the most difficult part of construction. The beams are made rectangular in section and of such size that the upper part, which is in compression, will not have an excessive compressive strain. Concrete is admirably adapted to withstand compression, and beams do not have to be made inconveniently large. Near the lower side of the beams one or more iron rods are imbedded in the concrete for the purpose of resisting the tension there. Owing to the great difference in the modulii of elasticity and tensile strengths of steel and concrete a relatively small amount of steel gives the strength required. The proportion of steel to concrete varies more or less, but is somewhere



RANSOME SYSTEM.

about 1 per cent or 1½ per cent. Thus the concrete furnishes the compressive strength of the beam, the steel gives the tensile strength, and the shearing stresses alone remain to be cared for. This is done by means of vertical irons, or stirrups, of proper section, imbedded in the beam, either vertically or at an angle, and generally spaced nearer one another towards the ends where the shearing stresses increase.

RANSOME TWISTED BAR

The accompanying sketches show the general principles of some of the methods used in reinforcing concrete beams. It is not within the scope of this article to attempt to show all the different methods, as a large number have been developed, but simply to show a few of the methods most commonly used in this country. As will be noted by referring to the Hennebique beam, the reinforcement consists of a series of rods parallel with the lower face of the beam and bent rods placed over them in the same vertical planes. This may be considered as forming a truss, the tension members of which are iron rods, and the compression members formed by the concrete. At the end the rods are split and spread open somewhat so as to give additional holding power and prevent their sliding longitudinally. The shearing stresses are resisted by stirrups formed of hoop iron of proper gage and width bent into a "U" shape. The holding power of the rods is principally derived from the adhesion of the concrete to the surface of the iron. The rods are generally round in section and the number and size are proportioned to the stresses coming upon the beam.

In the Ransome system the rods are placed parallel with the lower face of the beam and have a mechanical bond in the concrete. They are formed of square iron rods, twisted their whole length and when imbedded in the concrete hold somewhat like a screw. It will thus be seen that the reinforcement used in this system does not depend for its holding power upon the adhesion of the concrete to the iron. In addition to the holding power obtained by twisting the rods, it is found that the tensile strength and the limit of elasticity are both considerably increased, as the twisting is done cold. The stirrups used in this system are generally formed of smaller twisted rods and for convenience in setting are commonly placed vertically.

Another sketch shows a beam of the Kahn system, which uses rolled steel bars of special section. In cross section the bar has a square center with flat flanges extending diagonally from two opposite corners. The stirrups are formed by cutting these flanges and turning them upwards at an angle of about 45 degrees. The stirrups are thus a part of the reinforcing rod, are attached to them at the lower end, and are held in place at the proper angle while being imbedded in the concrete. This rod also has a mechanical bond and does not depend upon adhesion of the concrete to the iron.

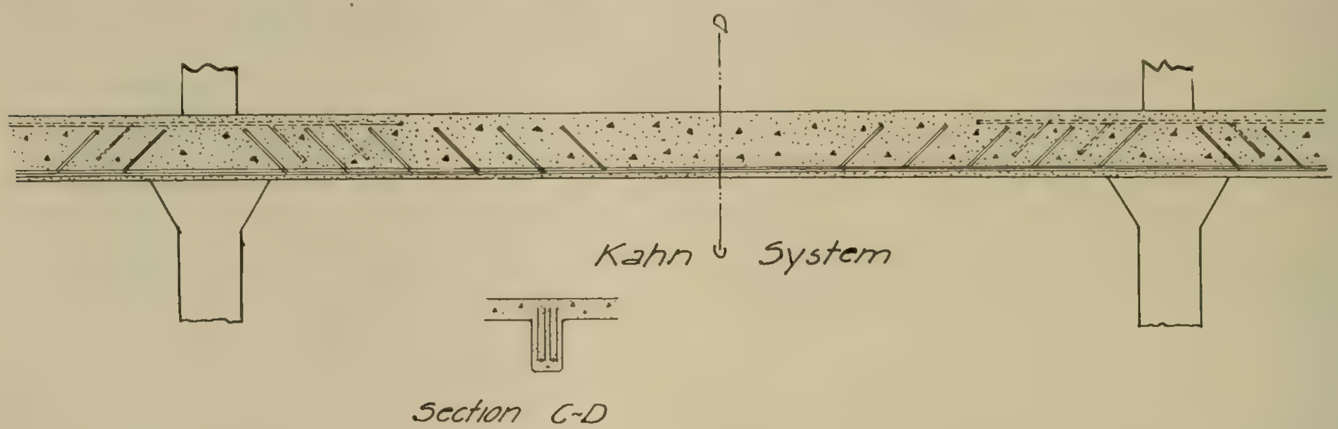
The arrangement of the stirrups of the Kahn beams at an angle of 45 degrees brings up the question as to what is the best arrangement of stirrups, and whether they should be set vertically or at an angle. From a theoretical standpoint it is probably better to set them at an angle of 45 degrees, as, in this position, they are better able to resist the stress upon them, but for convenience in setting it is customary to place them vertically.

In concrete construction the posts and columns need reinforcing and a number of different methods are used. In general, they all consist of vertical rods placed near the corners of the columns, if square, and held in place by some convenient form of separator so as not to spread when the concrete is rammed in place. In addition to the vertical rods tests show that spiral reinforcement is very desirable, and experiments made by M. Considère on hooped columns throw a great deal of light on the subject and show that this adds greatly to the strength.

In the construction of the floor itself a number of different methods are employed, depending upon the system used and the span between beams. In certain systems the reinforcing of the floor slabs is by means of rods imbedded in the concrete near the underside of the floor; these strengthen the floor the same as the reinforcement in the lower side of the beams strengthens it. A number of well known forms of construction use wire netting, expanded metal, or other similar forms to give the necessary strength to the floor. It is generally customary in all systems of reinforced concrete construction to build the beams and floors at the same time so that they become one mass and thus secure the advantages of monolithic construction. The upper surface of the floor may have a granolithic finish, or, if a wooden top floor is desired, it can be laid on wooden sleepers imbedded in the concrete.

In buildings where concrete construction is used throughout, the walls are generally made with large windows and the vertical space between the windows is built like a column and has vertical reinforcement. The spaces above and below the windows can also be built of thin concrete with little, if any, reinforcement, as there is no strain on them. But in some cases the thin curtain walls above and below the windows are built of brick.

A word should be said about the method of constructing a concrete building. In the first place, it is necessary to make complete wooden forms for all parts of the structure. These should be carefully made, smooth on the inside, and so designed that they can be taken apart readily and removed after the concrete has been put in



KAHN ROLLED STEEL BAR.

place and set. The designing and making of the forms should receive particular attention, so that they can be easily and economically set in place and afterwards removed. After the forms are set in place the reinforcing metal is put in and the concrete thoroughly tamped so as to make a dense and solid mass. As concrete can be placed in any desired position or shape it is possible to strengthen a particular part of the work or obtain results that could not be accomplished with wood or steel without a complicated design.

As regards the durability and strength of reinforced concrete there is no question. We have many examples of concrete having withstood the storms of centuries and we have also examples of iron that has been imbedded in concrete for years without rusting or being otherwise affected. As regards the strength of such work repeated tests have been made and all prove that if the work is properly designed and erected almost any desired strength can be obtained. In one case the floor of a warehouse was built with a 40 ft. span to the main beams and designed to sustain a load of 400 lb. per sq. ft. Material was piled upon the floor so as to give this load and it was found satisfactory in every respect. In another case a boiler house was built with the space above the boiler room arranged for coal bunkers, the load to be 2,000 lb. per sq. ft. Concrete construction was used throughout with satisfactory results. These cases are mentioned to show the possibilities of such construction and to emphasize the fact that concrete is adapted for work where heavy loads are to be carried; in fact, it is especially adapted to those places where the loads are unusually heavy.

A few of the forms of metal used for reinforcing concrete are here shown, and in addition to these, there are numerous others. Many engineers are at work on this subject and much effort is being put into designing such shapes as will best serve the purpose and give a good mechanical bond. Tests that have been made on the

CORRUGATED STEEL BAR—ST. LOUIS EXPANDED METAL FIRE-PROOFING CO.

adhesion of concrete to steel show that it is so good that a rod of any reasonable length has surface enough to give all the adhesion desired and will break by tension before it will slide longitudinally. In case the concrete is not properly put in place the adhesion is seriously affected and most of the systems commonly used in this country prefer to have a mechanical bond rather than to depend on adhesion to the metal. It should be stated, however, that a great deal of the work that has been successfully accomplished with reinforced concrete has used plain rods with very satisfactory results.

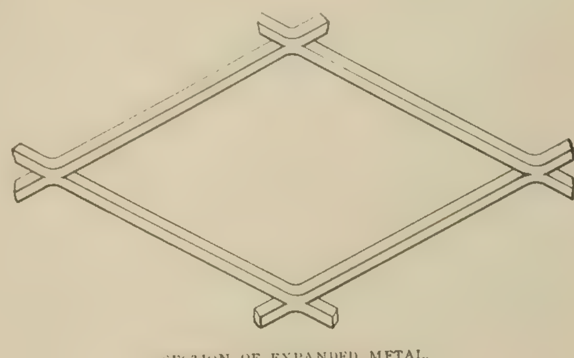
The present has been referred to as the "age of concrete" and we see a great deal of truth in this when we consider the manifold uses to which this material is now put. It enters more or less into all kinds of buildings and is proving especially desirable for many purposes for which but a short time ago it would not have been

THACHER BAR.

considered. It has long been used for foundations, for its advantages for this purpose are well known. By means of reinforcing rods properly placed in concrete foundations the size and amount of concrete can be materially decreased without in any way weakening the work. Recently it has been used for piles and on account of its durability in exposed locations it is liable to have an extensive use for this purpose. Concrete piles generally have vertical metal reinforcement and after they are once in place are probably indestructible, as they are not attacked by the destroying agents that act on wooden piles.

For street railway and electrical stations concrete is a most suitable material of which to make the complete buildings, as there is no chance of damage by fire and such buildings are absolutely fireproof. For the construction of storage battery rooms the advantages are at once apparent.

There are now quite a number of bridges of concrete, some of them being of long span and of considerable architectural beauty. In effect they appear like stone bridges, and in many cases can be built cheaper and undoubtedly possess greater durability than steel work. Almost any form of ornamentation that can be obtained with stone can also be had with concrete and there is no reason why this construction should not become extensively used for this class of work. It might here be noted that any concrete structure can be



SECTION OF EXPANDED METAL.

finished to look like dressed stone, if such an effect is desired. After the wooden forms are removed it is a simple matter to go over the work with pneumatically operated tools which will produce a surface the same as on finished stonework.

For railroad roundhouse roofs concrete offers a construction that is not affected by smoke and gases and avoids all danger from fire. Chimneys are also built of reinforced concrete and it is claimed that they possess greater strength and durability and occupy less room than if built of brick.

A study into the subject of reinforced concrete seems to show that it is an ideal building material for many purposes and, as its merits become generally understood, it will undoubtedly be extensively employed and in a great measure displace many of the materials of construction now commonly used.

Annual Report, Montreal Street Railway Co.

The report of the president and directors of the Montreal Street Railway Co. for the year ended Sept. 30, 1904, and submitted at the 44th annual meeting of the shareholders, November 22, shows net earnings of $952,826.80, as compared with $905,939.01 last year. After providing for the percentage on earnings accrued to the city, and interest on bonds and loans, four quarterly dividends were declared, amounting to $642,520, and in view of the company having assumed its own fire risk, placed an additional sum of $20,000 to the credit of the fire insurance fund, which now amounts to $267,904.92, and $50,000 to the credit of the contingent account, leaving a surplus of $821.48. An amount of $100,404.99 expended during the year on special renewals has been charged against the contingent account.

Considerable new extensions to the tracks of the company have been constructed during the year and the rolling stock and equipments have been largely increased to keep up with the requirements of traffic. The company contributed to the Mutual Benefit Association, established for the benefit of employes, for the seven months to June 30th last, the end of the Association's year, the sum of $9,513.40. During the year franchises have been secured in the municipalities of Delorimier and Longue Pointe and in the village of Beaurivage and town of Westmount. Changes in the staff of officers during this period include the appointment of Alexander Stewart as auditor, in place of John McDonald, deceased; K. W. Blackwell elected vice-president, and W. G. Ross, managing director, vice F. L. Wanklyn, resigned. A comparative statement for the year 1904 as against 1903, and 1903 as against 1893 is given below, from which may be seen the growth of the business of this company.

	1904.	1903.	1893
Gross Receipts	$2,463,824.70	$2,222,787.05	$750,751.78
Operating Expenses ...	1,510,997.90	1,316,848.64	593,041.71
Net Earnings	952,826.80	905,939.01	157,710.07

Some Power Plant Experiences.

BY H. C. REAGAN.

An interurban electric road running out of New York City had one of its power stations situated about 15 miles from the terminal and another station, supplying current to another portion of the system, about seven miles from the terminal. The station farthest away was in charge of the writer, who was requested to take hold and straighten things out, as the equipment in general had been badly used and run down.

This plant consisted of three units, belt driven, four return tubular and two large vertical boilers, the four boilers using forced draft. The steam main or header was on top of the boilers with a very small head room, as the roof was very low. The space between the back of the boilers and the wall was just large enough to permit one to use the blow off valve. Feed pumps were set at one end of the boilers and a passage way extended from the engine room to the front of the boilers. Particular attention was given to these boilers regarding cleanliness, a compound being used to remove scale and sediment.

On taking charge the first condition that presented itself was trouble with one of the generators of a well known and standard make. The machine ran hot, the brushes could be heard screeching for half a square; the commutator was hot and sparks would fly in all directions with change of load. It was grooved and had large flat spots on it. This condition had existed for some time.

The next trouble that presented itself was the wrist pin on a corliss engine which the retiring engineer stated was giving him trouble. This was oiled by a wiper. He stated that sometimes the pin would screech and he would then take a hand oil can and pour oil on the strap and let the oil work down to the pin. It is to be understood that this pin had a hole in the center and was then drilled out to the surface to oil grooves in the pin.

The next items of interest were the vertical boilers which had been scorched (and that badly), the crown sheet warped, flues leaking and gaskets shriveled up.

There was also a Westinghouse engine which the engineer stated was all right after it was started and until it came to be shut down, then there was trouble and it sounded as if it was going to pieces. He said he had tried everything to remedy it, but did not know what caused the trouble.

The switch board also demanded attention. A circuit breaker did not work right; it flashed whenever tripped, which was evident from its appearance.

With the foregoing introduction the retiring engineer left the plant in charge of the writer. Each trouble was then taken up in its turn, the generator receiving first attention. After looking it over when shut down, a loose field connection was found on the shunt winding. This would jar back and forth. It was tightened up. A commutator truing tool was next brought into play, the commutator trued up and new brushes procured as the old ones were burned so that all lubrication was wasted out. It was also found that the brush yoke had been shifted past the line of commutation. The machine was started up and showed no signs of trouble or distress, met all changes of load without any sparking and the bearings did not run warm any more. They formerly ran warm, due to the heated armature and commutator.

The wrist pin received attention next. On taking the pin out, the grooves were found to be filled up solid with metal and oil that had become burned hard. The pin was cut and the metal was cut down so that the bearing on the pin was made by the two edges of the brasses, which alone was sufficient to produce heating. The pin was sent to the shop to be trued up and new metal was put in the brasses. The wiping device was changed as it was observed it did not get oil to the cup and would strike the oil and throw it off. To insure oil getting to the pin a small pipe was procured and allowed to extend along the guides for a considerable distance. This pipe was pierced with a number of small holes along its length, and the oil cup was attached to the pipe. After the pin returned and was put in place, the engine was started up with the result that there was no heating and the pin received plenty of oil as the wiper had several drops of oil to take instead of one at the extreme end as formerly.

The means by which one of the boilers was scorched was as follows: This boiler had been subject to a hydrostatic test and remained full of water for several days until a heavy load called for additional steam. The firemen were instructed by the former engineer to get it ready, which they proceeded to do, opening the blow off to let the water out to a height suitable, as they supposed. The water column had a stop valve in the pipes leading from the boiler to the column. A fire was started and the water in the gage glass was supposed to be all right. In order to get to the gage glass it was necessary to climb up a ladder, which was not done any oftener than necessary. After the fire had been started the firemen's attention was given to another part of the boiler room. After a time one of the firemen went to the boiler just started and found it leaking badly all around and found it burned. This was caused by a false water indication in the gage glass due to the valve in column pipe being closed. There was leakage enough to allow the water to fall in the glass slowly, consequently the blow off valve had been left open too long and all the water ran out while the glass showed only a gradual falling of water.

The circuit breaker arced, due to the auxiliary make and break which had become fused and did not make contact, so that when the breaker was opened the total break was made at the main terminals, the magnetic blow out having no effect. The auxiliary terminals were repaired and the springs adjusted, after which all trouble ceased during short circuits or over loads.

The Westinghouse engine presented a peculiar case. When opening up the casing and examining the crank shaft, it was found that the metal from the top half of the brass was hammered out in sheets which projected out at the sides on the right hand cylinder facing the front of the engine which left considerable lost motion in pin between the bottom and top shell. As will be understood, the pressure is on the down stroke in these engines, having trunk pistons. The brasses were taken out and rebabbitted, the crank smoothed up, the engine connected up, and it ran very quietly except when starting or stopping there seemed to be a jerking or out of balance motion which quickly developed lost motion and hammering. It appeared without an indicator card to tell that one side was not getting as much steam as the other and upon this point an investigation was made and the trouble soon found. The engine had the piston steam valve between and back of the two cylinders with a long and short steam port. Where the port enters the cylinder, the cylinder head is chamfered away to give clearance. The writer had the head taken up very carefully so that it would not turn around from the position that it had before being raised, and that revealed the trouble. At some time the head had been taken off and when put back, the chamfered portion of cylinder head was turned around and away from the proper position in relation to the steam port. This reduced the port opening into the cylinder, causing the other cylinder to do more work, and it caused a pound which hammered out the metal, creating lost motion which in turn would increase the hammer. After the head was put in proper position, the trouble ceased.

A very serious accident happened to one of the four tubular boilers which required quick decision and action, and which nearly caused the death of one of the firemen. This fireman was charging the furnace with coal when the writer called to him, desiring to direct his attention to the action of the feed pump. He closed the fire door and was half way across the room when there was a loud report and an explosion of some portion of the boiler which he had just been firing. The flame shot out of the fire box accompanied by a rush of steam. Realizing that it was serious, the writer opened up the switches and shut down the three engines. In the meantime an effort was made to get up to the stop valves on the boiler to close them to prevent steam and water from running out of the other boilers into the boiler in distress, but to no purpose as the rush of steam prevented any one from getting on top of boiler on account of low head room. The fires were partly drawn and dampened down with ashes under difficulties, due to the rush of steam and hot water into fire room in front of boilers. When the steam had spent itself so that the stop valves could be closed down on the defective boiler, fires were pulled down in the other boilers, after ascertaining where the water was in each boiler, and steam raised and the cars started. The examination revealed a burst blow off pipe. This pipe was in the combustion chamber with

nothing surrounding it. The examination showed that this section of pipe was a butt welded pipe which is always dangerous in such a position. It should be lap welded. This boiler had been just blown down in the morning and the pipe was clear, so that it was evidently not due to scale; also the iron did not seem to be burned. The force of the steam dug out a large hole in the combustion chamber and back wall. A failure to have pulled out the switches on the board would have resulted in a reversal of generators as they were in parallel with the other station with no circuit breaker in the line.

A peculiar accident happened at this station to one of the generators. The storeroom was directly over the generator room, with a board floor some of the joints of which were open. The linemen had put a large carboy of sulphuric acid in the room and the writer having to put a new brass in one of the engines sent the oiler to storeroom to get it. In a few moments there was a cry as of one in distress, and then the generator room was filled with the fumes of acid and a stream of acid poured through the storeroom floor and down onto one of the generators, which fortunately was not started at that time. The results to generator were realized in a moment, as the insulation of the armature and field coils was foaming and turning white, due to the action of the acid. There was a 5-gallon can of kerosene near at hand, which the writer poured over the armature coils and fields and the chemical action ceased as soon as the kerosene came in contact with the acid. After thoroughly drenching the machine and giving the kerosene time to penetrate all points, the generator was started up to dry it out. After running for about 30 minutes the fields were built but at about 25 volts the armature coils leaked badly, so another dose of oil was given and the machine ran for about 3 hours, after which it was started at 25 volts and built up gradually until it showed no signs of leakage, when the load was put on. The coils were shellaced and dried and the machine went into service, giving no further trouble. The oiler was gotten out of the acid fumes as quickly as possible after his outcry. In getting the brass from the shelf it dropped out of his hands and struck the carboy of acid, breaking it. It is well to note that the kerosene while accomplishing the results desired, also had another good property—that of evaporation, leaving no gum or combined oil and carbon dust in and among the coils at inaccessible points.

New Draw Bars in St. Louis.

Having had considerable difficulty with the types of draw bars in use the St. Louis Transit Co. has recently adopted a bar of cast steel which is shown in the accompanying drawing. This bar is made in two pieces, the eye being separate and spring connected to the bar in the manner shown. In connection with this bar a push bar, also of cast steel, as shown in Fig. 2, is used.

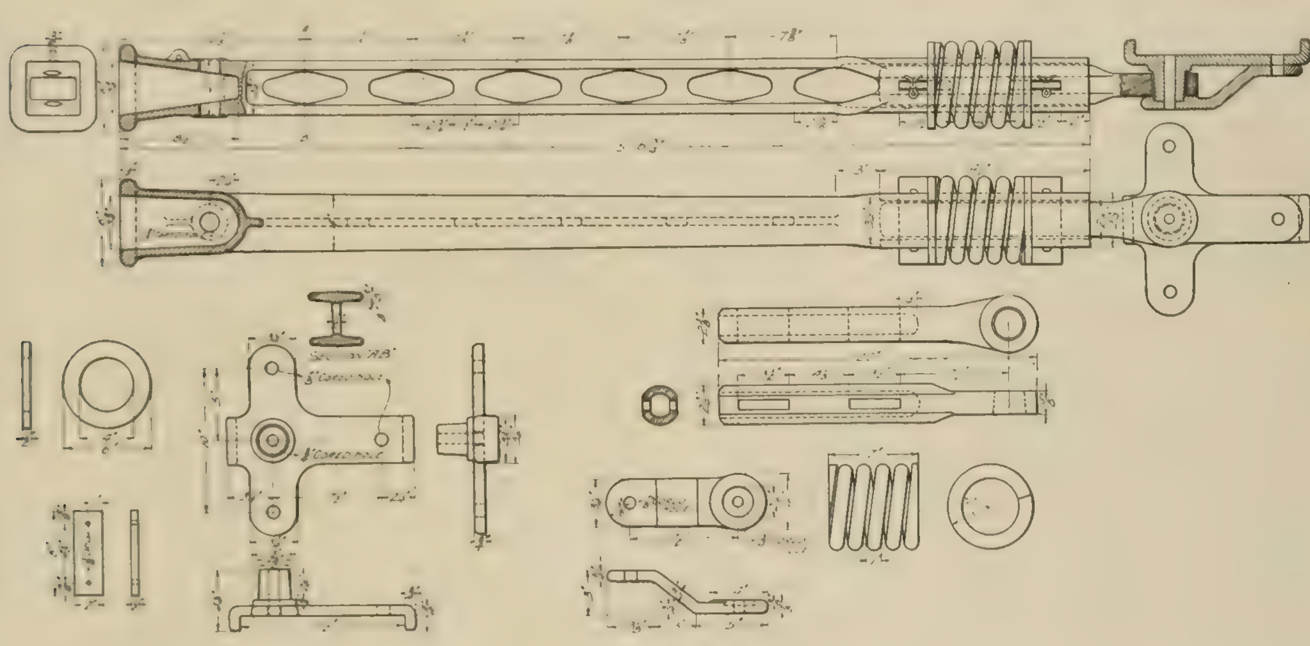


FIG. 1—DRAW BAR.

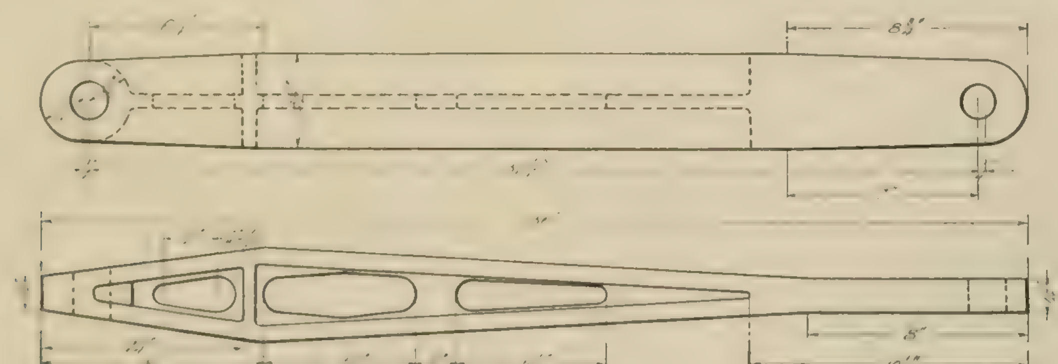


FIG. 2—PUSH BAR.

The Western Ohio Railway Co. will in the near future take its ticket agents and conductors on a trip over its lines and those roads, both steam and electric, which connect with it and cross the Western Ohio at the various points to teach them all the connections between different points. Half of the employes will be taken at a time.

Suggestions to Car Service Men.

The Pittsburg, McKeesport & Connellsville Railway Co., of Connellsville, Pa. (controlled by the West Penn Syndicate), has distributed to its men a time record book, vest pocket size, which contains "suggestions" so pertinent that we herewith reprint the whole of them as follows:

Introduction.

The departments of an electric railway system are as interdependent as the wheels in a watch, and for smooth operation every man must do his part as accurately as the wheels of the full jeweled movement which he carries in his pocket.

We want the West Penn Railways, carrying its millions of passengers annually, to be the smoothest operating electric railway in the United States. To this end we must have the whole-hearted, honest and loyal help of every train service employee on the system; to the boys who three hundred and sixty-five days and nights per year, through sunshine and rain, make their runs over the hundred odd miles of the West Penn, these notes are addressed with the hope that they may aid them in their work and feel that in the faithful performance of their duty, whether it be driving a through liner down the Hunker Valley at forty miles per hour or operating the Bryn Mawr transfer car, their efforts are noted and appreciated by the Transportation Department. Faithfully yours, J. W. Brown, Supt. Transportation.

Treatment of Passengers.

A conductor or motorman to be successful must be courteous, courteous, courteous all the time. It is hard work, but it wins in the end, and when you are compelled to eject a man from the car and have held your temper during the argument with him, you will have the sympathy of every good citizen aboard. On the other hand, if you are irritable, quick to threaten to eject an obstreperous passenger or remind him that you are running the car, you may expect trouble and very little sympathy from the onlookers.

If you carry a passenger past his station, do not get on the defensive at once. Admit that you forgot him and say that you are sorry, and nine times out of ten he will forgive you before he gets to his destination. If he threatens to report you, don't say: "I wish you would; my number is so-and-so." The best way to avoid troubles of this kind is not to carry your passengers past their destination.

Announcing Stations.

Announce your stops distinctly. Some conductors forget that they have passengers on board who are making their first trip over the line and are listening anxiously for the announcement of their getting-off place. One conductor, in a weak, half-hearted way, says "Uyuntown," as if he were ashamed of the place, while another one roars out from away down in his manly bosom, "Uniontown, change for Dunbar, Connellsville, Leisenring, Scottdale, Mt. Pleasant and Greensburg; this car for Revere, Footedale and Leckrone," and everyone puts him down as a public benefactor.

Observance of Schedule.

Be prompt about leaving terminals. Get out of Leckrone or Dickerson Run as punctually as you would leave Pittsburg street, Connellsville. It is the conductor's duty to give signal when to leave terminal, but it is just as much the motorman's duty to hit time points on the dot, neither behind nor ahead. Remember, you can disappoint a great many patrons by passing points a minute sharp. Don't lag behind; a connection missed at Leisenring or Scottdale must upset somebody's plans for a whole day, and it is your business to keep our patrons pleased with the service.

Tending to Business.

Some conductors are smarter than others. Some men find that it takes all their time to operate a car carefully, get all the fares and properly register them, load and unload passengers safely, helping old people and women with baskets and children on and off; while other conductors find time for a flirtation with some butterfly, or else engage in a conversation with some one on the back platform. Don't be guilty of this habit. It will get you into trouble sooner or later.

Your motorman has troubles of his own, and you will add to them if you tell him all about what a time you had last night, or call his attention to the pretty girl in the third seat on the right hand side; and then the passengers want off occasionally and they expect you to be at your post ready to give the signal at the proper point. The motorman who talks to either the passengers or his conductor, except when it is really necessary, invites disaster.

Talk About Your Work.

Some motormen and conductors use judgment in the operation of their cars; others do not. The thinking conductor is quick to see the ventilation is bad, or the car is too breezy, or that a lady wants a blind lowered; he keeps himself informed of the schedule of cars on the remote section of the road, handles kicks of passengers so nicely that they feel ashamed of themselves before they get off.

The thinking motorman studies the condition of the rail, the working of his car; watches his schedule closely that the speed is not alternately high and low, but as uniform as the schedule will permit, makes his stops smoothly, never exceeds the limit of safety and uses good judgment at all times; while on the other hand the unthinking motorman runs his car with about the same amount of thought as the swarthy-faced foreigner did his wheelbarrow when the road was being graded, no more intelligence displayed, no more interest in making a success of its operation. Be sure that you are a motorman, not a wheelbarrow runner.

Loyalty.

Be loyal to the road on which you are working. Every day you can hear some one finding fault with the management of a public service company; it's a habit of the American people. Don't place much weight in the remarks of the man who tells you how much better he would run things if he were boss. Stand up for your company; if you don't like your job get another one and then you can cuss the old job to a standstill if you feel like it, but don't say mean things about the line that makes you a living. Be loyal to your officials; they have trials and perplexing situations to meet every hour of the day, and a whole-hearted effort to do the best that is in you goes a long way towards making the road a success, and its success is your success.

Accidents.

What accidents should be reported? Every accident, however slight, occurring on or near your car must be fully reported at once; neither you or anybody else can determine just how important an action for damages may result from a trivial accident. Therefore, report everything that happens and you will be on the safe side in this respect.

In case of personal injury, get name and address of injured party, note any remarks made by the party or their friends, ascertain as fully as possible the extent of their injuries, get the names of every one on the car if possible, taking care that the addresses are also obtained; be just as sure to get the names of the persons who criticise the actions of the crew as the names of those who sided with you, and render all possible aid to the injured party. In cases where surgical aid is required, the surgeon of the company who can reach the point quickest must be called without delay and the case put in his exclusive charge. In case of emergency, where the injured party requires immediate surgical aid and the attendance of the company's surgeon cannot be had at once, then proper surgical aid should be procured until his arrival. There must be no delay, however, in sending for the company surgeon, notwithstanding the called surgeon is in attendance

In case of damage to property:

After getting names of all witnesses, carefully examine vehicle and note just what is broken; also whether animals hauling the vehicle are in any way bruised or injured.

In all cases where accidents occur causing any delay to car it must be protected in both directions against opposing and following cars.

Information about accidents:

Call dispatcher from nearest telephone, being prepared to give the following information:

Exact time, line, direction, car number, exact place of accident, injury to person, damage to property, name of injured party, where they are at present time, how the accident happened.

In case of derailment or accident to car:

Number of wheels off track, position of car, nearly parallel to track or crosswise, brake rigging operative or not, motors operating or not; is car on embankment or level ground?

Immediately upon being relieved after an accident make out full report written in ink on regular accident report form, conductor and motorman making separate statement of the accident. Under no circumstances talk about an accident, no matter how trivial, to any one outside of the proper officials; refer all newspaper men to the Superintendent for information about accidents; do this courteously. The papers can either be a great help to us or create a great deal of trouble in the write-up of an accident. Remember, your interests and the West Penn Railways are identical.

Signal System.

"Eternal vigilance is the price of safety," therefore eternally keep your eye on the signals; be able to take oath how your signals stand when you arrive and depart from a block. If you come to a scheduled passing point and no light appears against you at time opposing car is due, try signal used by opposing car and satisfy yourself that it is in working order, then throw your ahead light and proceed with caution. In case you arrive at block and opposing car does not appear against scheduled time and your ahead signal is not operative, you will lay on siding two minutes over the time consumed in running the block, viz: If the time is six minutes, lay eight; if eight, lay ten; this time to be counted from scheduled time to pass; try signal used by opposing car and satisfy yourself that it is in working order, then proceed with caution, conductor flagging all curves, going ahead of his car sufficient distance for opposing car to stop safely under all circumstances.

New Lines and Extensions.

October 25th J. C. White & Co. finished its work on the construction of the Youngstown & Southern Railway Co.'s line.

October 28th the new trolley line connecting Reading with Birdsboro, Pa., nine miles southwest of Reading, was completed and the road was opened to the public.

October 28th the extension of the Tatnuck line of the Worcester Consolidated Street Railway Co. was opened and cars are now running over this section of the road.

October 28th the first of the interurban cars made a trial trip over the line of the Ft. Wayne & Wabash Valley Traction Co. from Ft. Wayne to Logansport, Ind. Regular through service was commenced November 1st.

October 31st cars on the electric line between the union depot and the pier at Gulfport, Miss., were placed in operation.

October 31st the Wheeling & Western Traction Co., which is operated by the Wheeling Traction Co., ran its first cars from Wheeling, W. Va., to the terminus of the road at Barton.

November 3rd the first regular cars over the Scioto Valley Traction Co. lines from Columbus to Circleville and from Columbus to Lancaster were run and regular service established.

November 3rd the Louisville & Interurban Railway Co. began the extension of its Eighteenth street line to Orell, a distance of five miles from Pleasure Ridge Park. The new line will not be completed, however, until some time in the spring.

November 5th the Detroit, Monroe and Toledo Short Line, [illegible] between Detroit and Toledo, started its first through [illegible]. The new road will run hourly cars between the hours.

Aids in Computing Car Mileage.

"Take care of the details and the larger matters will readily adjust themselves." So spoke a successful electric railway manager not long ago. This aphorism is probably applicable to all the activities of life, but it is true with peculiar emphasis in the business of running an electric railway. The manager who is able to show profits at the end of the year knows that the surplus comes from a very small fractional part of the 5-cent fare, and that no legitimate reduction in operating expenses is too small to be considered, even though the saving is so small a per cent as to require several places in the decimal to express it.

Along this line the following suggestions for facilitating the work of the mileage clerk may be classified as "small economies", but they are worth thinking about. They come from the Connecticut Railway & Lighting Co., on which system the use of the diagrams shown has materially reduced the labor of computing car mileage.

All car routes are laid out in diagramatic form, as shown in Fig. 1. This diagram gives distances in feet between all important points, together with progressive total distances in both feet and miles. To obtain miles between points, it is only necessary to make a subtraction between any two progressive mileage figures. The mileage clerk, with the conductors' daily report blanks before him, first determines from the blank over what routes or portion of routes each car has traveled during the previous day, and, by glancing at the diagram, is able to jot down immediately the total miles covered by each car.

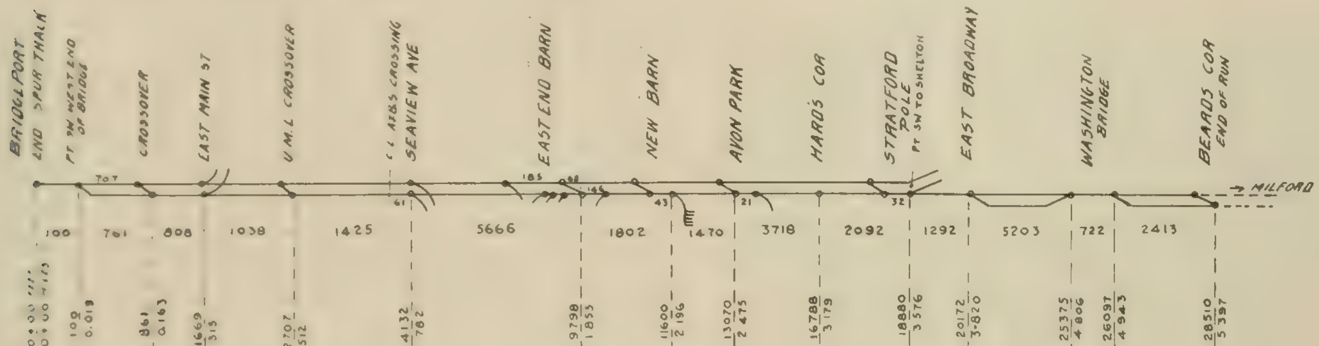


FIG. 1. MILEAGE DIAGRAM.

	BRIDGEPORT R.R. STATION	BLACK ROCK	FAIRFIELD	SOUTHPORT	GREENS FARM	WESTPORT	SAUGATUCK	COMPO BEACH	NORWALK MAIN & WALL	SO NORWALK R.R. STA
BRIDGEPORT R R STATION	O	2 80	4 97	6 40	8 75	10 60	12 39	14 08	13 89	15 71
BLACK ROCK	2 80		2 17	3 60	5 95	7 80	9 59	11.28	11 09	12 91
FAIRFIELD	4 97	2 17		1 43	3 78	5 63	7 42	9 11	8 92	10.74
SOUTHPORT	6 40	3 60	1 43		2 35	4 20	5 99	7 68	7 49	9 31
GREENS FARM	8 75	5 95	3 78	2 35		1 85	3 64	5 33	5 14	6 96
WESTPORT	10.60	7 80	5 63	4 20	1 85		1 79	3 48	3 29	5 11
SAUGATUCK	12 39	9 59	7 42	5 99	3 64	1 79		2 15	4 76	6 58
COMPO BEACH	14 08	11.28	9 11	7 68	5 33	3 48	2 15		6 45	8 27
NORWALK MAIN & WALL	13 89	11 09	8 92	7 49	5 14	3 29	4 76	6 45		1 82
SO NORWALK R R STA	15 71	12 91	10 74	9 31	6 96	5 11	6 58	8 27	1 82	

MILEAGE - CHARTERED CARS

FIG. 3.

Fig. 2 is a chart used for quickly transposing lineal feet into decimal fractions of a mile. This table will be found accurate to three places in the decimal. It has proven very convenient in car mileage work, and, in fact, in all track and similar calculations The formula, "Lin. Ft. x .00019," will give correct reading to two

TABLE OF FEET IN DECIMALS OF A MILE.

1000 FT.	= .1893 MI.	20000	= 3.7878
2000	= .3787	30000	= 5 6816
3000	= .5681	40000	- 7 5757
4000	= .7575	50000	= 9 4697
5000	= .9469	60000	= 11 3640
6000	= 1.1364	70000	: 13.2577
7000	= 1.3257	80000	= 15.1515
8000	= 1.5151	90000	= 17.0454
9000	= 1.7047	100000	= 18.9393
10 000	= 1.8939		

NOTE: LIN. FT X .00019 = MILES

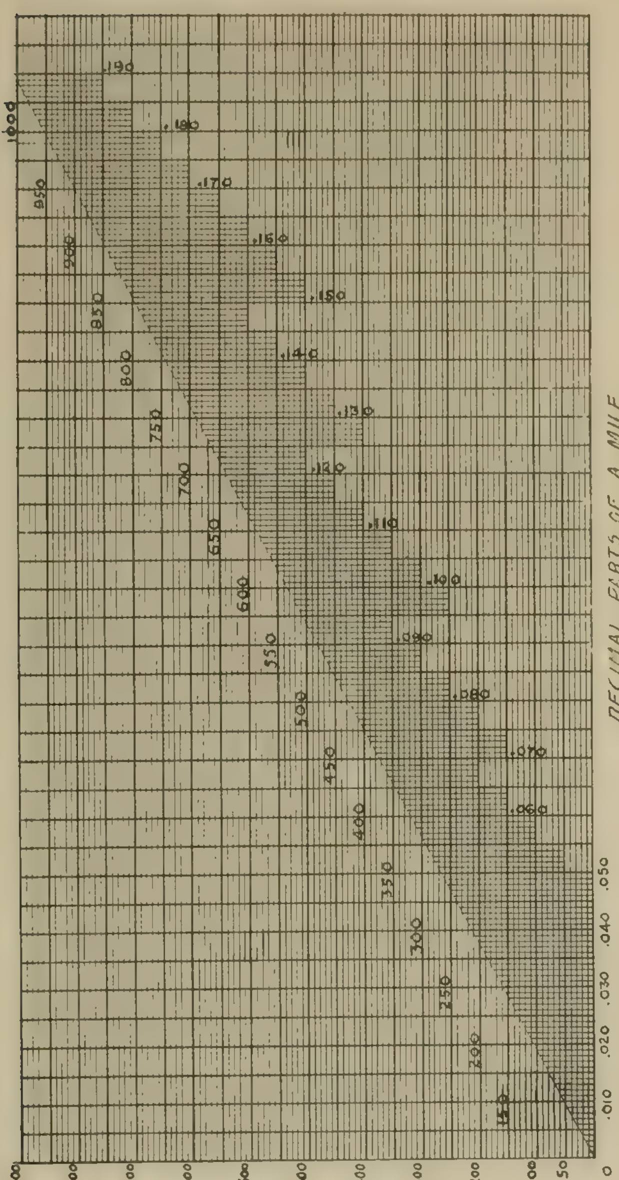


FIG. 2 MILEAGE DIAGRAM.

places in the decimal. This formula is not altogether original with the company, but is based on a table in "Electrical and Engineering Tables", by Sidney Sprout, E. E., San Francisco.

In Fig. 3 is shown a table that has been found useful for ready reference in determining the cost to be quoted for chartered cars. The table is laid out in the form of a square, and gives the mileage and rates between all points of importance between the company's lines. In the table shown the rates are not indicated, but are to be inserted in the individual squares beneath the mileage figures.

The Care of Switchboards.*

It is surprising to notice, in visits paid to central stations for the supply of electricity, evidences of the fact that, while systematic attention is devoted to the cleaning of the buildings and mechanical plant, and some little effort is made to keep the electrical running machinery in good order, very superficial notice is often taken of the condition of the switchboard. An instance of this came under our notice at a station whose switchboard was of the "flat-back" type. The marble front was beautifully clean, the glass and brass of the instruments were brilliant in their polish; but the engineer was unwise enough to show us the back of the board. A heavy coating of dust lay on the bus-bars and cables, a mop and pail of water stood in one corner adjacent to a resistance frame, and balanced on the angle-irons of the frame-work was an assemblage of pint-pots, cups and parcels of food, this portion of the board being evidently reserved as a pantry by the switchboard attendants. This laxity is all the more astonishing because the board is the point of assemblage of all the power developed by the plant in the station prior to its departure to the feeding-points of the system.

The reason for such neglect is probably that, with a continuous supply, the board is never entirely available for overhauling and cleaning. Parts which are in operation, or regarded as "spare," are exempted from strict examination owing to risk of life or other causes. The danger of this is, however, apparent to anyone who has had the opportunity of seeing what dust can do in increasing leakage, and noticing the effect of loose connections in increasing the drop of volts in a bus-bar.

A switchboard should be subjected to a detailed examination as often as, and of as severe a nature as that of the rest of the plant, which, though perhaps occupying more space, is, after all, only of the same power-capacity as the board. This should be undertaken by the engineer-in-charge, and he should be particularly on the alert for loose connections. It is not a wise policy to wait until a screw drops out and an open circuit is formed before making an anxious investigation and a penitential report. A half-hour spent with a spanner and screw-driver say, once a week, may save the credit of the station. It must be remembered that in a power house there is nearly always vibration constantly tending to jar connections loose. Alternate expansion and contraction of metal parts by heating as current is passed through them or interrupted aids vibration in making these parts work loose.

Dust in an engine room is usually rather oily, and where it touches it sticks. Moreover, parts charged to a potential differing from that of earth attract and retain light particles of dust. In some stations a small portable motor-driven air-compressor is used in order to blow the dust off electrical fittings, and the introduction of such appliances should not be discouraged. But it is not safe to rely on this method, partly because the general application of an air-blast tends to diminish the detailed examination of the insulating part of the board by the attendant, and partly because oily dirt is not moved by a current of air. The blast should be followed by a careful wipe-over by an intelligent human being armed with a piece of dry soft rag. Waste is not to be recommended, as it leaves fluff and loose strands lying about. In applying an air-blast, particular attention should be paid to resistance-frames and other inaccessible parts. It is not desirable to have the pressure of the air higher than 60 lb. per sq. in., as cases have come within our knowledge where mica insulation has been stripped away by too great a blast of air. Where it is impossible to draw links in order to make a certain part of the board "dead," a feather brush mounted on an insulating handle may be used on systems at ordinary pressures of supply.

On many boards oil-break fuses are used, which have an occasional trick on breaking of distributing their oil fairly impartially over the surrounding apparatus. Oil is in itself an insulator, and, therefore, although it looks untidy, it is safe. But a streak of oil is a resting-place for all passing dirt, and if it is not soon removed the insulating properties of the board may be greatly reduced. On any board where oil is used, care must be taken that none gets upon insulation composed of rubber or wax, as they become deteriorated by its action.

*From the Electrical Review, London.

It may not, perhaps, be out of place to draw attention at this point to the careful examination of fuses. Metal strip fuses, it is notorious, deteriorate in course of time, and should be systematically replaced. A rough method of checking their behavior is to test their temperature when on full load. When a particular fuse has an unusually high temperature, it should be marked for removal at the earliest possible opportunity. Quite apart from this, however, a fuse should not be allowed to remain in use for more than a year's running. Where oil-break fuses are used the level of the oil in them should be examined daily. Some types are constructed to break in air, the fused ends being then plunged in oil; other makers prefer to make the arc in the oil itself. In either case the oil must not get too low. Metal-vapor bridges a very wide air space, and hideous results may follow from the improper breaking of a fuse.

It is an unfortunate phenomenon in central station practice that many parts of the plant, originally put up as temporary plant, become by their good conduct permanent institutions. This is very much the case with switchboards, where opportunities of reconstruction are rare. Teak—a very slow burning wood—has been used for this purpose. It is oily, and so resists moisture. It should, however, be watched with an anxious eye by the engineer-in-charge. Asbestos, from some points of view, is better—it will not burn. But it absorbs any moisture it can find, and hence its insulating properties are diminished. If asbestos is used, it should be painted with some insulating varnish to remove this danger. The same remark applies to slate, whose enamel has been damaged by an arc. Precautionary measures of this description are worth any amount of brilliant evolutionary operations with burning switchgear in order to save the lights.

One of the functions of the switchboard is to register the amount of energy generated and distributed. The switchboard attendant is supposed to take a record every quarter or half-hour of his indicating meters, and to register the readings of his integrating meters at the end of his shift. If these meters are out of order, the proceedings become a solemn and arduous farce. The engineer should at least know how to adjust the zero of his indicators, and should do it. He should also check his machine meters against his feeder meters, one voltmeter against another, pretty frequently, and report faulty instruments. He should time his integrating instruments against his ammeters, and make sure there are no shunt current errors, friction losses, and so on.

It is, of course, impossible to enumerate all the points which require supervisory routine. Different types of switchboard develop various tendencies to failure, which have to be particularly watched. It is, however, safe to say that the engineer-in-charge will find that a conscientious scrutiny of his switchgear from time to time will amply repay him.

Allis-Chalmers Appointments.

Mr. W. A. Nelson was appointed superintendent of equipment for the Allis-Chalmers Co. October 1st. Mr. Nelson was formerly assistant superintendent of the Westinghouse Electric & Manufacturing Co., with which company he was connected for about five years. Prior to that he was with the Pratt & Whitney Co., and before that was superintendent of the Simonds Rolling Machine Co. While at Pittsburg he was in charge of the plans for the arrangement and location of machinery in the New East Machine Shop.

Mr. R. C. [illegible], for several years in charge of the design of special tools and fixtures used in the manufacture of steam turbines by the Westinghouse Machine Co., has been appointed to a similar position with the Allis-Chalmers Co.

Mr. Charles F. [illegible] has been appointed foreman of the steam turbine department at the West Allis works. He was formerly with the Westinghouse Machine Co. in a similar capacity.

Mr. C. A. Derby has resigned as assistant manager of the Lyon Cypress Lumber Co. to join the selling staff of the Allis-Chalmers Co.

It is stated [illegible] of the electric line from Coeur d'Alene City to [illegible] of the Coeur d'Alene & Spokane Railway Co. of Spokane, Wash., proposed for next year [illegible]

Forms for Shop Use.

BY G. T. SMITH, MASTER MECHANIC, METROPOLITAN STREET RAILWAY CO., KANSAS CITY, MO.

In connection with the report presented before the joint meeting of the Mechanical and Electrical and the Accountants' Associations at the convention in St. Louis, the blanks for keeping shop records which have been designed for the use of the Metropolitan Street Railway Co. will be found of interest.

Form 1 is an individual time card corresponding to Form 7 in the joint report. This blank which is 8½ x 5½ in. in size is designed along different lines from the committee's card, in that no attempt is made to provide on the blank the list of the different accounts to which time is to be charged. This card contains merely blanks for the division number and account number to which time is to be charged (these to be filled in by the foreman) and two columns, the first for the kind of work performed, and the second

STORE ROOM LEDGER.

Article ....

Date.	Receipts.			Issues.			On Hand.
	Order No.	Price	Quantity.	Req. No.	Dept.	Quantity.	

FIG. 1—FORM 6. SIZE OF ORIGINAL 13 X 11 IN. LOOSE LEAF. THERE ARE TWO SETS OF RULINGS LIKE THIS ON FORM 6.

the number of hours (these to be filled in by the workman). On this blank is a notice reading as follows: "It shall be the duty of each workman to fill out this card daily and state plainly the kind of work performed, and the time taken up by each kind of work. The foreman must state to what division and account time should be charged. Any person failing to comply with the above will be considered incompetent." This individual time card (Form 1) is to be used by the workman and foreman, and is to be turned in daily by the workman to the foreman and by the foreman turned into the office.

Form 2 is a blank to show the monthly time record, and the monthly distribution of the time of an individual. This blank is filled out by the time keeper who posts the items to this form from the individual time cards Form 1. This form is 11 x 7 in. in size, and is ruled with vertical columns for the name of the account, for

WHEEL REPORT.

Car No ....

.... 190

Wheels Put on.	Wheels Removed.	New or Old.	Kind.	Cause of Removal.

FIG. 2—FORM 7. SIZE OF ORIGINAL 6½ X 5 IN. EIGHT HORIZONTAL LINES ARE PROVIDED.

the 31 days of the month, and for the total time, rate and amount. The horizontal rulings provide for 30 different accounts. The grand totals on the distribution and on time should check if the figures are correct. In the heading of Form 2 are blanks for showing the following information: Name of workman and number, occupation, month and year, number and date of time check.

Form 3 is a large form known as the pay roll distribution sheet, and consists of a double sheet which when folded once measures 20½ x 18 in. Vertical columns are provided for the name and number of the workman and for each of the 15 general accounts designated by letters and the 37 expense accounts designated by numbers, of the Street Railway Accountants' classification. At the right hand of the form are also columns for the total number of hours, the rate, the amount and the number of the time check.

Form 3 is filled out by posting the time from Form 2, and if the figures are correct the total of the vertical columns showing the distribution of the pay roll account will check with the footings of the horizontal columns, which show the pay roll. These forms are designed for use in connection with a Baker & Vawter folder. When filled out a carbon copy is made at the same time, the original being sent to the auditor and the duplicate filed in the loose leaf folder for the mechanical department.

Form 4. Requisitions for supplies made on the purchasing agent are on a form 13 x 8½ in., the rulings being designed to show the following information: Date of and quantity of material ordered on the last previous requisition; quantity, description of articles, purpose for which required, date when required on the present requisition; and the purchasing agent's order number.

Form 5 is the requisition on the storekeeper and is made in two sizes. One size has 10 horizontal rulings; this is 7¼ x 4¾ in. in size. The other size has 30 horizontal rulings. This form shows the quantity, description of article, price, and amount, and is made out in triplicate. The original and one duplicate go to the storeroom, where one copy is priced and sent to the auditor, and the other is sent with the goods, and after being signed by the division superintendent or foreman who receives them, this blank is returned to the storeroom, and the items thereon posted to the stock ledger.

Form 6. The storeroom stock ledger is a loose leaf book with pages 13 x 11 in. ruled for column heads as shown in Fig. 1. After the data appearing on the requisitions made on the storekeeper, or purchasing agent have been entered in the stock ledger, this latter constitutes what is virtually a daily inventory of stock. The size of this sheet permits two sets of duplicate rulings; one set only is shown in Fig. 1.

Forms 7 and 8. For wheel records the company uses two blanks. One is known as the wheel report and is 6½ x 5 in. This is ruled as shown in Fig. 2. All wheels must be reported to the office where the wheel records are kept, the day the wheels are taken out or put in. The second wheel blank is known as the wheel record, and is a loose leaf sheet 13 x 11 in. The ruling of this blank is reproduced in Fig. 3. This form is considered to be especially valuable where the manufacturer makes a guarantee of the wheels. The rulings provide for 10 wheels per sheet. Two years covers the ordinary life of chilled wheels.

Form 9. The mileage of cars is kept on a form 11¾ x 11 in. with column headings shown in Fig. 4, a copy of this being furnished the Mechanical Department. The mileage made by a given car can be transferred to the corresponding sheet and upon this sheet is recorded all data relating to the performance of the wheels under that car.

________________ COMPANY. CAR NO. ____________

WHEEL RECORD

Wheel No.										
Kind										
Put on										
Removed										
From Car										
Cause of Removal										
Back Mileage										
190										
January Mileage										
February "										
March "										
April "										
May "										
June "										
July "										
August "										
September "										
October "										
November "										
December "										
TOTAL "										
DISPOSITION										

FIG. 3—FORM 8. LOOSE LEAF. SIZE OF ORIGINAL, 13 X 11 IN.

METROPOLITAN STREET RAILWAY CO.

................................Division. Cars Run During Month of............................... 190 ...

CAR NUMBERS. Grip.	Closed.	Open.	TRIPS.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total Trips.	Number Miles.	Remarks.

FIG. 4—FORM 9. MILEAGE RECORD. SIZE OF ORIGINAL 11¾ X 11 IN.

Notes on Painting.

At the 35th annual convention of the Master Car and Locomotive Painters' Association of the United States and Canada, held at Atlantic City, N. J., in September last, several reports and papers that are of interest to street railway men were presented on the maintenance of passenger equipment.

Bulging of Putty.

A committee was appointed at the convention of this association two years ago and instructed to thoroughly investigate this subject in a practical manner and to show the result of tests and experiments. The committee reported that extensive investigations and numerous tests developed that there is nothing to substantiate the claim that certain mixtures of putty absorb moisture and oxygen from the atmosphere, causing it to expand and thus protrude above the adjacent surface. The theory advanced by many that in driving and setting nails the fibers of the wood are broken and turned inward, thus giving opportunity, through the absorption of moisture and the vibration of the car while in motion, for the fibers to straighten out and resume their normal position, taking the putty with them, has also been proved to be wrong. It is also shown that there is but little foundation for the claim that the formation of rust on the head of the nail would, as it gathered in volume, force the closely adhering putty to the surface. All exposure tests made by the committee strengthened the belief that the expansion and contraction of wood due to absorption of moisture during damp weather and the use of unseasoned lumber is the most plausible theory advanced as to the cause of putty bulging, it being further believed that at least 90 per cent of the difficulty is attributable to this cause, the remaining 10 per cent being perhaps divided between the expansion of the nail and the action of the fibers in the attempt to straighten themselves and resume their former positions.

In summarizing, the committee contended that these causes alone were worth considering as being responsible for the bulging of putty. It further stated that as expansion and contraction of metal and wood cannot be controlled, there will always be cause for putty to bulge as long as these materials are used in the construction of cars. It can, however, be reduced to a minimum, and in many cases entirely overcome by using only thoroughly seasoned lumber, by making the cavity as small as possible by using small-headed brads and sinking them not to exceed 1/16 in. below the surface, by avoiding all surface nailing wherever possible and by thoroughly priming and second coating all depressions, including the heads of nails, screws, etc.

Removing Cracked Varnish on the Interior of Passenger Cars.

Papers on this subject were read by Mr. Chris Clark, of the N. Y. C. & St. L. R. R. Co.; Mr. A. A. Nicoll, of the Northern Central R. R., Baltimore, and Mr. William Vogel, of the Missouri Pacific Ry., St. Louis. The discussion was entered into very enthusiastically and it was the general opinion that the best method of removing cracked varnish on the interior of passenger cars was with liquid and paste solvents as against the old method of scraping. It had been the experience of the majority that in removing varnish with scrapers that sharp corners, edges, points of cornices and such were destroyed and that the wood is gouged in many places, leaving objectionable marks throughout the car, while on the other hand, the removal of varnish with solvents does not only give better results as to finish, etc., but it is more economical, costing from one-third to one-half less. However, in the selection of a varnish remover, great care should be exercised that it does not contain acids that affect the wood, and particularly carbon bisulphide, which is very detrimental and dangerous to the health of the men using it. There is also some danger from fire as these removers contain volatile ingredients, and for this reason care should be exercised in the use of them. Some time was also given to the discussion of the price of labor, the contention being that in the use of scrapers skilled labor was required, while in the use of solvents unskilled labor is as good for it as the skilled, it only taking a short time for men to become efficient in this line of work.

Treatment of Modern Passenger Car from a Painter's View.

A paper on this subject was presented by Mr. J. A. Gohen, C. C., C. & St. L. Ry. Co., Indianapolis. The writer first considers the appointment and equipment of a modern passenger car, its cost, of which the painting does not exceed 6 per cent, and the subsequent cost of maintenance (which is entirely dependent on the original design and construction). It is contended that while the over-exacting public in a measure demands the costly furnishings of the modern dining cars, parlor cars and coaches in the way of lambrequins, carpets and curtains of silk, plush or other germ-propagating fabrics, rather flattering themselves on traveling in style and comfort, such materials not only increase the expense of maintenance, but are unhealthful and disease-courting, and should not be used when more sanitary material is at hand. Furthermore, while all this might be permitted in a parlor or sleeping car where there is a minimum of passengers and a maximum of space, there seems to be no excuse in allowing it in the coach where the reverse exists and which is patronized by all classes.

The treatment of a modern passenger car while in the hands of the painter was next considered and it was proposed that a minimum and a maximum shopping period should be established and maintained. Good judgment should be exercised in the shopping of cars which should be coincident with other repairs or renewals and which removes the opportunity for the frequent and often unnecessary revarnishing or repainting of cars. Quality and not quantity should be the aim and object of the master painter and the organization which turns out 20 cars per month that will run 12 months is far more efficient, capable and economical than one that turns out 40 cars per month that will run only eight or nine months.

In the discussion of this subject it was the general opinion that the companies were awakening to the fact that it was costing too much money to maintain their passenger equipment. It was suggested that the upholstering of cars in leather, the use of linen covering and the substitution of marquetry work for carvings, grooving and moulding would not increase the original cost and would materially decrease the cost of maintenance and the cars would be neater, cleaner and look equally as well. It was thought that the tendency at the present time is towards simplicity in the finish of cars.

The Treatment and Attention of Passenger Car Roofs.

Papers on this subject were presented by Mr. T. J. Hutchinson, of the Grand Trunk Railway; Mr. Charles E. Copp, of the B. & M. R. R. car department, and Mr. W. J. Russell, of the G. R. & I. R. R.

Mr. Hutchinson stated that he believed the principal difficulties we have to contend with under present methods in our roof painting are caused through the use of hard, dry oil colors, and that linseed oil, while generally considered essential to the most durable job of painting properly applied on wood surfaces, proves the certain destruction, in a comparatively short time, of the canvas covered roof. As a substitute for the oil that would act as a preservative to the canvas and when incorporated with keg lead in proper proportion would prevent it hardening and remain pliable, he suggests the use of beeswax, the value of which as a preservative in the painter's line all are aware of.

Mr. Copp's paper treats of the tin roof. He recited the difficulties and preplexities in keeping a tin roof covered with paint, especially when the cars get old and the undercoats of paint become non-adhesive and brittle by age. He states that the tin roof, once flaking and peeling, may, however, be successfully treated and repainted as good as new, removing the old paint by beating the roof as one would beat a carpet. This should be done while the roof is cool and the paint, which is then brittle and non-adhesive, will fly off like so many chips, leaving the tin clear, and when newly painted the roof is good for a term of years without further trouble of this character. He is of the opinion, however, that the canvas roof, rightly applied, is the best for passenger equipment, and when properly painted with a natural graphite color it need not be re-

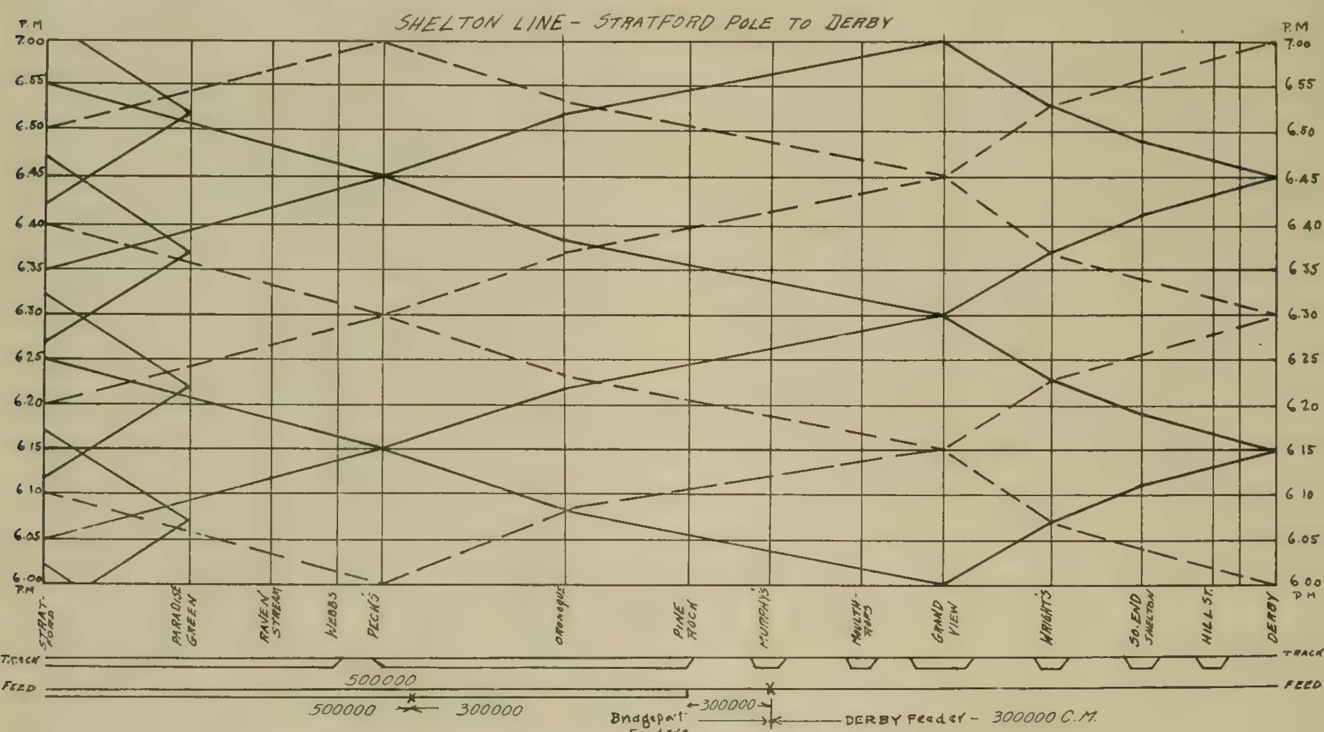
painted each year of shopping if the cleaners are careful in their cleaning, but may run several years before painting and thus avoid the cracking incidental to a roof being overloaded with paint each year.

In the paper prepared by Mr. Russell, he stated of the three principal kinds of material used in making passenger car roofs, the worst one from a painter's standpoint is galvanized steel, as six years is about the life of paint on this kind of roof, while there is no limit to canvas and tin. He states that in treating the canvas roof he applies one coat of thin paint consisting of boiled oil and a little oxide of iron paint. This should stand two or three days, or longer if time permits; then a second coat of boiled oil and oxide of iron thick, to fill up and make smooth, and when dry a third coat of the same paint as the second coat. This will last until the car comes to the shop for general repair, when two coats of ordinary thick paint are applied each time. From the treatment no bad result has been experienced and the roof lasts the life of the car. On the tin roofs a little asphaltum is used with the oil and oxide paint as the asphaltum contracts the same as the tin with heat and cold. The steel roof is treated in the same manner

In the general discussion which followed the reading of these papers the experiences of many were expressed as being along these same lines.

The Schedule Diagram as an Aid in Determining Feeders.

The idea of using a schedule diagram as reproduced in this connection will be found valuable as an aid in determining present and probable loads on feeders, and when used with readings at the power



SCHEDULE DIAGRAM FOR DETERMINING FEEDERS.

station during hours of maximum and minumum loads, a very clear idea may be gained as to placing of feeders to better advantage.

The sketch shows a typical suburban line with this scheme worked out. The diagram indicates track as well as the various feeder sections through which cars pass, and the minimum, maximum and average load at any point and time may be determined readily when the average current per car is known. The dash lines on the sketch show extra cars on an increased headway. The chart reproduced here is made out for a regular 30-minute headway on the suburban line with a 15-minute city service extending out on the line a short distance.

Ft. Wayne & Wabash Valley Traction Co.

Definite announcement of the completion of the sale of the Ft. Wayne & Southwestern Traction property, together with the Ft. Wayne lighting system, which was acquired by the company several weeks ago, to the Ft. Wayne & Wabash Valley Traction Co. ends a multitude of rumors connected with this merger, the negotiations for which were first broached in December, 1902. On October 15th the Ft. Wayne & Southwestern Traction Co. took over the lighting plant and system of the city and on November 3d the Ft. Wayne & Wabash Valley Traction Co. absorbed both properties. The appointments that have been announced since the merger are as follows:

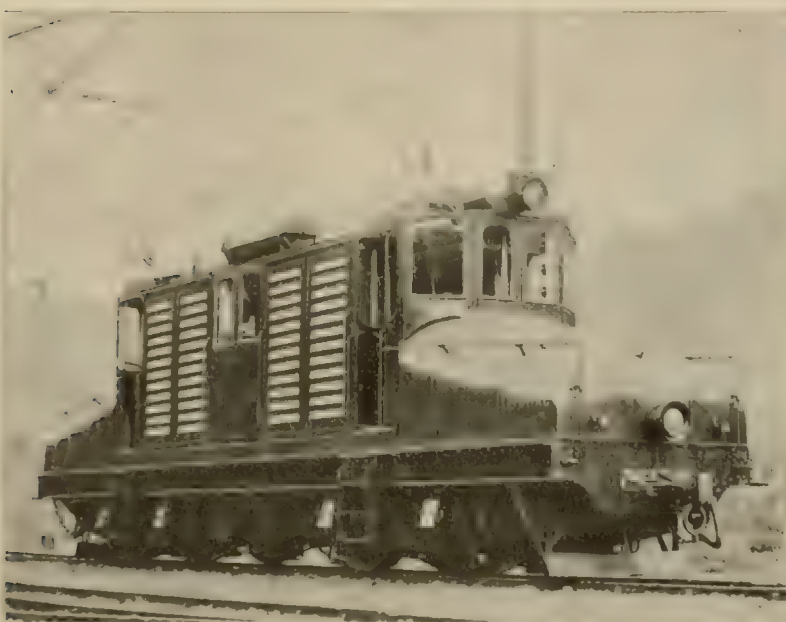
Mr. L. O. Williams, formerly superintendent of the Ft. Wayne & Southwestern Traction Co., is made interurban division superintendent of the road from Ft. Wayne to Logansport, including the Wabash and Peru city lines, with headquarters at Huntington; C. L. Hull, auditor of the Southwestern, will be retained by the Ft. Wayne & Wabash Traction Co.; E. C. Folsom, superintendent of transportation and maintenance of way in charge of operation of the entire road including terminals, with headquarters at Ft. Wayne; C. H. Fansler, master mechanic, with office in Ft. Wayne; M. J. Kehoe, chief engineer and electrician, in charge of all power and sub-stations from Ft. Wayne to Logansport, with office in Ft. Wayne; and F. R. Fahlsing, claim agent, with headquarters at Ft. Wayne.

Proposed improvements include a power station to cost nearly a million dollars, a through buffet car service from Ft. Wayne to Indianapolis, encouragement for interurban lines to enter Ft. Wayne, the erection at Ft. Wayne of a terminal station to receive the interurban trains, the extension of the electric light and power lines to all parts of the city and the improvement of the traction service over more direct lines. Among those interested in these improvements are W. Kesley Schoepf, of Cincinnati, one of the largest investors in the Ft. Wayne traction and lighting properties; Dr. Louis Duncan, of New York, who was one of the engineers on the New York subway commission, engineer of the B. & O. R. R. tunnel in Baltimore, and for many years lecturer in the Massachusetts School of Technology; Charles Murdock, of La Fayette; H. C. Paul, J. M. Barrett and C. D. Emmons, general manager of the Ft. Wayne & Wabash Valley Traction Co.

The Electric Railway of La Mure.

BY F. GUARINI

The electrical operation of railroads of all kinds is a problem of the day which is occupying the attention of all countries. A number of attempts in this direction have been made in various places,



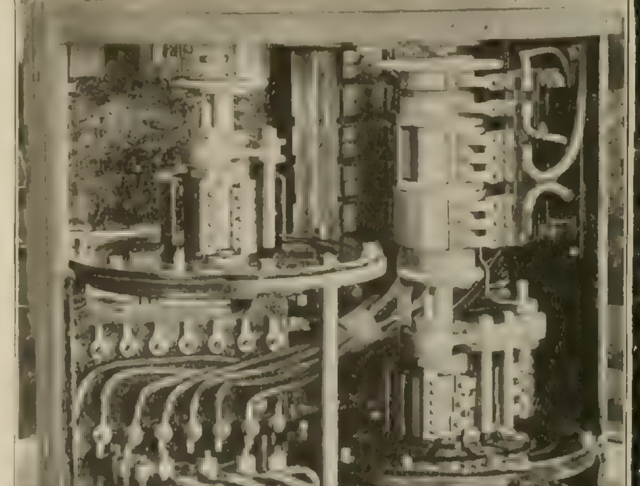
ELECTRIC LOCOMOTIVE OF THE LA MURE RAILWAY.

some of which have already met with success. Among the later should be mentioned the electric railway of La Mure for which the Electrical & Mechanical Industrial Co., of Geneva, recently constructed a somewhat remarkable electric locomotive. This locomotive is used principally for expediting the operation of the anthracite coal mines in the basin of La Mure. The machine is one of the first, if not the first, which has been put into use for drawing heavy trains at very slow speeds.

This railway from St. Georges de Commiers to La Mure has a length of 31 km. over which the new locomotive operates, and it was previously operated by steam locomotives, but on account of the numerous and unusually steep grades which are found along the line, as well as curves having a radius of sometimes less than 100 m., it was decided to adopt electric traction on the more important part of the line from La Motte les Bains to La Motte d'Aveillans. The new locomotive is capable of drawing 120 tons or 24 coal cars at a speed of from 22 to 23 km. per hour. It weighs 50 tons and its length over all is 13.18 m. It is provided with a central cab 7.8 m. long, 4 m. wide and 3.72 m. high. It is operated by means of high tension continuous current on the three wire system, two of the wires being overhead and having a difference of potential 2,400 volts. The rails take the place of the third wire and the tension between the overhead wires and the rails was made 1,200 volts in order to facilitate the insulation of the line. The current is col- [illegible] connected in pairs of two each.

At each end of the cab are controllers which are mechanically connected and which are operated together at will for both the forward and reverse direction. They contain a large number of running positions which are obtained by the combination of two handles, one principal handle, one multiplying handle, the latter interpolating each time the same series of resistance between two consecutive contact points of the principal handle. In this way there are obtained by means of two handles, one of 12 and the other of 8 contacts, 96 variations in the operating speed. The contact for cutting off the current is placed outside of the controller, properly speaking, and the current is broken at several points in series instead of in an oil bath.

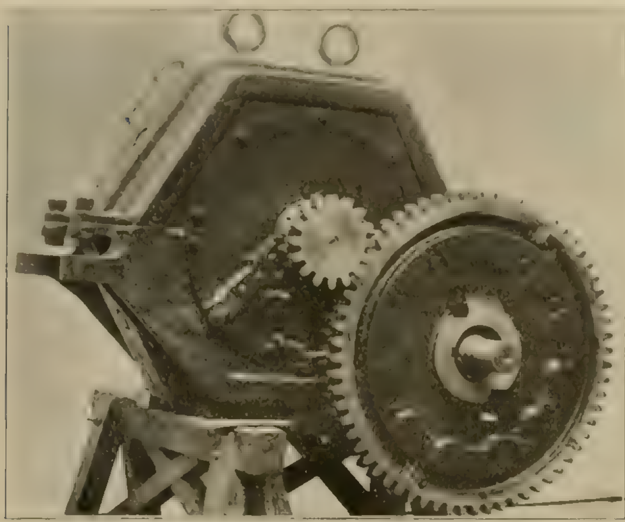
Apparatus is also provided for coupling for both forward and reverse running, as well as brakes for use in both directions. The coupler cannot be operated except when the controller is brought to the off position. The current can be cut off in any position of the controller whatever but the circuit cannot be closed again until the controller handle is put back to the off position. This arrangement holds good for all of the different speeds. The controllers operate the resistances which are also located in the cab and which absorb the current on down grades produced by electric braking of the locomotive, in which case the motors act as generators. These resistances are calculated large enough to permit continuous braking with a weight of 150 tons, that is to say, when all of the tractive weight of the locomotive is utilized. This permits the use of electric brakes at all speeds between 2 and 28 km. per hour. The locomotive is also provided with two other brakes, one hand brake acting on the four axles with 16 brake shoes, and which is operated by a handle and an automatic air brake which acts on all four axles of the locomotive and on all the cars in the train. A small 1,200-volt series motor of 4 h. p. capacity operates a rotary air pump and a special regulator is used to start and stop the motor and to operate the valve. The cab of the locomotive also contains a foot plunger which operates a sand box and a small handle controls the distribution of sand under the tread of the locomotive wheels. In addition to the machinery the cab contains the necessary voltmeters, ammeters, air gages, etc., required in the operation of the locomotive, as well as lightning arresters and an automatic cut-out and fuses. The electrical apparatus for the lighting and for the air brake motor also permits the operation at will of the trolleys, raising them on up grades and lowering them on descending grades, by borrowing current in the latter case from the motors during the electric braking. The superstructure of the locomotive is extended from the cab to either end of the frame and is made of iron plates, which gives the machine the general appearance of some high speed American electric locomotives. The pinions of the motor axles are geared to the locomotive axles through a simple train of gearing. The motors are mounted on two trucks and have a fixed bearing on the axles at one end while the opposite ends are supported by means of springs fastened to the locomotive frame. The motors have a



CONTROLLER FOR ELECTRIC LOCOMOTIVE.

capacity of 125 h. p. each and they are four in number, connected in pairs and operated permanently in series under a tension of 600 volts. They are grounded between the second and third motors in order to limit the maximum voltage between the winding and the frame to 1,200 volts. The motors use 185 amperes at a speed of 400 r. p. m. The bore of the fields is 750 mm. and the length of

the armature is 200 mm. Carbon brushes are used and the lubrication is by means of oil rings. The frames of the motors are of steel, and they have six laminated pole pieces which are bolted to the frame. Owing to the small width of the road it has been necessary to reduce to the utmost all mechanical incumbrances to the motors so that the complete machine presents a very compact appearance with minimum dimensions consistent with its capacity. The service given by this locomotive has been found entirely satisfactory in every respect.



VIEW OF MOTOR AND GEARING.

Municipal Accounts.

On the occasion of the second annual meeting of the Industrial Freedom League held in London in July last, the chairman, Lord Avebury, in his address made the following statement concerning the financial result of municipal undertakings:

"The financial result of the business undertakings conducted by municipalities as regards profit and loss is very difficult to ascertain with accuracy. It seems clear that taking the figures as a whole no sufficient allowance is made for wear and tear, and depreciation. Moreover, the accounts are very complicated, and in some cases misleading. I went into this at some length last year, and will only give one or two other illustrations. At a meeting of the Brighton Corporation, on the 21st of April, on the consideration of the minutes of the Works Committee, objection was taken to the expense of renovating ornamental arc light columns being charged to the Works Committee, instead of to the electric undertaking. It was pointed out that the system tended to show false profits, and made the net results of the trading returns misleading. Mr. A. Beazley, in a criticism of the Cardiff Corporation Accounts, states in regard to the electric lighting works, that nothing whatever has been charged for depreciation, if we except the sum of £500 set aside as reserve fund in the year ended March, 1903, although some £200,000 has been spent. The indebtedness now amounts to nearly £3,350,000. Mr. J. P. Elms, secretary of the Newport Ratepayers' Association, states that in this borough there are electric light works owned by the municipality costing about £100,000, which at 4 per cent. would give a net rateable value of £4,000. The actual sum entered in the rate book is £432, but it is sought to assess the local gas company, with which the electric light works are in competition, at twenty times as much as the latter. As the overseers of the parish are nearly all members of the borough council, the largest ratepayer in the union is allowed to assess his own property

"The accounts of municipal electric light undertakings for the year ended 31st of March, 1903, show losses in more than sixty towns in the United Kingdom. The total capital expended in regard to these towns amounts to £5,881,351, and the loss on working was £86,649. It is evident, moreover, that the accounts do not show the full loss. In comparatively few places does any sum appear to have been placed to depreciation or reserve during the year under review. At Glasgow the loss was transferred to a suspense account, and in several other cases the loss was either charged to the general district or borough fund, or in part paid by this means and the balance carried forward to next year's account.

"In my speech of last year I referred to the London tramways. Mr. Benn, chairman of the Tramways Committee of the London County Council, questioned not indeed my figures, which were official, but the inference I drew from them. He urged that the year 1902 was not a typical year, owing to exceptional circumstances. We have now another year's experience, and the result, so far from confirming Mr. Benn's sanguine prophecies, is to strengthen my argument. I said last year that in 1900 the surplus revenue from the northern tramways was £39,000, and from the southern tramways £43,000; that in 1901 it was on the north £40,000, and on the south £14,325; and that in 1902 it was on the north still £39,000, but that on the south the surplus revenue had fallen to £9,000. In 1903 the surplus on the northern system, which you will remember is leased to a company, and which pays a large sum in relief of the local rates, was £37,794. On the other hand, on the southern system, the profits have gradually dwindled away, and last year there was a loss of £2,252. For the year 1904 I understand that the revenue from the northern system is £27,657—that is the system which is leased; and on the southern system, which is worked by the Council, a loss is shown of £8,283."

Foreign Visitors Entertained at Pittsburg.

The Westinghouse Electric & Manufacturing Co. on Wednesday, November 2nd, entertained at its works the members of the Iron & Steel Institute, showing them through the various works during the afternoon and tendering to them a banquet in the evening. The banquet was given in the largest aisle of the works of the Westinghouse Electric & Manufacturing Co., which is one-third of a mile long. The portion of the aisle set apart for the banquet was handsomely decorated and lighted.

A most unique souvenir was given to each person present at the dinner, it being in the form of an induction motor and small enough in size to permit of its being carried in the pocket.

The occasion was marked as being one of the most successful and largest attended. There were over 600 persons invited, and fully 600 joined in the festivities.

Sir James Kitson, past president of the British Iron & Steel Institute, thanked the city of Pittsburg on behalf of Andrew Carnegie for the unusual kindness shown to the distinguished visiting manufacturers, and Mr. Westinghouse indicated his great pleasure in being honored on this occasion by the presence of visiting friends from abroad.

The party returned to Pittsburg at the conclusion of the banquet, and on the following day continued the journey westward to the Louisiana Purchase Exposition, where they had planned to spend some time.

A Recent Invention.

A device to indicate the names of the street to the car passengers is the latest means for accommodating street car patrons that will be tried by the Cleveland Electric Railway Co. It is about the size of the fare indicator, and is placed in the forward end of the car. On the face of the dial are printed the names of the streets on the line in consecutive order, while below are numbers corresponding to the distance the given street is from the starting point of the cars. As the cars run along a rod projecting from the top of the car strikes, just before it reaches every block, a weight suspended from one of the trolley suspension wires. This blow to the rod causes it to fly back, releasing a spring which moves the indicator point forward to the name of the next street. The indicator is set for a round trip and can be regulated by the conductor. D. P. Jones and N. C. Butler, of Cleveland, are the inventors.

The Springfield & Xenia Traction Co., which was recently offered for sale and no bids tendered, has been reappraised for $200,000 and will again be offered for sale.

The Mexican cities of Jiming, state of Chihuahua, and Allendi, state of Coahuila, are to build large electric plants to supply light and power.

Trial of New York Central High Speed Electric Locomotive.

The special exhibition and trial of the high speed electric locomotive designed and built for the New York Central & Hudson River R. R. by the General Electric Co. and American Locomotive Works took place at Schenectady, Nov. 12th, for the electric traction commission of the railroad company and its guests.

A large party of railroad men and newspaper representatives were taken from New York City to Schenectady on a special train composed of nine Pullman cars. Among those in attendance were William J. Wilgus, fifth vice-president, New York Central & Hudson River R. R.; John F. Deems, general superintendent of motive power, New York Central & Hudson River R. R.; Bion J. Arnold, Frank J. Sprague, George Gibbs, Edwin B. Katte, Samuel Rea, fourth vice-president, Pennsylvania R. R.; T. Voorhees, first vice-president Philadelphia & Reading R. R.; W. H. Marshall, general manager, Lake Shore & Michigan Southern R. R.; H. H. Vreeland, president, New York City Railway Co.; W. G. Besler, general manager, Central R. R. of New Jersey; J. M. Graham, fourth vice-president, Erie R. R.; M. B. Cutter, general superintendent, Lehigh Valley R. R.; E. G. Connette, general manager, Syracuse Rapid Transit Co.; A. G. Yates, president, Buffalo, Rochester & Pittsburg R. R.; A. I. Culver, second vice-president Delaware & Hudson R. R.; A. B. Mitchell, superintendent of motive power, Lehigh Valley R. R.; E. L. Rossiter, first vice-president, New York Central & Hudson River R. R.; George H. Daniels, general passenger agent, New York Central & Hudson River R. R.; E. Van Etten, second vice-president, New York Central & Hudson River R. R.; H. Fernstron, chief engineer, New York Central & Hudson River R. R.; C. A. Coffin, president General Electric Co.; Eugene Griffin, second vice-president, General Electric Co.; C. Loomis Allen, general manager, Utica & Mohawk Valley Railway Co.; W. Dalton, chief engineer, American Locomotive Works; James McNaughton, general superintendent, American Locomotive Works; H. J. Kenfield, "Street Railway Review"; J. H. McGraw, Street Railway Journal; R. Hitt, Railroad Gazette.

Four runs were made by the locomotive with different numbers of cars at speeds varying from 54 to 72 miles per hour. With a [illegible] train of [illegible] tons a speed of 72 m. p. h. was made. A five-car train of 400 tons made 62 m. p. h., a seven-car train of 500 tons made [illegible] m. p. h., and a ten-car train of 600 tons made 54 m. p. h.

By the use of the Sprague-General Electric multiple unit system of control, two or more locomotives can be coupled together and operated from the leading cab as a single unit. The motive power may therefore be easily adapted to weight of train with no complication in operation and with uniform make-up of train crew. A single electric locomotive will be able to maintain the schedule with a 450 ton train, two locomotives being coupled together for heavier trains. The locomotive developed remarkably easy riding qualities at high speeds and during acceleration, responding with ease to the will of the operator.

The locomotive consists of four driving axles on each of which is mounted without intermediate gearing, the armature of an electric motor having a normal rating of 550 h. p. The total rated capacity

ELECTRIC LOCOMOTIVE FOR NEW YORK CENTRAL & HUDSON RIVER R. R.

of the locomotive is 2,200 h. p., although for short periods a considerably greater power may be developed, making it more powerful than the largest steam locomotive in existence.

The armatures are mounted rigidly upon the axles, thus reducing the bearings to those of the pony trucks and the main journals, all of which are outside of the driving wheels. The motor has two poles with flat faces so as to permit a large relative vertical movement between armature and poles as the latter move up and down with the riding of the frame upon the springs.

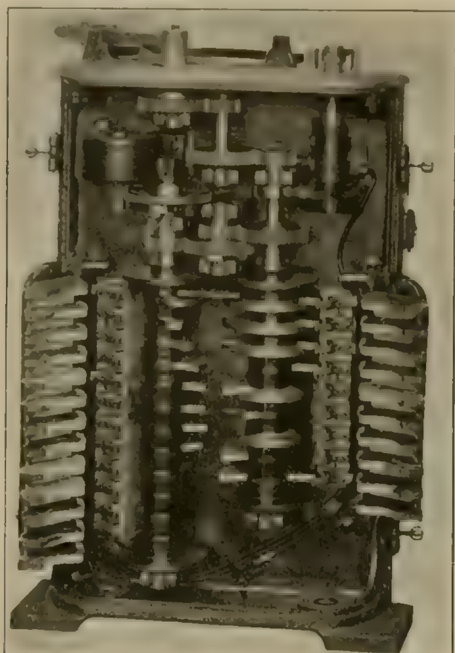
The main frame is of cast steel, and forms not only the mechanical frame of the locomotive but also part of the magnetic circuit of the electric motors. The armatures are arranged in tandem, the end

ARMATURE MOUNTED ON AXLE.

pole pieces being cast as part of the end frames and the double pole pieces between the armatures being carried by heavy steel transoms bolted to the side frame and forming part of the magnetic circuit as well as cross braces for the truck. The field coils are wound upon metal spools which are bolted upon the pole pieces. Proper distribution and division of the weight of the locomotive amongst the axles has been accomplished by suspending the main

frame and superstructure from a system of half elliptic springs and equalized levers of forged steel, the whole being so arranged as to cross-equalize the load and to furnish three points of support.

This construction besides being strong and simple in design greatly facilitates repairs and renewals as an armature with its wheels and axle may be removed by lowering the complete element without disturbing the fields or any other part of the locomotive and a new element inserted in its place. All parts are also especially accessible for inspection and cleaning.



ELECTRIC LOCOMOTIVE CONTROLLER.

The brush holders are mounted on insulated supports attached to the spring saddle over the axle journal, thus maintaining a fixed position of the brush holder in relation to the commutator. These brush holders are made adjustable so as to allow for wear of the commutator and journal bearings.

The dead weight on the axle is not materially greater than is customary with steam locomotives and in addition there is no unbalanced weight to produce vibration with attendant injuries to track and road bed construction.

The superstructure consists of a central cab for the operator containing master controllers, engineer's valves, and switches and valves required for operating sanding, whistling, and bell ringing devices.

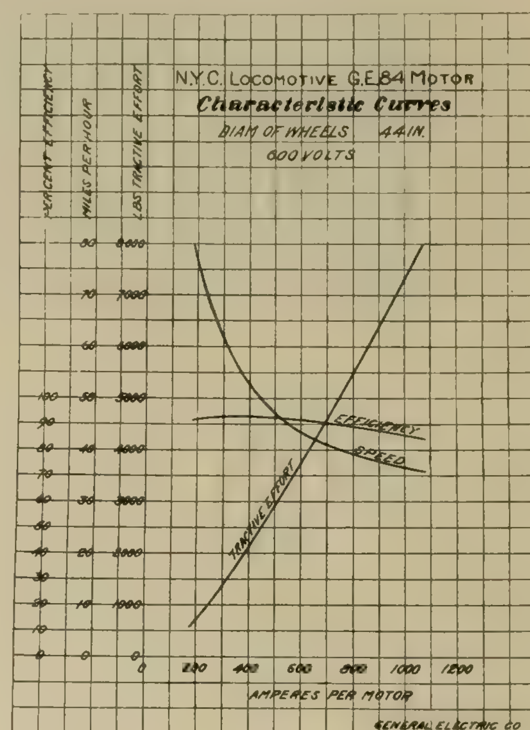
THIRD RAIL SHOE.

This apparatus is furnished in duplicate, one set on each side of the cab, and is arranged so as to be easily manipulated from the operator's seat, while at the same time a practically unobstructed view to front and rear may be obtained from the windows. The air gage, meters, etc., are located so as to be easily read by the driver.

There is a central corridor extending through the cab so as to permit access from the locomotive to the cars behind, and the contactors, rheostats, and reversers are arranged along the sides of these corridors in boxes of sheet steel which are sheathed on the inside with fireproof insulating material. All of these appliances are therefore easily accessible for repairs or inspection.

The control system permits three running connections, namely four motors in series, two groups of two in parallel series, and all four motors in parallel. The motor reverser, contactors, rheostats and other controlling appliances are all of the well known Sprague-General Electric multiple unit type. The master controller, however, is fitted with a special operating lever about 24 in. long and capable of being moved through an angle of about 75°. A current limiting device is provided in the master controller, the arrangement being such that when the current exceeds a pre-determined amount the cylinder cannot be rotated further until the current has fallen sufficiently to allow relay to drop. As long as the current does not exceed the desired limit the automatic feature is not in operation.

In the operator's cab there is placed a General Electric motor driven air compressor having capacity of 75 cu. ft. of free air per minute. The compressor is controlled by a governor which automatically cuts the motors in and out of circuit when the air pressure falls below 125 lbs. or rises about 135 lbs. A reduction in air pressure simultaneously starts up the air compressors in both locomotives when running double headed, and when the air pressure has been raised and one air compressor is closed down the other will be cut out of service.



Current is collected from the third rail by multiple-contact spring-actuated third rail shoes whose supports are carried on channel irons attached to the journal box. There are four of these shoes on each side of the locomotive. In the yards at the terminal the large number of switches and crossings necessitates an overhead construction in places and additional contacts are therefore mounted on the top of the locomotive for collecting current when the locomotive is passing over these points. This device may be raised and lowered by air pressure controlled from the engineer's cab. A magnetic ribbon fuse is placed in circuit with each shoe and overhead contact device so as to secure protection in case of accidental short circuit.

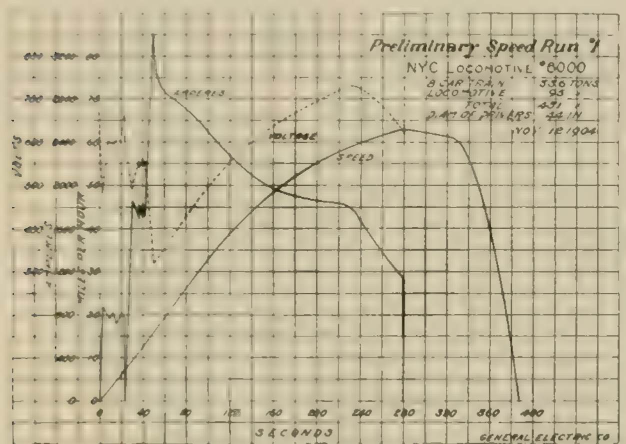
It is the intention of the New York Central & Hudson River R. R. Co. and the General Electric Company to make complete preliminary tests and trials on these locomotives under all conditions likely to obtain in service operation. For this purpose the New York Central & Hudson River R. R. Co. has set aside a six mile stretch of track on its main line between Schenectady and Hoffmans and equipped same with standard third rail construction. The track is practically straight and ballasted so as to permit maximum speed of 70 to 80 m. p. h. being attained.

Power for operating the locomotive is furnished by the General Electric Co., and a special high tension transmission line has been constructed from the power station for a distance of five miles to the sub-station at Wyatts.

The apparatus in the sub-station, the location and arrangement of same, the width and dimensions are in general as proposed for the sub-stations to be built within the electric zone at the New York city terminal so that practical experience with the plant may be obtained while the locomotive tests are being made and in advance of construction.

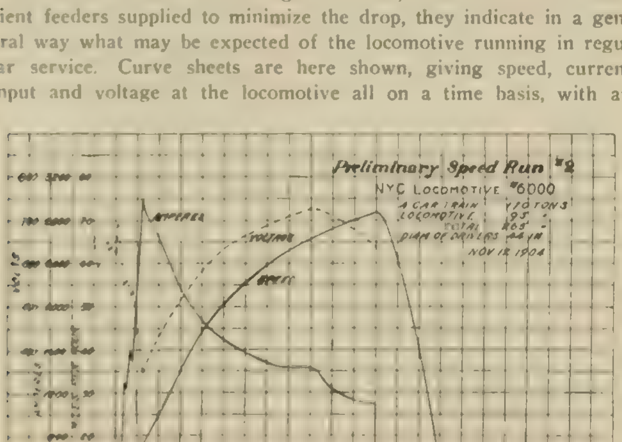
The general dimensions and data applying to the locomotive are as follows:

Number of driving wheels, 8; number of pony trucks, 2; total weight of locomotive, 95 tons; weight on drivers, 69 tons; rigid wheel base, 13 ft.; total wheel base, 27 ft.; length over buffer platforms, 37 ft.; extreme width, 10 ft.; height to top of cab, 14 ft. 4 in.; diameter of drivers, 44 in.; diameter of driving axles, 8½ in.; normal draw bar pull, 20,400 lbs.; maximum starting draw bar pull,



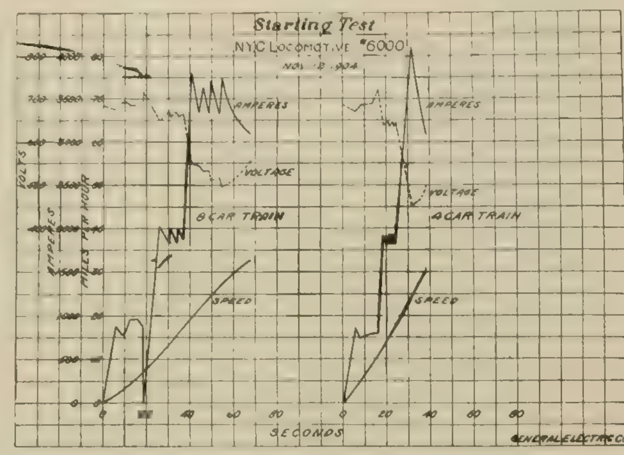
32,000 lbs.; speed with 500-ton train, 60 m. p. h.; voltage of current supply, 600.

Owing to the fact that only a portion of the track to be used for testing is available as yet, no complete locomotive tests have been made. There has been installed in the cab a full set of recording instruments, and records have been obtained of some of the preliminary runs made to test the bearings and running qualities of the locomotive. Although these records will be superseded by careful tests made on the full length of track, bonded and with sufficient feeders supplied to minimize the drop, they indicate in a general way what may be expected of the locomotive running in regular service. Curve sheets are here shown, giving speed, current input and voltage at the locomotive all on a time basis, with an



eight-car train weighing 336 tons, and a four-car train weighing 170 tons, both exclusive of locomotive. The total weight of train, including locomotive and passengers, was 431 tons, and 265 tons for the eight-car and four-car trains respectively.

Two sets of curves are shown, two running tests reaching as high a maximum speed as possible with the length of track available, and two sets of starting tests showing the more rapid rate of acceleration possible with the higher maintained voltage available near the sub-station. The maximum speeds reached were 63 m. p. h. with an eight-car train, and 72 m. p. h. with a four-car train. It will be noted that the trains were still accelerating at these speeds, but the length of tracks so far equipped did not permit attaining higher speeds.



In the starting tests a speed of 30 m. p. h. was reached in 60 seconds with an eight-car train weighing, including the locomotive, 431 tons, corresponding to an acceleration of one-half mile per hour per second. During certain periods of the acceleration the increase in speed amounted to 6 m. p. h. per second, calling for a tractive effort of approximately 27,000 lb. developed at the rim of the locomotive drivers. This value was somewhat exceeded with the four-car train, where a momentary input of 4,200 amperes developed a tractive effort of 31,000 lbs. at the drivers with a coefficient of traction of 32.5 per cent of weight on drivers. The average rate of acceleration with the four-car train, weighing including the locomotive 265 tons, was 30 miles in 37½ seconds, or .8 miles per hour per second, calling for an average tractive effort of 22,000 lbs.

The maximum input recorded, 4,200 amperes at 460 volts, or 1,933 kw., gives an output of the motors of 2,200 h. p. available at the wheel.

Annual Report Northwestern Elevated.

The annual report of the Northwestern Elevated Railroad Co. for the fiscal year ended June 30, 1904, shows the following:

Income Account.		
Passenger Earnings		$1,274,684.38
Other Earnings (including Loop Net Earnings)		450,245.48
Total Earnings		$1,724,929.86
Operating Expenses.		
Maintenance of Way and Structure	*$ 58,968.14	
Maintenance of Equipment	67,096.60	
Conducting Transportation	383,897.78	
General Expenses	56,113.77	566,076.29
Net Earnings		$1,158,853.57
Charges.		
†Taxes	161,153.03	
Bond Interest	779,350.00	
Other Interest	15,096.24	955,599.27
Surplus for Year		$203,254.30

*Includes $36,000.00 which has been set aside in monthly installments, for betterments and maintenance of structure.

†Includes compensation to city on account of loop.

The report also shows the total number of passengers carried during the year ended June 30, 1904, to be 25,497,079, as against 24,305,704 for the previous year. The daily average number of passengers carried during the year ending June 30, 1904, were 69,664, as compared with 66,591 for the previous year, an average daily increase of 3,073, which is equal to 4.61 per cent. The ratio of operating expenses, including maintenance reserve, to earnings, is 42.75 per cent, and the ratio of operating expenses, maintenance reserve, loop account and taxes to earnings, is 61.57 per cent.

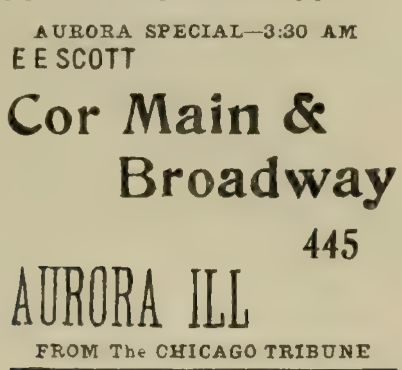
Newspaper and Milk Service.

Ever since the Aurora, Elgin & Chicago Ry. commenced operation, the management has been keenly alive to the importance of developing all classes of special service which would effect a saving of time to its patrons, or offer unusual conveniences for which there was a substantial demand. In carrying out its plans along these lines the company has not been afraid to undertake novel experiments, such as operating the buffet car Carolyn, illustrated at page 584 of the "Review" for September last. This company is, we believe, the only electric railway to operate such a car.

Two other classes of special service, which are unique in their magnitude rather than in principle have been successfully developed within the last year, namely carrying newspapers and carrying milk. The company's territory offered exceptionally good opportunity for these, as there is a very large demand for Chicago newspapers in the towns lying east of the Fox River, and in the cities of Aurora and Elgin, 33 and 35 miles distant, respectively, from 52nd Ave., Chicago. These points all being within what may be called the outer suburban zone need for good newspaper service is apparent, and for the return trip of the newspaper car there is milk for Chicago market, so that the car has one paying trip each way per day.

NEWSPAPER AND MILK CAR—AURORA, ELGIN & CHICAGO RY.

The Aurora, Elgin & Chicago instituted the newspaper service in October, 1903, and during the past summer the papers carried have aggregated 80 tons to 100 tons per month. These are loaded upon the newspaper car at a point convenient for all the newspapers, the car leaving this point as soon as the first installment of the last edition of the papers is off the press at about 3:30 a. m. daily, arriving

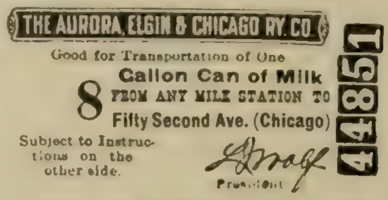


AURORA SPECIAL—3:30 AM
E E SCOTT
Cor Main &
Broadway
445
AURORA ILL
FROM The CHICAGO TRIBUNE

NEWSPAPER TAG.

at Wheaton about 4:20 a. m., and at Aurora about 4:45 a. m. About 25 per cent of the papers are delivered at 52nd Ave., and thence are distributed in Oak Park, Austin and nearby districts by means of wagons provided by the newspaper publishers and dealers; 20 per cent of the total are for Aurora, 20 per cent for Elgin, and the remaining 35 per cent comprise those consigned to the smaller way stations, and for transfer to the Elgin, Aurora & Southern Traction Co. for delivery as far south as Yorkville and as far north as Carpentersville.

The special advantage to the publishers and newsdealers is that the latest editions are now delivered from 45 minutes to 1 hour and 30 minutes earlier than was heretofore possible with the steam rail-



THE AURORA, ELGIN & CHICAGO RY. CO.
Good for Transportation of One
8 Gallon Can of Milk
FROM ANY MILE STATION TO
Fifty Second Ave. (Chicago)
Subject to Instructions on the other side.
President
44851

MILK TICKET.

way service available, and they are now able to give subscribers this edition, whereas formerly they could get only the first or "country" edition in time for distribution. The company receives compensation for this service on a tonnage basis, settlements being made monthly from the weight records of the publishers.

The newspaper special is returned to Wheaton about 6 a. m. and the crew relieved for breakfast. After breakfast the car is run a few miles west to Eola Junction and begins to pick up milk at the various stations. The milk is delivered at the 52nd Ave. milk platform in Chicago, at 8:40 a. m. daily, this station being convenient for many of the city milk dealers as they can reach the platform there with less delay than at the stations of other lines. The milk service was started in May last.

The charges on milk are prepaid by a milk ticket inserted in a holder on each can. The rate is 15 cents per 8-gallon can, independent of the length of haul. At the present time the company is handling about 175 cans of milk per day. The cans all bear the names of the owners and are returned without further charge.

The engravings herewith show the forms of newspaper tags and milk tickets used.

The City Council of Winnipeg has authorized the Winnipeg Electric Railway Co. to make a number of extensions to its line.

LaCrosse & Southeastern Railroad Co. has ordered two 64-ft. Prouty gasoline cars with a speed of 40 miles per hour.

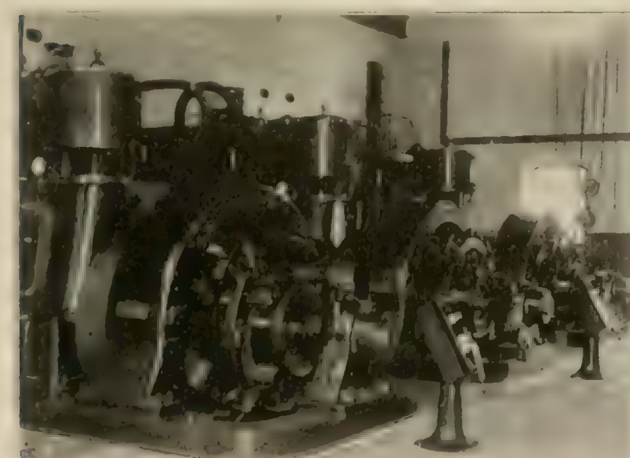
A new map of the proposed line of the Tabor & Southern Electric Railway Co., of which E. N. Sanger and W. J. Dobbs, of Council Bluffs, Iowa, are the promoters, has been completed. The entire length of the line is 75 miles, from Omaha, Neb., to Tarkio, Mo.

It has been announced that plans have been consummated by the United Electric Light & Power Co., Baltimore, for the erection of one of the largest generating stations in the United States. The company has purchased 22 acres of landing immediately adjoining the city having a water front of over 1,000 feet.

Electric Tramway in Mandalay.

The Mandalay Electric Co. was incorporated in London in October, 1902, with a capital of £200,000. Actual work was commenced in December, 1902, by Dick, Kerr & Co., Ltd., and the first car was moved by electrical power on June 17th, 1904. The center of the tramway system has been placed at the new Zegyo bazaar, from which the tramway radiates in three branches, one leading to the shore, where steamers embark their passengers, the second running to the Arakan Pagoda, and the third leading to the Court House. The tramways have a length of 7 miles, double track throughout. The rails are 6 in. deep with a 1½ in. groove, laid to a gage of 3 ft. 6 in., in 45-ft. lengths. The rails are double spiked to hard wood sleepers, which are laid at 2 ft. 9 in. centers, the whole being laid on a ballasted bed. The joints are of the plain type, secured with [illegible] fish plates and are double bonded with two No. 0000 B. & S. Neptune pin bonds.

CAR BARNS—MANDALAY ELECTRIC CO.



INTERIOR OF GENERATOR ROOM

The overhead equipment is on the span wire system, a double line of trolley wire being used throughout. The standards are made of [illegible] tubes, and have an overall length of 27 ft., set 6 ft. deep below the upper surface of the rails. The trolley wires consist of hard drawn copper .364 in. diameter, with a breaking strain of 25 tons per sq. in. Section insulators are provided as well as lightning arresters of the Garton Daniel type. The feeders consist of solid soft drawn copper wire, carried on special high resistance toggles clamp insulators, which are in turn bolted to substantial malleable iron brackets attached to the poles. At several points along the route these feeders are tapped by insulated cables which are connected to the main feeder switches in switch pillars fixed on the sidewalk.

The rolling stock consists of 24 electric motor cars of the single deck, open, cross-bench type, built by the Electric Railway & Tramway Carriage Works, Ltd., Preston. The car bodies are 35 ft. 4½ in. in length, and about 6 ft. wide, designed to provide seating accommodation for 48 passengers. To prevent the car from sagging a substantial truss is provided supported in the center by two wrought iron standards. The roof frames are composed entirely of teak, the covering being of cotton duck, laid wet in a coat of white paint. Each car is provided with two circuits of 100-volt incandescent lamps with changeover switches for putting one or the other headlight in circuits. The trucks upon which the cars are

TYPE OF CAR USED IN MANDALAY

mounted are of the Brush company's single type. The cars are equipped with two Dick, Kerr & Co. standard 25 B. traction motors, capable of delivering approximately 28 h. p., and controllers of the same firm's standard D. B. I. form "C" type, especially arranged with resistance for emergency braking.

The power-house has been erected on the company's site in 78th street, together with the necessary offices, car shed and repair shops. The steam plant consists of three Babcock & Wilcox water tube boilers with a working pressure of 160 lbs. per sq. in., a water

storage tank with a capacity of 20,000 gallons of water, a fuel economizer and two double acting single-cylinder feed pumps, each capable of delivering 2,000 gallons of water per hour. The engines which are three in number, are of the "Belliss" compound two-crank type, mounted on bed plates extended to take the direct coupled generators; each engine is capable of giving a normal output of 300 b. h. p. The electrical plant consists of three continuous current compound wound generators, coupled direct to the engines, the output of each generator being 200 kw. when running at 400 revolutions per minute, and they are designed to give an overload of 20 per cent for 2½ hours, with a moderate rise of temperature. The magnet frames are of cast iron, the pole pieces of laminated steel cast into the magnet frame, the commutation is sparkless at all loads and the field windings are so arranged to give a 10 per cent rise in the e. m. f. from no load to full load. The switchboard was built by Dick, Kerr & Co., Ltd., and consists of nine black enameled slate panels 1½ in. thick each supported independently on an iron frame. The board consists of three generator panels, four feeder planels, one station lighting and one Board of Trade panel. A 10-ton traveling crane with a span of 38½ ft. and a lift of 20 ft. has been erected in the power house.

The contractors for the whole of the work and plant were Dick, Kerr & Co., Ltd., represented in Mandalay by Mr. T. Williamsson. The sub-contractors were Messrs. Nahapiet & Martin of Rangoon; the consulting engineers were Messrs. Kincaid, Waller, Manville & Dawson of Westminster, who prepared the detailed plans and specifications and were represented in Mandalay by Mr. E. Sellon. The local work was carried out under the able superintendence of Mr. Griffin and Mr. A. C. Morgan.

Air Compressors in the Operation of the New York Subway.

The daily traffic service of the New York Subway contemplates the operation of two tracks carrying local trains at one-minute intervals. It will be appreciated that the safe handling of trains in such number and frequency offered problems in signal work. A system has been applied which is a development of the electro-pneumatic switch and signal system used for years on steam railways. In the operation of this system electricity and compressed air have joined forces; electricity being, as it were, the nerves and compressed air the muscles, of the system. The electrical appliances offer nothing of decided novelty; they are standard. But the air compressors are unique in design and are worthy of a brief description.

The machines were built by the Ingersoll-Sergeant Drill Co. of New York and are a modification of a standard type known as Class "EC." They are two-stage machines with horizontal inter-cooler, fitted with the Ingersoll-Sergeant piston inlet valve and designed throughout for maximum economy, simplicity and reliability. Nine compressor units have been installed and three more are under construction. Each compressor is connected by a Morse silent chain to a 35-h. p. Westinghouse direct current motor taking current from the lines at from 400 to 700 volts. Motor and compressor units on a solid sub-base. At rated speed of 120 r. p. m. each unit has a capacity of 215 cu. ft. of free air per minute compressed to 80 lb. pressure. The compressors are automatically controlled and regulated by the air pressure. Working pressure on the system is maintained constant within 5 lb. of the fixed standard. When the receiver pressure falls below normal a combination of electrical circuits operates to bring the compressor to speed with no load, then cut out the starting resistance and throw off the load. When normal pressure is reached on the system, the machine is unloaded and the motor cut out. Arrangement is also made whereby the starting and stopping of the unit also automatically starts and stops the flow of intercooling water and lubricating oils.

Compressed air from these machines which are located in substations along the subway, is distributed through 2-in. pipe lines running the length of the system and operates various signal mechanisms, pneumatic switches, automatic train stops, etc. The installation of these electrically driven air compressors with their automatic control and regulation marks a great step forward in switch and signal work.

New Cars For the City of Mexico.

The accompanying illustration shows one of four combination passenger and baggage cars lately shipped to the Mexico Electric Tramways, Ltd., of the City of Mexico, by the American Car Company of St. Louis, and are a part of an order for twenty-eight cars of the same character. An interesting feature of these cars is a sheathing of ⅛-in. steel upon the sides, which is intended to prevent injury due to the severe climate which is common to wooden

INTERIOR OF CAR FOR MEXICO CITY.

paneled cars. The intensely dry climate encountered in that altitude in the tropics is very severe on wood work. Another unusual feature which gives the car a somewhat odd appearance is the division of the sash lights into four parts. This arrangement is only used in second class cars, the first class have the usual sashes with single lights.

The cars run in but one direction, therefore the entrances are on one side, and vestibules at one end. The cars are very substantially

COMBINATION CAR FOR MEXICO CITY.

built, including in the bottom framing 8 x ⅝-in. sill-plates and heavy under trusses; side sills of long leaf yellow pine are 4¾ x 7¼ in. and the end sills 5¼ x 6⅞ in. The corner posts are 4½ in. thick and the side posts, 2¾ in. The general dimensions are as follows: Length over end panels, 30 ft. 8 in., and over crown pieces, 40 ft. 1 in. Length of baggage compartment, 10 ft. 5 1-16 in.; width over sills and sill plates, 8 ft. 2 in.; between centers of posts, 2 ft. 8 in. Height of steps, 17⅜ in., and of risers, 14 in. The cars are equipped with angle iron bumpers, "Dumpit" sand boxes, "Dedenda" gongs, ratchet brake handles and folding gates made by the J. G. Brill Co., and the trucks are No. 27-G, also made by that company.

World's Fair Awards.

The Juries of Awards of the Louisiana Purchase Exposition have announced the following awards, which will be of interest to our readers:

To the Allis-Chalmers Co. a grand prize was awarded for the 5,000-h. p. engine, and also the generator built by this company's electrical department, the Bullock Electric Manufacturing Co. These two machines form the huge unit which supplies the decorative lighting of the Exposition buildings and grounds.

In the Department of Mines and Metallurgy the Allis-Chalmers exhibit was awarded a grand prize. The Bullock Electric Manufacturing Co's. grand prize also covered all its alternators, synchronous motors, direct current generators and motors, and rotary converters. In addition to this the Bullock system of multiple-voltage control of motors won a gold medal.

The E. W. Bliss Co., Brooklyn, N. Y., has been awarded a grand prize and a gold medal for tools and machines exhibited at the Louisiana Purchase Exposition. The awards were granted for superiority of workmanship, smoothness of action, ingenuity displayed in design and highest quality of product. This exhibit was described in the "Daily Street Railway Review" for Thursday, October 13th.

The Continuous Rail Joint Co. of America was awarded a gold medal for its display in the Transportation Building of its rail-joint products. The exhibit shows various types of rail joints produced by patented machinery controlled by the company in this country and was illustrated and described in the "Daily Street Railway Review" for October 13th.

The Scarritt Car Seat Works, 1800 North Main St., St. Louis, was awarded a gold medal. Readers of the "Review" are familiar with this exhibit through its description and illustration in the World's Fair number, bearing date June 20, 1904, as well as the description on page 795 of the "Daily Street Railway Review" for Friday, October 14th.

In Group III, Higher Education, Techinal Schools, etc., a bronze medal was awarded to the Thomas S. Clarkson Memorial School, The exhibit was warmly commended by the members of the jury, and has been a source of interest to visitors throughout the summer.

The American Frog & Switch Co., Hamilton, O., has been awarded the highest prize in its class, a gold medal, for its exhibit at the exposition. This exhibit was described and illustrated in the souvenir number of the "Review."

G. M. Gest, subway contractor of New York and Cincinnati, has been awarded by the jurors at the St. Louis Fair the highest award for conduit construction. Mr. Gest's exhibit at the Fair was described in the October number of the "Review."

Grand prizes were awarded to the Westinghouse Electric & Manufacturing Co., for "Alternating current generators and motors, alternating current turbo-generator installation, static transformers, and rotary converters;" for "Direct current generators and motors," and for "Electric railway motors, alternating current and direct current, and control systems for single and multiple unit operation and for mining and industrial locomotives." To the Westinghouse Machine Co., for "Horizontal gas engines and steam turbines." To the Westinghouse Air Brake Co., for "Air brakes and friction draft gears." To the Westinghouse Traction Brake Co. for "Brakes for electric cars." To the American Brake Co., for "Driver brakes." To the Westinghouse Automatic Air and Steam Coupler Co. for "Air and steam couplers." To the Westinghouse Brake Co., Ltd., London, England, for "Air brakes and accessories." To the Westinghouse Co., Ltd., of St. Petersburg, Russia, for "Air Brakes and accessories." To the Union Switch & Signal Co., for "Signal system." To the Cooper Hewitt Electric Co., for "The development of the mercury vapor arc lamp."

Gold medals were awarded to the Westinghouse Electric & Manufacturing Co., for "Complete switchboards and controlling apparatus, and the application of electric motors for mechanical purposes;" for "Alternating current, direct current, and Bremer arc lamps and arc lighting systems;" for "Electric measuring instruments," and for "Industrial betterment work."

To the Nernst Lamp Co., for "Nernst lamps." To the Cooper Hewitt Electric Co. for "Vapor lamps for photo-engraving." To the Pittsburg Meter Co., for "Water and gas meters." To the Westinghouse Air Brake Co., for "The housing of the working classes."

Silver medals were awarded to the Westinghouse Electric & Manufacturing Co., for "Switches fuses, and wiring appliances." To the Sawyer-Man Electric Co., tor "Incandescent lamps." To the Bryant Electric Co., for "Electric light fittings." To the Societe Anonyme Westinghouse, Havre, France, for "Gasoline automobiles."

A Bronze Medal was awarded to the Perkins Electric Switch Manufacturing Co., for "Electric switches."

Hoover, Owens, Rentschler Co., Hamilton, O., was awarded a gold medal for its 2500-h. p. vertical engine exhibited.

Niles-Bement-Pond Co., of New York, manufacturer of machine tools, was awarded a grand prize for its exhibit.

McGuire-Cummings Manufacturing Co. was awarded a silver medal, the highest award given, for its exhibit of electric trucks, snow sweepers and street sprinklers.

Goldschmidt Thermit Co., New York, was awarded a grand prize for its very complete and interesting exhibit.

Galena Signal Oil Co., Franklin, Pa., was awarded a grand prize for railway signal oil and lubricants.

Buckeye Engine Co., Salem, O., was awarded a gold medal for heavy duty cross-condensing compound engine.

R. Thomas & Sons Co., East Liverpool, O., was awarded a gold medal for high-voltage insulators exhibited at the Exposition.

Weston Electrical Instrument Co., Newark, N. J., was awarded two grand prizes.

J. G. Brill Co., Philadelphia, was awarded a gold medal for its exhibit in the Transportation building, which was described in the "Review" for June.

The Consolidated Car Heating Co., Albany, N. Y., whose exhibit was described in the "Review" for June, has been awarded a gold medal for the exhibit.

The Pantasote Co., New York, has received a grand prize and two gold medals for the three classified sections of its exhibit in the Palace of Varied Industries, which was described in the June "Review."

John Stephenson Co., Elizabeth, N. J., has been awarded a silver medal for its exhibit in the Transportation building. This exhibit was described and illustrated in the World's Fair number of the "Review."

The Walworth Manufacturing Co., Boston, was awarded a gold medal for its display at the Exposition in Machinery Hall, illustration and description of which appeared in the June 20th issue of the "Review."

The Atlas Railway Supply Co., Chicago, who exhibited in the Transportation building, received a bronze medal for its display, which was described and illustrated in the June "Review."

Heine Safety Boiler Co., St. Louis, a short history of which company appeared in the September "Review," received gold medals for each of its exhibits at the Exposition.

The Truscott Boat Co., St. Joseph, Mich., was awarded a grand prize for its exhibit in the Transportation building.

The General Electric Co., whose exhibit was illustrated and described in the "Review" for June 20th, received five grand prizes, nine gold medals, five silver medals and two bronze medals for its various products exhibited at the Exposition.

The Kenfield Publishing Co., of Chicago, has been awarded a gold medal for its publications, the "Street Railway Review," "Street Railway Law," etc.

Hale & Kilburn Manufacturing Co., Philadelphia, whose exhibit was illustrated in the "Review" for June, has received a gold medal.

Kingston Lord's Day Alliance.

For some time the Lord's Day Alliance of Kingston, Ont., has endeavored to prevent the electric railway from operating its cars on Sundays and a judgment to that effect was secured. This case has now been reversed, the courts holding that the company's charters are imperative to the effect that cars shall run daily and that failure to operate would lay the company open to the forfeiture of its charter.

The Brightwood Electric Railway Co., one of Washington's (D. C.) suburban lines, fully equipped with modern underground trolley and good rolling stock, is offered free to anyone who will take it and assume the debts of the company.

Personal.

MR. DAN R. HANNA has been elected a director of the Cleveland Electric Railway Co. to succeed George G. Mulhern, resigned.

MR. THOMAS JACKSON, superintendent of the Hot Springs (Ark.) Street Railroad Co. for several years, has been promoted to the position of assistant manager.

MR. CHARLES FANSLER, formerly superintendent of the La Fayette Street Railway Co., La Fayette, Ind., has been appointed master mechanic of the Ft. Wayne & Wabash Valley Traction Co.

MR. H. C. MACKAY, comptroller and auditor of the Milwaukee Electric Railway & Light Co., has been appointed a delegate to represent the Street Railway Accountants' Association at the convention of the National Association of Railway Commissioners, to be held at Birmingham, Ala., November 15, 16, and 17, and with his family will accompany the commissioners on a trip through Mexico.

MR. S. L. NELSON, who until the recent consolidation of the Ft. Wayne & Southwestern Traction Co., with the Ft. Wayne & Wabash Valley Traction Co., was president and general manager of the former company, was born on a farm near Hicksville, O., June 23, 1859. In 1874 he learned telegraphy and in 1875 began work with a construction outfit on the Baltimore & Ohio R. R. and worked up to the position of operator. In 1881 he entered the service of the Illinois Central R. R. as train despatcher at Champaign, Ill.; the next year he took up telephone work at Champaign, going to Springfield, Ill., in 1884 and later to Dayton, O., returning to Champaign in April, 1885, as superintendent of the water works and electric light plant owned by Mr. W. B. McKinley. Since that time Mr. Nelson has been identified with the management and operation of the various McKinley properties at Champaign; Defiance and Springfield, O.; Bay City, Mich.; Port Jervis, N. Y.; Joliet, Quincy, Peoria and Danville, Ill.; Wichita, Kan., and Ft. Wayne. It is understood that Mr. Nelson will remain in Ft. Wayne and make his home in that city, while continuing to look after his interests in the McKinley properties in Illinois and Kansas. Mr. Nelson is a thorough and practical traction man, as well as a business man of high ability and is an important factor in traction circles in the middle west.

S. L. NELSON.

MR. ALVIN W. KRECK has been elected a director of the Coney Island & Brooklyn Railroad Co. in place of Thomas Clark, Jr., deceased.

MR. ROGER CONANT, formerly of Boston, has been engaged as consulting engineer of the Aurora, DeKalb & Rockford Electric Traction Co., with headquarters at Aurora.

MR. H. F. SMITH, chief train despatcher of the Lake Shore Electric Railway Co., has resigned to accept the position of master of transportation of the Rockford & Interurban Railway Co.

MR. J. H. DONNELL, who has been division superintendent of the Pittsburg Railways Co., has been appointed superintendent of the San Bernardino (Cal.) Valley Traction Co., to succeed Charles S. Putnam, resigned.

MR. JOHN S. BLEAKER, formerly with the Stone & Webster property at Seattle, Wash., has assumed his position as superintendent of the Houghton County Street Railway Co., Hancock, Mich.

MR. EMILE GARCKE, managing director of the London Tramway Co., who represents the foreign stockholders of the Utah Light & Railway Co., has recently been in Salt Lake City inspecting the properties.

PROF. LOUIS DUNCAN, Ph. D., head of the electrical engineering department of the Massachusetts Institute of Technology, has resigned and will devote his entire time to his interests as electrical engineer for the New York Rapid Transit Commission and several railroad and telephone companies.

MR. AND MRS. JOHN F. WALLACE were tendered a reception by the Union League Club of Chicago at its club house, Thursday evening, Nov. 3, 1904, as a farewell to Mr. Wallace, before leaving to assume charge of the Panama Canal as chief engineer.

COL. D. B. DYER, formerly president of the Augusta Railway & Light Co., of Augusta, Ga., has recently given a very valuable collection of Indian relics to Kansas City for the public library of that place. This collection includes over 12,000 pieces.

MR. H. F. VOGEL, general manager of the St. Louis Car Co., is at present sojourning in Europe. While there he will visit London, Berlin and Paris. The trip is a business one and while in London, Mr. Vogel will open a branch office for the company.

MR. J. A. BRETT, who recently resigned his connection with the Electrical Installation Co., with which concern he has been identified for eleven years, is now with the Westinghouse Electric & Manufacturing Co. and will handle the railway department of its Chicago office. Mr. Brett's headquarters will be in the New York Life Building, Chicago.

MR. JAMES DALRYMPLE, deputy manager of the Glasgow Corporation Tramways, has been appointed general manager by the Glasgow Town Council, in place of Mr. John Young, resigned. During the 10 years of Mr. Dalrymple's service with the tramways he has done splendid work, not only as an accountant but also as deputy manager, to which position he was recently appointed, his promotion to manager being a most appropriate recognition of this.

MR. JOHN YOUNG has resigned the position of general manager of the Glasgow Corporation Tramways to become general manager of the Metropolitan District Ry., of London, and we understand he will also act as general assistant to Mr. Charles T. Yerkes, chairman of the Underground Electric Railways Co. in the control of tubes and tramways of his companies. Mr. Young has been connected with the Glasgow Corporation Tramways for nearly 30 years and to a large extent the present successful position of the tramways in Glasgow is due to his great organizing power and the manner in which he executed the work before him.

MR R. H. DERRAH, who is well known to our readers through his contributions to the "Review," and the pamphlets on electric railway excursions that have been published by him, has just been appointed passenger agent for the Boston & Northern and the Old Colony Street Railway systems. These two companies operate about 1,000 miles of electric line to the north and south of Boston, including practically all of the seashore resorts and places of historic interest in eastern Massachusetts. We believe that these companies are the first in New England to create the office of passenger agent and that Mr. Derrah will have under his jurisdiction greater mileage and territory than any electric railway passenger agent in the country.

MR. S. J. DILL, superintendent of the Michigan Traction Co., has resigned to become general manager of the Youngstown & Southern Railway Co., with headquarters at Youngstown, Ohio. Mr. Dill is a railroad man of large experience in both steam and electric roads, having started his career in the train service of the company in 1897 to enter the service of the Metropolitan Street Railway Co., of New York. From 1897 to the spring of 1901 Mr. Dill was connected with the operating department of the Metropolitan, beginning in a uniform and working up to a division superintendent. In 1901 he resigned from the Metropolitan to accept the position of superintendent of the Detroit, Ypsilanti, Ann Arbor & Jackson Railway Co., with headquarters at Ypsilanti, Mich., in which capacity he served for two years. Mr. Dill's service with

S. J. DILL.

the Michigan Traction Co. covers a period of only one year but in that time he has done much toward improving the properties, including the construction of the large bridge over the Michigan Central R. R. tracks at Galesburg, and the extensions of the Portage St. and Seminary lines. He was in full charge of the city and interurban lines in Kalamazoo and Battle Creek, and in the discharge of his duties he has not only satisfied the stockholders but won the confidence of his employes and the favor and respect of the public.

MR. ROBERT A HILL, for many years assistant general superintendent of the Tri-City Railway Co., has resigned his position with a view of moving to California for permanent residence.

MR. HUGH TH. MILLER, of Columbus, Ind., secretary and treasurer of the Indianapolis, Columbus & Southern Traction Co., was elected lieutenant-governor of Indiana by over 80,000 plurality.

MR. FRANK E. SCOVILL, secretary and superintendent of the Austin Electric Railway Co., has resigned his position to become manager of the Laredo Electric Light & Railway Co., of Laredo, Texas.

MR. GEORGE KEEGAN, assistant to the general superintendent of the Interborough Rapid Transit Co., New York, has been appointed assistant to the general manager, the position of general superintendent having been abolished.

MR. W. B. McKINLEY, president of the Illinois Central Traction Co., the St. Louis & Springfield Railway Co., the Danville, Urbana & Champaign Railway Co. and the various city systems included in the McKinley Syndicate properties, was elected to congress from the 19th Illinois district.

MR. EDWARD JAMES, connected for many years with the Burt Manufacturing Co., in charge of the filter department, has entered the employ of the Pittsburg Gage & Supply Co., Pittsburg, Pa., in charge of the White Star oil filter, and will travel throughout the West and South in this interest.

MR. CHARLES N. WOOD announces that he has withdrawn from the Frank Ridlon Co., of Boston, Mass., and will at once enter into business for himself in the same line. His temporary address is Room 802, Board of Trade Building, Boston, and he is prepared to fill all orders promptly. Mr. Wood is one of the best known supplymen in the East in the electric railway field, and has the best wishes of his many friends for success in his new undertaking.

MR. JOHN F. OHMER, vice-president and general manager of the Ohmer Fare Register Co. of Dayton, O., who has been abroad for some months in the interest of this company, was greeted with a pleasant surprise upon his home-coming November 2. Mr. E. B. Grimes, assistant general manager, and other officers of the company, decorated Mr. Ohmer's private offices with flags and bunting and covered his desk with a profusion of beautiful flowers. An Ohmer fare register, a floral masterpiece made entirely of pink carnations, was displayed with Mr. Ohmer's picture resting on top of it.

Mr. Ohmer was delighted with the glad welcome, and calling all the employes together, he thanked them for their thoughtfulness and good will, and told them of his pleasant and successful journey.

Obituary.

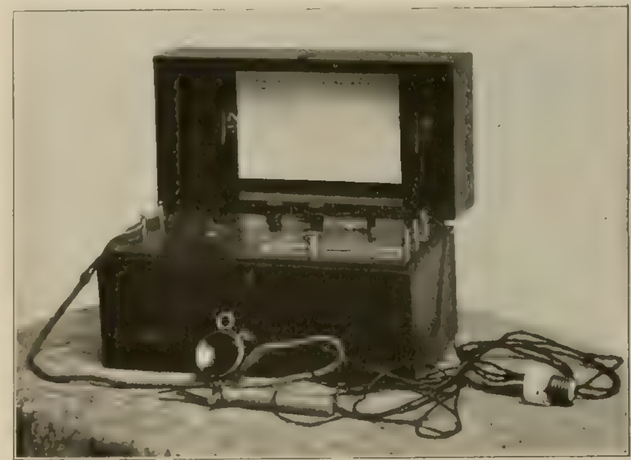
MR. SAMUEL E. RIGG, general superintendent of the United Traction, Oley Valley and Neversink Mountain Railway companies, died at his home in Reading, Pa., October 23rd, aged 54 years. Mr. Rigg had been identified with the local traction company since 1876, when he came to Reading from his birthplace, Churchtown, Pa.

The initial run of the Interstate Limited, the handsome buffet parlor car of the Dayton & Western Traction Co., was made Wednesday, November 2nd, and the trial trip was very successful. [illegible]

The Minneapolis branch of the Cigar Dealers' Association of [illegible] on the street cars by circulating petitions among the smokers of Minneapolis for their signatures. These petitions will be presented to the Twin City Rapid Transit Co.

The "New Century" Field Tester.

The accompanying illustration shows a testing instrument which is new in the sense that it is now for the first time being offered for sale. It is not, however, an experiment, as it has been used on a number of different roads and all reports indicate that it has proved to be quick and accurate in the detection of short circuits in fields and faults in armatures. In this preliminary practical testing it has been given a thorough trial and the makers, DuBois & West, 100 Randall Ave., Syracuse, N. Y., present it to the trade as a thorough testing instrument. As may be observed from the illustration, this instrument is complete and self-contained and it is only necessary to connect the binding posts to the field to be tested, no other field being required for comparison. It is stated that any



"NEW CENTURY" FIELD TESTER.

person, no matter how unskilled, can use this instrument with success, the reading obtained being an arbitrary indication which is to be compared with the point of balance of a standard field. In working out the design of this instrument it was assumed that to be successful in operation it would have to be adapted to a particular line of work and that the more simple it could be made the more valuable it would be. The condition of the fields can be ascertained as quickly as the man below the car can make connections by means of two awls. The condition of commuters can be determined within two minutes. The manufacturers advise us that the testing set has been used with great satisfaction by the Auburn & Syracuse Electric Railway Co., the Scranton (Pa.) Railway Co., the Syracuse Rapid Transit Railway Co., the Ashtabula Rapid Transit Co., the Erie Traction Co., Citizens Traction Co. of Oil City, Pa., the Brooklyn Heights Railway Co., the United Power Co. of East Liverpool, Ohio, the Syracuse, Lakeside & Baldwinsville Railway Co., the Utica & Mohawk Valley Railway Co. and the Chautauqua Traction Co. of Jamestown, N. Y.

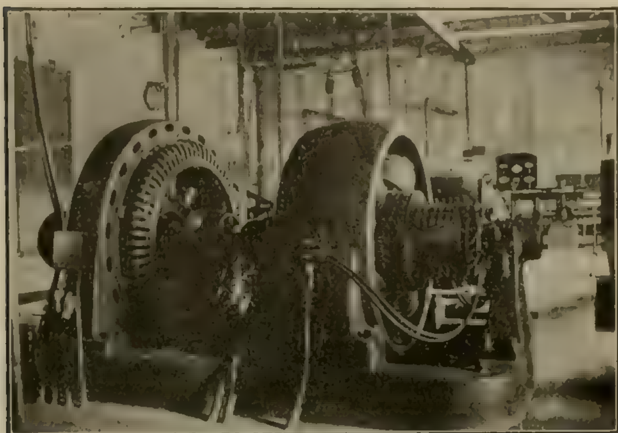
Interesting California Plant.

The latest installation of electrical machinery made by the Monterey County Gas & Electric Co. of Monterey, Cal., represents the newest products of the National Electric Co. of Milwaukee, Wis.

This plant constituted the exhibit of the Kilbourne & Clark Co., Pacific Coast agent of the National Electric Co., at the eighth annual convention of the Pacific Coast Electric Transmission Association, held in Monterey on June last, and it proved of double interest to the members of the convention who inspected it because of the fact that in it was shown for the first time on the Pacific Coast a type of machinery that had not been seen in operation theretofore, and because of its attractive and finely finished appearance, its well proportioned designs, its high efficiency, and its cool working in all parts despite the heavy duty imposed upon it.

In detail, the National machinery installed consists of a 200-kw. generator and motor-generator set, consisting of a synchronous revolving field motor of 162-kw. capacity, which drives by direct coupling a National [illegible] volt direct current railway generator with a rating of 150 kw.

The 200 kw. alternating current generator is of the belted type, with two bearings, pulley slide rails and belt tightening device, complete in every respect. This is of substantial construction, and follows very closely the structural design that has become well established in American types of revolving field generators. Its erected weight is 12,850 lb., and its inherent regulation is well within 6 per cent at unity power factor. It is run at a speed of 600 r. p. m., and consequently to deliver a current at 60 cycles is provided with 12 poles on its revolving field. The usual temperature guarantee, that



NATIONAL ELECTRIC CO'S. INSTALLATION AT MONTEREY, CAL.

with an atmospheric temperature of 25° C., the temperature of the machine will not rise more than 35° C. under a continuous 24-hour run at full normal load, was well above the limit reached in operation; the rise was but 22° C. above the temperature of the surrounding air.

The efficiencies of the generator are as follows: 93 per cent at 25 per cent overload; 92.5 per cent at full load; 91.25 per cent at three-quarter load; and 88 per cent at half load.

The exciter runs at a speed of 1,450 r. p. m., is normally rated at 12 kw., at 110 volts, and is belt driven from a pulley placed on the end of the generator shaft.

The motor-generator set runs at a speed of 720 r. p. m. per minute, and in operation it has been found that the temperature of the synchronous motor does not exceed 25° C. above the temperature of the surrounding air, and the direct current generator does not show a rise of more than 25° in any part, when both machines are working under full load conditions.

An interesting feature in connection with the motor-generator set is that a 22-in. pulley with a 16-in. face has been placed on the shaft between the motor and generator, and belted to the fly-wheel of a 200-h. p. high speed Buckeye engine. This gives absolute flexibility to the plant in that during the hours of light load both the units of the motor-generator set may be run as generators and in that the motor generator set affords the link by means of which the railway load may be coupled in with the two-phase load, or vice versa. Obviously this enables a day alternating current service to be maintained in conjunction with the railway load, at minimum efficiency in operation and, though the installation of the motor-generator set may appear anomalous in view of the fact that the current for its operation is taken from generators located within the same premises, it is considered in reality the rational solution of the problems presented by the local conditions which prevail.

The Dayton, Covington & Piqua Traction Co. has equipped a car with portable run for loading and unloading live stock, the amount of which business over its lines is considerable.

The trolleymen's waiting-room at Jersey City, N. J., was formally opened November 11th, when the Public Service Corporation gave the men a reception and turned over the rooms to the men. The rooms are equipped with pool tables and reading tables.

New Rule Books for Denver City Tramway.

The Denver City Tramway Co. has recently published a new edition of the rules for the operating department, in the arrangement of which a scheme has been adopted that can be followed to advantage by other roads in that so far as possible all rules of a purely temporary character have been eliminated from the rule book proper and printed in a separate pamphlet. The rule book bears the title "Rules and Regulations for the Operating Department." This is 5½ x 3¼ in. in size and contains, including the index, 68 pages. The rules for the government of employes adopted at the 1903 convention of the American Street Railway Association have been followed in compiling the rules. Additions have been made to the Association rules where it seemed desirable, as, for instance, between rules Nos. 2 and 3 of the Association have been inserted three new rules dealing respectively with signing for run, watches, and motorman's tools. Between three and four are inserted rules governing uniforms, badges and eye glasses. Thus, rule No. 4 of the Association, referring to "Politeness", appears in the Denver schedule as No. 10; however, the identity of the Association rule is preserved by inserting its number in parenthesis after the consecutive number which it bears in the Denver book. A complete index, with references both to rule number and page number, makes the contents easily accessible.

Rules of a temporary character—that is, such as would naturally be changed more frequently than the general rules, and because of such changes tend to make the rule book obsolete—have been included in a separate paper-bound book, which is 5½ x 3 in. in size. This is entitled "Regulations Governing the Issuing and Accepting of Transfers and Tickets." It is a book of 37 pages.

Matter of perhaps even more temporary nature is included in a third pamphlet, entitled "Schedule of Running Time and Headway." This gives the time allowance on each run.

The idea in preparing the rules has been to condense the matter as far as practicable and yet cover all important points and also to put the rules in such form that the requirement tnat all employes shall carry copies of the rules at all times will not be a burdensome rule. Throughout the books each paragraph is given a number, so that violation of any section of the rule may be brought to the employe's attention.

The company has recently adopted the Brown merit system of discipline.

Convertible Cars for Lynchburg, Va.

The Lynchburg Traction and Light Co., of Lynchburg, Va., added to its equipment in the early part of this month two new convertible

NEW CAR FOR LYNCHBURG, VA.

cars built by the J. G. Brill Co. This is the third lot of cars of this type ordered by the railway company, making eleven in all. Mr. Apperson, the president and manager, states that the cars are highly satisfactory and very popular with the people of Lynchburg. The company operates sixteen miles of road and owns Rivermont Park, a popular amusement resort in the vicinity of Lynchburg. Lynchburg has a population of about 20,000 and is one of the most important tobacco centers in the state. The cars have seats for 34 passengers. The seats are 34 in. long and have backs of the step-over type with brackets between the backs and the posts arranged

to serve as grab handles. Passengers leaving at the side entrances can hardly fail to see these handles, and taking hold of them step down facing the forward end of the car, thereby lessening the liability to accidents. The illustration shows the car with part of the panels and sashes raised into the roof pockets. The posts, besides having an extra firm setting and being bolted through the metal round-corner seat-end panels, have ⅜-in. steel plates on the outside. Single seats are placed at each corner with sand boxes underneath. The interiors are finished in quartered oak of natural color with ceilings of the same decorated in gold. The platforms have portable vestibules and folding gates, both of the Brill type.

The length of the car over end panels is 25 ft. 9 in., and over crown pieces 34 ft. 9 in.; width over sills and sill plates 7 ft. 4¼ in., and over posts at belt 8 ft. 2 in.; sweep of posts 5 in. The bottom framing is unusually substantial and includes 7 x ⅝ in. sill plates and undertrusses. The platform timbers are re-enforced with angle iron and the center knees are composed of angle irons brought well back of the body bolsters. The cars are mounted on Brill 27-G trucks having a 4-ft. wheel base, 33-in. wheels, 4-in. axles, and are equipped with 25-h. p. motors, four to each car. The weight of car and trucks without motors is 26,750 lb.

Graphical Mathematics—V.

BY A. G. HOLMAN, M. E.

Radial Percentage Chart.

The problems in multiplication and division which have been solved by the use of triangles depend upon the principles of proportion. That is, the proportions of the various triangles having the same angles remain constant. This fact, with a different form of construction, can be utilized in percentage problems.

Take, for example, the question of the relative quantity of coal used and product produced in any manufacturing process. The pounds of product and of coal are given and the "percentage of coal to product" is required; or in other words, the number of pounds of coal used for each 100 lb. of product. The method of construction for a percentage chart is shown in Fig. 29.

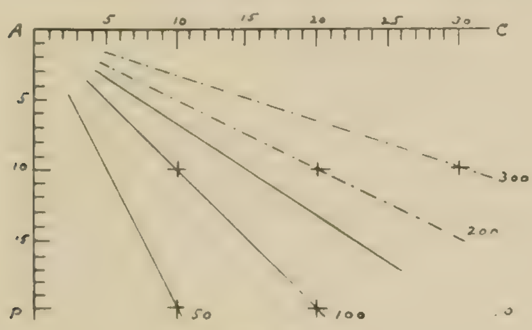


FIG. 29.

Draw a vertical line P to represent product, divide it into equal spaces by any convenient scale. In the same manner draw and divide a horizontal line C to represent coal. Then number the divisions on each scale beginning with the point A as zero.

If the amount of product and coal are the same, 100 lb. of product would require 100 lb. of coal and the percentage would be 100. Therefore take any convenient point in line P, as 20, and the same distance 20 on the line C. Draw a horizontal line from 20 P and a vertical line from 20 C and mark the point of intersection 100. Draw a line from this point towards A. It is evident that horizontal and vertical lines drawn from any two equal points on scales P and C will also meet in this line, as for instance the lines from 10 P and 10 C, as indicated in the figure.

If the amount of coal is ½ that of the product, or 50 per cent, this 50 per cent radial line can be located on the chart by finding the intersection of distances in the proportion of 2 on P to 1 on C, as 20 and 10, as shown in the radial line nearest to P in Fig. 29.

If the proportion of coal is 150 per cent, or as 100 to 150, the line can be located by taking points on the scales in that proportion, as 20 and 30, and the points of intersection found. In the same manner any number of radial lines can be located. It will be observed that along the horizontal line drawn from 20 P the spaces are equal for equal percentages, that is, the distance from 50 to 100 is the same as from 100 to 150. Therefore the finer divisions can be made simply by marking off equal intermediate spaces for the values between those first determined. Where this cannot be done along the lower line, as indicated by broken lines in Fig. 29, for 200 and 300 per cent a similar construction can be used along a horizontal from 10 P, where the same principle applies and 150 is equidistant from 100 and 200. A chart for practical use should be drawn upon a large sheet and the percentages drawn in black at intervals of 25 and in red at intervals of 5

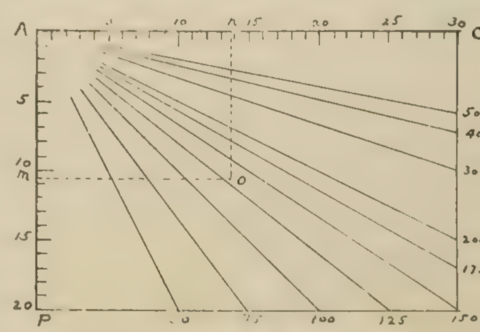


FIG. 30.

per cent up to a point where the steadily diminishing space prevents so fine a division. As the scale near the point A is not used it is unnecessary to draw the radial lines as far as that point and a better appearance is secured by stopping all lines uniformly on a circle at some distance from A.

The general appearance, but not the fine divisions, of a completed chart, are shown in Fig. 30. The method of using the chart is also shown by dotted lines.

Use of Percentage Chart.

Suppose that the chart is laid off in generous proportions upon sectioned paper or with horizontal and vertical lines drawn so that any points on the scales can be readily traced to their intersection. Also suppose that the radial lines are accurately laid off to represent proportions varying by 5 per cent. Then if it is reported that for a certain time 1,375 pounds of coal was used in producing 1,050 pounds of product, consider the spaces on lines P and C as

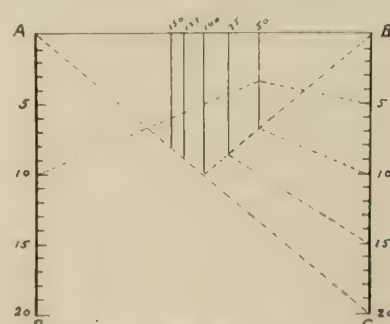


FIG. 31

hundreds, take the point m as the 1,050 product and n as 1,375 coal. Then the intersection o indicates 130 as the percentage.

In laying out such a chart there may be a temptation to attempt to condense it by beginning the scales at a larger value than 0, arguing that the smaller values will not be used. It is true that the graduations are not required below a certain point, but the space must be left in order to preserve the proper proportions.

Rectangular Percentage Chart.

In the use of the chart just described it will be noticed that after the two values on the scale are located there is a somewhat confusing process of following the lines across a series of radial lines. This can be avoided and one danger of error removed by the modified construction next presented.

In Fig. 31 two vertical lines AP and BC are drawn at any

convenient distance apart, and for practical use this distance should be of generous proportions. The lefthand line AP represents the product and the righthand line BC the coal. If the weight of product and coal are equal, or the coal is 100 per cent of product, if equal distances are taken upon P and C, as for instance 20, and a line be drawn from 20 P to B and from 20 C to A, these lines will intersect at a central point. If the percentage

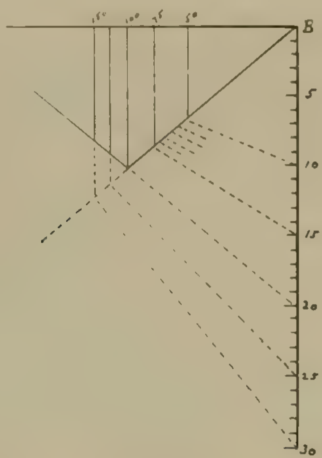


FIG. 32.

is 50 or 1 to 2, and lines be drawn from 10 P to B and from 20 C to A, the intersection will be at another point. It can be easily seen or demonstrated that whatever the actual values, if the proportions remain the same, these points of intersection will fall in the same vertical line. Thus lines from 20 P and 10 C, and from 10 P and 5 C, intersect in the vertical line marked 50, and this line indicates 50 per cent. By the same construction the other vertical percentage lines may be located. Fig. 32 shows the principle involved in this construction, and illustrates the method of locating the lines rapidly by extending the scale along the line BC, and the process of obtaining the finer subdivisions on the chart.

A practical application of this percentage chart is shown in Fig. 33.

It is impossible upon so small a scale to indicate the finer subdivisions of either the percentage lines or the vertical scales, but the general appearance will be understood from this sketch. A fine cord is attached to a pin at A, to be used in finding the radial

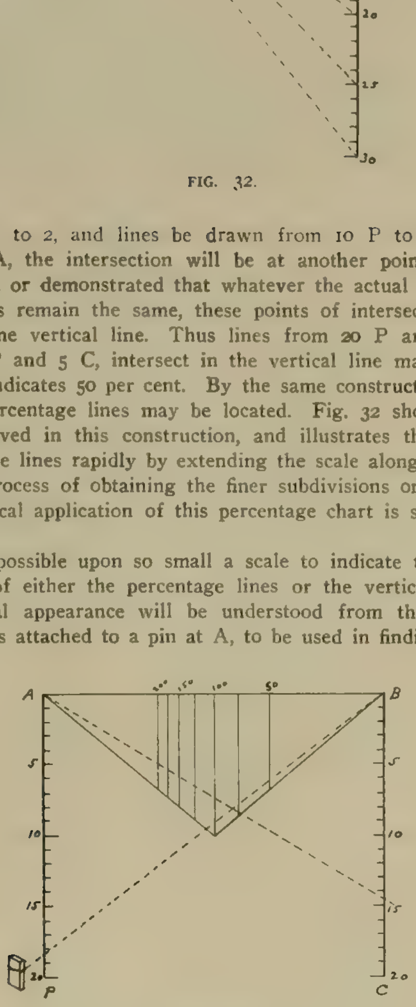


FIG. 33.

lines from this point to the scale C. To insure the use of this particular cord for values of coal a piece of coal may be attached to the cord.

Another cord from the point B has some equally suggestive object. If the product is paper a small block properly wrapped to represent a ream of paper may be used. When the weights of coal and product are given all that is necessary, in order to find the percentage, is to draw the coal cord so that it crosses the scale C at the proper point and the product cord in a similar manner across the scale P. The cords will cross each other on or between vertical lines representing the percentage.

In the figure the values represented are 1,850 lb. product and 1,450 lb. paper, and the answer given by the chart is 78 per cent.

Care is taken to distinguish the coal and product cords from each other, because the two scales P and C are exactly alike and it might be thought at the first glance that either one could be used for the coal. But it will be seen that whichever side is used for coal in plotting the percentage lines must also be used for the same purpose in the solution of problems.

As coal is an important element in most manufacturing processes and requires constant watching, a convenient process for constantly comparing results with sufficient accuracy for checking any material variations is of practical value.

If the values given in any problem are larger than are represented on the scales, an equal number of places can be cut off from the right of each number and the solution then obtained as before.

For example, if the product were 18,500 and the coal 14,500, a cipher could be taken from the right of each, which would divide each by 10 and would not change the proportion and the problem would then fit the chart.

If there is such a wide difference in the two values that the result is brought into an indistinct portion of the chart, the accuracy may be sometimes increased by multiplying the smaller quantity by a given number and then dividing the result by the same number.

In paper mills, where the ordinary percentage falls somewhere between 50 and 200, a chart laid out as here indicated would meet the usual requirements. In preparing a similar chart for some business in which the proportions were much larger or smaller than this, the special conditions could be provided for in either the chart of Fig. 30 or 33 by a change in the original plotting of the percentage lines.

New Publications.

ENGINEERING NEWS' CLASSIFIED DIRECTORY OF ADVERTISERS; 4¼ x 6¾ in.; Engineering News Publishing Co., 220 Broadway, New York, publishers. This publication contains a classified directory of advertisers in the Engineering News and a list of books published by the company.

"DRIVING THE NEW YORK SUBWAY" is the title of a recent publication issued by the Ingersoll-Sergeant Drill Co., New York. This issue includes an interesting and instructive article on the driving of the New York subway and the part the Ingersoll-Sergeant air compressors and drills played therein, the use of the Ingersoll-Sergeant ticket cancellers installed at the passenger stations along the subway, the use of Ingersoll-Sergeant compressors for the operation of switches and signals in the subway, the Ingersoll-Sergeant machinery in great public utilities, and descriptions of this machinery. It is a very neat and attractive publication and is the work of the Orr Press, New York.

"THE ELECTRICIAN," ELECTRICAL TRADES' DIRECTORY & HANDBOOK, 1905, (The Big Blue Book); "The Electrician" Printing & Publishing Co., Ltd., London, England, publishers; subscription price 7s 6d, United States 10s 6d; after publication, 12s 6d, United States 15c 6d. This publication contains a very carefully compiled list of British, colonial and foreign electricians, electrical engineers, electro-chemists and metallurgists, electrical apparatus, machinery, instrument manufacturers and supplymen, and all persons engaged in electrical pursuits throughout the world; useful tables and data relating to electric light and traction, electric power transmission, telegraph and telephones, British and foreign government departments, and a biographical section, giving interesting particulars of the careers of about 300 eminent men connected with electricity and all its applications, with many portraits. The 1905 edition will appear early in the year and all interested in having their houses entered should send the needed data at once.

AMONG RECENT PUBLICATIONS of fiction that are of interest to railroad men is "Tom Keenan, Locomotive Engineer, a story of 50 years on the rail as told by himself." The story is by Nelson Jones and published by the Fleming H. Revell Co. Price, $1.00 net.

The story is that of the life of a railroad man, beginning at his early school days it takes us through the difficulties in and facili-

ties for securing an education in the 40's, his first work and entrance into railroad service and its degrading influence and carelessness of operation. With him we hear the call of the west, go with him by boat from New York to California, railroad on the Sierra Nevada mountains in the late 60's, and return home. Then we see the entrance and influence of the Christian religion into the life of railroad men, Tom's conversion and the gradual growth and result of this influence. The remainder of the story is devoted to the work of the railroad Y. M. C. A. and the development of its elevating influence among these men. While the story would not appeal to the reader from a literary standpoint and the critic would not pronounce it an artistic success, yet the story of this life, as is the wish of the author, may prove inspiring and helpful to the thousands of railroad men who are striving to do right in the midst of adverse conditions.

SCIENTIFIC AMERICAN REFERENCE BOOK. Size, 5½x8 in.; 516 pages, profusely illustrated, six color plates; price $1.50, p. p. This work is a compilation by Albert A. Hopkins and A. Russell Bond, and is published by Munn & Co., New York. The publishers state that in this book the result of queries of three generations of readers and correspondents is crystalized. The work deals with matters of interest to everyone and contains 500,000 facts. It is, of course, out of the question to give a complete statement of the contents but the following list of chapter headings will indicate in some manner the scope of the work: The Progress of Discovery; Shipping and Yachts; The Navies of the World; Armies of the World; Railroads of the World; Population of the United States; Education, Libraries, Printing and Publishing; Telegraphs, Telephones, Submarine Cables, Wireless Telegraphy and Signaling; Patents; Manufactures; Departments of the Federal Government; International Institutions and Bureaus; Mines and Mining; Geometrical Constructions; Machine Elements; Mechanical Movements; Chemistry; Astronomy; Weights and Measures. Concerning the statistics, it should be mentioned that information has been drawn from a great many of the United States Government reports, in fact the publishers state that over a ton of these have been consulted. As might be expected, the chapters relating to mechanics and patents, especially recent inventions, are particularly complete.

Financial.

Boston & Worcester Street Railway Co. for the year ending September 30th, shows gross earnings of $400,046.27, a net surplus for the year of $91,373.21, and a total surplus, October 1st, after all expenses, interest and dividends, of $57,266.33.

Gross earnings of the Rockford (Ill.), Beloit & Janesville Railroad Co. for the first nine months of this year were $98,238, as compared to $101,687 for the corresponding period of last year. Net earnings were $40,848, as compared to $48,453 and surplus $16,578, as compared to $25,953.

The statement of the Lake Shore Electric Railway Co., Cleveland, for September shows gross earnings of $67,465.21 as against $63,-408.69 for the same month last year; operation expenses $36,661.17 as compared to $36,639.49 and net earnings $30,904.04 as compared to [illegible].

Muncie (Ind.), Hartford & Ft. Wayne Railway Co. reports gross earnings for the nine months ending September 30th of $134,639.89, operating expenses $63,535.82, net earnings $71,104.07, interest charge $30,000 and net surplus $32,104.07.

TWIN CITY RAPID TRANSIT CO.

The Twin City Rapid Transit Co. reports for September:

		Increase
Gross earnings	$373,944	$1,602
Operating expenses	166,918	9,004
Net earnings	207,026	*7,402
Surplus	116,684	20,807

*Decrease.

NORTHERN OHIO TRACTION & LIGHT CO.

Northern Ohio Traction & Light Co. statements for the month of September and for the nine months of the year are as follows:

September	1903.	1904.	Decrease
Gross	$84,013	$80,782	$3,229
Operating	43,917	41,352	2,564
Net	40,096	39,432	664
Surplus	17,390	16,765	624
Nine months.	1903.	1904.	Increase.
Gross	$666,300	$669,714	$3,413
Operating	361,949	363,383	1,733
Net	304,351	306,031	1,679
Surplus	104,687	102,372	*2,314

*Decrease.

ELGIN, AURORA & SOUTHERN TRACTION CO.

The Elgin, Aurora & Southern Traction Co. reports for September, 1904, as follows:

	1904.	1903.
Gross receipts	$38,886.04	$40,445.85
Operating expenses	21,431.64	22,055.69
Net earnings	17,454.40	18,390.16
Net income	8,121.06	9,217.65

For the three months ending September 30th:

	1904	1903.
Gross receipts	$127,259.41	$135,051.35
Operating expenses	63,887.47	71,580.80
Net earnings	63,371.94	63,470.49
Net income	35,532.76	35,952.96

Operating expenses include an accident appropriation equal to 2 per cent of gross receipts. Bonds of this company purchased and held in sinking fund, $51,000.

AURORA, ELGIN & CHICAGO RAILROAD CO.

The following is the financial statement of the Aurora, Elgin & Chicago Railroad Co. for September and for the three months ending with September, compared with the same periods of 1903:

September:	1904.	1903.
Gross receipts	$46,785.15	$44,394
Operating expenses	22,868.49	20,146
Net earnings	23,917.66	24,248
Three months:	1904.	1903.
Gross receipts	$158,856.65	$153,436
Operating expenses	78,128.53	62,080
Net earnings	82,728.12	90,356

LONG ISLAND ELECTRIC RAILWAY CO.

The statement of the Long Island Electric Railway Co. for the September quarter, 1904, as compared to the corresponding period 1903, is shown below:

	1904.	1903.
Gross earnings	$54,400	$48,304
Net earnings	23,599	23,748
Other income	419	308
Surplus after charges	14,728	14,870

CLEVELAND & SOUTHWESTERN TRACTION CO.

The following is the statement of the Cleveland & Southwestern Traction Co. for the month of September and for the nine months ending with September:

September:	1903.	1904.
Gross receipts	$43,158.96	$46,288.55
Operating expenses	25,329.79	25,907.51
Net earnings	17,829.17	20,381.04
Nine months:	1903.	1904.
Gross receipts	$330,232.38	$353,071.69
Operating expenses	194,739.48	224,138.99
Net earnings	135,492.90	128,932.70

NORTHERN TEXAS TRACTION CO.

The Northern Texas Traction Co. reports for September and for nine months as follows:

September	1904.	1903
Gross earnings	$46,021.17	$41,049.21
Operating expenses	25,146.45	22,033.01
Net earnings	20,874.72	19,016.20
Net profit	10,725.22	10,242.86
Nine months ended September 30		
Gross earnings	$405,864.04	$335,296.05
Operating expenses	220,799.76	178,167.68
Net earnings	170,064.28	157,128.07
Net profit	88,057.93	74,038.07

THE TOLEDO RAILWAYS & LIGHT CO.

The comparative statements of the Toledo Railways & Light Co. for the month of September and the nine months ending September 30th are given below

September:	1903.	1904.	Increase.
Gross receipts	$150,011.05	$150,344.18	$333.13
Operating expense	78,236.10	79,408.38	1,172.10
Net earnings	71,774.86	70,935.80	*839.06
Net income	30,356.61	29,067.35	*1,289.26
Per cent of operating expense	52.15	52.82	....
Nine months ending September 30th:			
	1903.	1904.	Increase.
Receipts	$1,225,929.05	$1,289,947.79	$64,018.74
Operating expense	631,174.04	692,151.79	60,977.75
Net earnings	594,755.01	597,796.00	3,040.99
Net income	227,904.13	222,492.39	*5,411.74

*Decrease.

CHICAGO & MILWAUKEE ELECTRIC RAILROAD CO.

Earnings statements of the Chicago & Milwaukee Electric Railroad Co. for the month of September and the nine months ending September 30th, compare as follows:

September:	1904.	1903.	Increase.
Gross earnings	$53,711.97	$40,920.70	$12,791.27
Operating expenses	17,395.67	9,820.14	7,575.53
Net earnings	36,316.30	31,100.56	5,215.74
Nine months.			
Gross earnings	$324,277.30	$194,635.80	$129,641.50
Operating expenses	125,744.16	66,935.69	58,808.47
Net earnings	198,533.14	127,700.11	70,833.03

INTERNATIONAL RAILWAY CO.

Statements of earnings of the International Railway Co. system for the month of September and for the quarter ending September 30th show:

FOR MONTH OF SEPTEMBER.

	1903.	1904.	Increase.
Gross earnings	$377,921.51	$384,960.78	$ 7,039.27
Operating expenses	201,040.64	193,194.62	*7,846.02
Net earnings	176,880.87	191,766.16	14,885.29
Fixed charges	127,445.45	136,382.91	8,937.46
Net income	49,435.42	55,383.25	5,947.83

FOR QUARTER ENDING SEPTEMBER 30TH.

	1903.	1904.	Increase.
Gross earnings	$1,198,315.92	$1,224,584.70	$ 26,268.78
Operating expenses	592,925.92	573,128.76	*19,797.16
Net earnings	605,390.00	651,455.94	46,065.94
Fixed charges	398,970.97	416,882.65	17,911.68
Net income	206,419.03	234,573.29	28,154.26

*Decrease.

PHILADELPHIA COMPANY.

Statement of earnings, expenses and net income of Philadelphia Co., Equitable Gas Co., Consolidated Gas Co. of the city of Pittsburgh, The Allegheny County Light Co. and Pittsburgh Railways is as follows for the nine months ending September 30, 1904:

Gross earnings from operations	$11,353,053.91
Expenses and taxes	6,810,296.57
Net earnings from operations	4,542,757.34
Miscellaneous income	285,423.18
Total earnings and income	4,828,180.52
Fixed charges	3,068,068.95
Total income	1,760,111.57
Accrued Dividend on Preferred Stock of Philadelphia Company	215,423.12
Net Income—Surplus	1,544,688.45
Proportion due to other owners of Common Stock of Affiliated Corporations	2,453.38
Available for Philadelphia Company	$ 1,542,235.07

Ludlow Rail Grinder.

As the soldered bond is now being used quite extensively, the Ludlow Supply Co., of Cleveland, Ohio, has designed an attachment that can be used in connection with its track drilling machines, or mounted on carriage as shown in the illustrations.

Fig. 1 is for grinding either under the base of the rail or on the upper side of the base. The leg of the grinder is attached to the frame at the point at which the belts meet, there being two belts, one running from the motor to a double pulley and the other

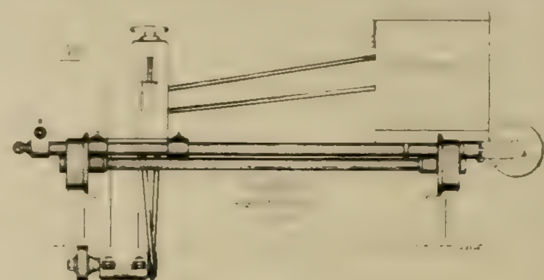


FIG. 1.

running to the pulley on the spindle. The leg is hinged on the same shaft as the double pulley, allowing it to be swung back between the rods high enough to be above the rail or ground, so as to not interfere with the moving of the carriage from joint to joint, as shown in Fig. 2.

The motor can be kept running, as the raising of the foot does not interfere with it. At the top of the attachment is shown a small hand wheel which can raise or lower the foot or emery wheel six

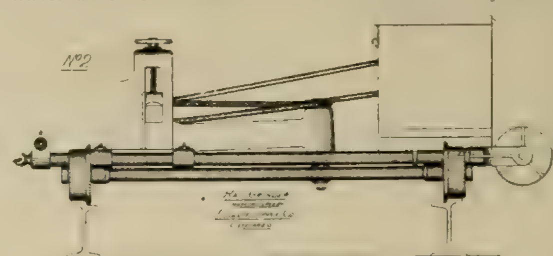


FIG. 2.

inches, enabling it to grind under the base of any rail, or on the top of the base.

Fig. 3 shows an attachment for grinding the outside of the ball of the rail. The lever is used for moving the emery wheel so as to not groove it while grinding, also to raise it high enough to allow the moving of the carriage from place to place. If the drilling machine is not required, the grinder will be mounted as shown. Where

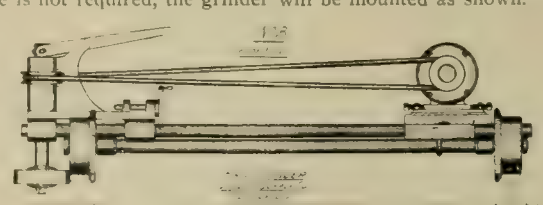
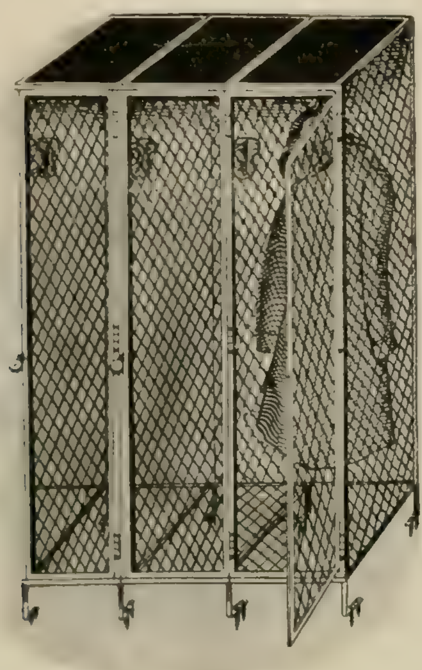


FIG. 3.

electric power is required, a 1-h. p. electric motor is used. Hand power will be furnished if desired. As these machines are operated on a carriage it can readily be seen that the surface ground must be true. The amount of grinding that can be done in a day depends entirely upon the quickness with which the operator moves the machine from joint to joint.

Sanitary Metal Lockers.

Economy of space and orderliness are to be desired in all offices, shops and plants and are found in well regulated places of business. The Meyers Sanitary metal lockers, manufactured by the Fred. J. Meyers Manufacturing Co., Hamilton, O., afford a secure and sanitary place for men's clothing. This type of locker is illustrated herewith, from which it may be seen that there is thorough ventilation, no dark corners, and no accumulation of dust and dirt, the entire structure being of steel. The lockers may be had in single or double tiers, and while the standard size is 12 x 12 x 60 in., they are also made in various sizes from 12 x 12 x 30 in. to 12 x 18 x 72 in. in single tiers and from 12 x 12 x 30 in. to 12 x 12 x 48 in. in double tiers. They are perfectly secure as well as neat and attractive and have proved very satisfactory to all who have used them.



MEYERS' SANITARY METAL LOCKERS.

W. R. Evans & Co., General Contractors.

The incorporation of W. R. Evans & Co., for the purpose of building, promoting, financing and engineering street railways, water works, electric light and power properties has been announced. Mr. W. R. Evans is president of the company and his connections with several large undertakings insure the success of this company. We are advised that the services of several capable, electrical, civil and mechanical engineers have been secured and the company is in a position to give most satisfactory services in this line of work. Reports and estimates will be furnished by the company and the bonds and stock of propositions of merit will be accepted in part payment of the cost of construction. W. R. Evans & Co. have their headquarters in the Traction Building, Cincinnati, O.

The Danville, Urbana & Champaign Railway Co. is establishing a park of 20 acres of timber land along the banks of Salt Fork, a short distance north of Homer, Ill. It is the intention of the company to dam the Salt Fork, thus making excellent rowing, and an [illegible] of boats will be provided.

It is stated the largest contract for freight shipments made over an interurban road has been obtained by Frank Norvell, of the Indianapolis & Northwestern Traction Co. The shipment will consist of 30 carloads of seeds and plants to be sent from Lebanon to Cumberland, Ind., by Huntington & Page, of Indianapolis.

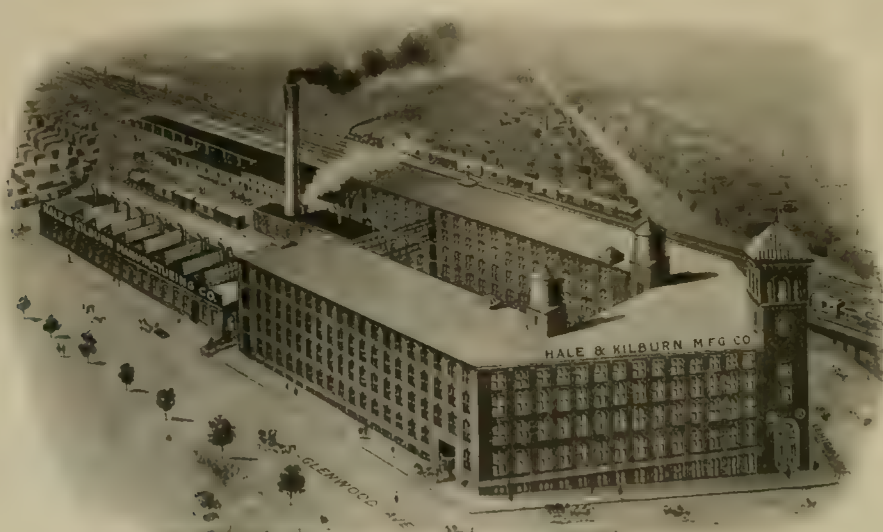
"Electrobestos" Socket Ring.

The patented "Electrobestos" incandescent lamp socket ring, which is herewith illustrated, is a new device for which the manufacturer, the H. W. Johns-Manville Co., 100 William St., New York claims several advantages over rings now in use. "Electrobestos" is an asbestos product and the rings made from it are fire proof and practically non-breakable, thus being especially adapted to street railway service. It is claimed that these "Electrobestos"

socket rings will not melt like rubber, neither will they break through vibration or because of atmospheric changes as do the porcelain rings, these features alone making them worthy of general use. Their non-conducting properties have been established in a break down test of 2,000 volts.

The New Home of the "Walkover" Seat.

The Hale & Kilburn Manufacturing Co., Philadelphia, has recently moved into its new plant at the corner of 18th and Lehigh



Ave., having outgrown the old works, which were located at 48 and 50 North Sixth St. This new plant covers 3½ acres and the total area of floor space is 300,000 sq. ft. From the accompanying illustration the design of the building and its relative location to the Pennsylvania R. R. tracks may be seen. The facilities of the new plant as compared to the old are double, every modern appliance in machinery and tools has been installed and the company is prepared to execute more promptly all orders, the shipping facilities offered by its close proximity to the railroad aiding in the prompt despatch of shipments.

New Cars for Knoxville Traction Co.

The accompanying illustration is that of one of the new single truck closed vestibuled motor cars for the Knoxville Traction Co.,

ST. LOUIS CAR FOR KNOXVILLE, TENN.

of which twelve have been ordered from the St. Louis Car Co. The length of the car over corner posts is 22 ft. 7 in., length over bumpers 32 ft. 9 in., width at sills 7 ft. 9½ in. and extreme width 8 ft. 2 in. The cars have double end automatic sliding doors and double side sashes, the upper ones raising into roof and lower sash dropping into side wall pockets. The vestibules have steps on each side provided with folding gates. The bumpers are of angle iron. There are six cross seats on each side of the aisle and one longitudinal seat in each corner of the car. The cars are equipped with St. Louis Car Co. patented illuminated destination signs, there being one over each vestibule center window. They are also equipped with the St. Louis Car Co. patented vertical wheel brakes and are mounted on No. 46 du Pont trucks, manufactured by the same company. The interior finish is of cherry with ceilings of white birch.

STREET RAILWAY REVIEW

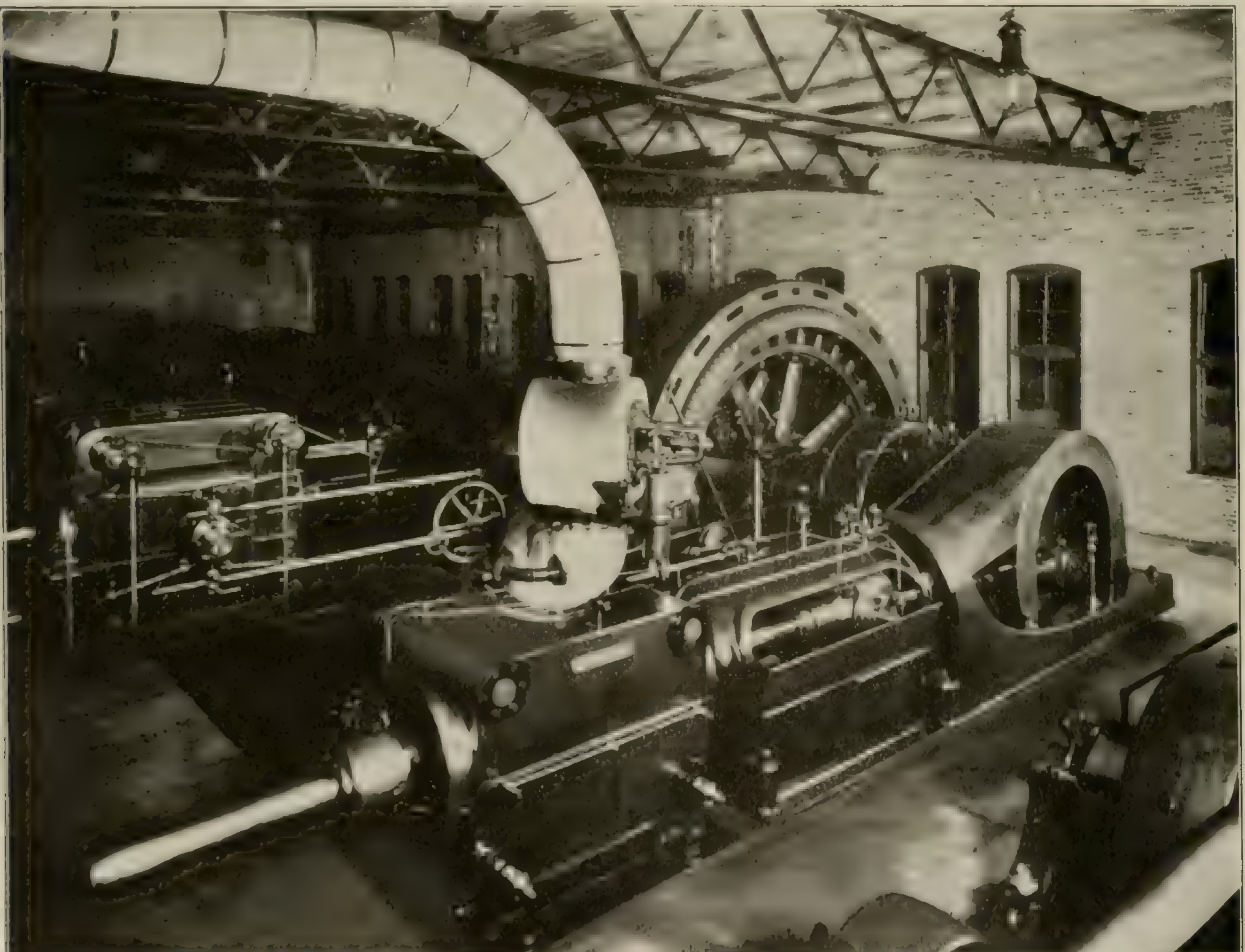
Vol. XIV DECEMBER 20, 1904 No. 12

Chicago & Milwaukee Electric Railroad.

Extensions and Improvements of the System—Installation of New Power House and Sub-station Equipments—Extensive Park and Pleasure Resort Additions—Some Operating Features.

The Chicago & Milwaukee Electric Railroad which operates through one of the most important suburban districts contiguous to [illegible] account of being the first electric railroad in this country to be equipped with a single high tension alternating current station and [illegible] Although this system [illegible] today [illegible] about five years ago that Mr. Bion J. Arnold suggested this system and [illegible] that the Arnold company was obliged to guarantee a certain efficiency of operation before it was awarded the contract for the equipment of the road according to this plan. The operation of the road, however, was entirely successful from the start and the very rapid growth in population of the territory which it served built up such [illegible] for the road that its former facilities were entirely inadequate to handle the constantly increasing traffic and some time ago plans were formulated which included almost a complete rebuilding of the road, new station and sub-station equipments, the addition of a large amount of new mileage and the building of amusement resorts.

These large expenditures have been fully warranted by the constantly increasing earnings of the road during the last five years. The gross earnings, operating expenses and net earnings for the four years from 1900 to 1903 are given in the following table:



[illegible] HIGHWOOD, ILL.

	Gross earnings	Operating expenses	Net earnings
1900	$140,684.55	$59,515.44	$ 81,169.11
1901	171,171.00	74,015.00	97,156.00
1902	190,110.31	79,364.12	110,746.19
1903	202,240.76	98,627.07	103,613.69

The receipts and expenses for the month of November, 1904, with a comparison for the same month of 1903, are as follows:

	Gross earnings.	Operating expenses.	Net earnings.
November, 1904	$45,325.94	$17,961.19	$27,364.75
November, 1903	30,218.57	10,626.66	19,591.91
Increase . . .	15,107.37	7,334.53	7,772.84

The figures for the 11 months from January to November, 1904, inclusive, with a comparison for the same period for the previous year, are as follows:

	Gross earnings	Operating expenses	Net earnings
Jan. to Nov., 1904...........	$425,228.30	$161,517.62	$263,710.68
Jan. to Nov., 1903...........	268,161.79	88,308.66	179,853.13
Increase	157,066.51	73,208.96	83,857.55

The population along the old line is about 85,000 people and the extensions which are being made west to Rockefeller and north to Kenosha will add 30,000 to this figure. The survey for the road has also been carried as far north as Racine and it is the intention of the company to push the completion of the road through to Milwaukee at an early date.

Right of Way.

The southern terminus of the road is at Church St., Evanston, where connections to Chicago are made either through the Evanston line of the Chicago Union Traction Co., the Chicago & Northwestern Ry., or the Chicago, Milwaukee & St. Paul Ry. From Church St. the road runs for 1.67 miles over the tracks of the Chicago, Milwaukee & St. Paul Ry. to Llewellyn Park and then for 1.1 miles in Wilmette it follows the street. Its private right of way next extends 4,700 ft. to Kenilworth where it runs for 1,000 ft. in the street and then follows private right of way for one-half mile in Winnetka, with another half-mile in the streets of this town. From here north the road follows its private right of way except for 1,000 ft. in Lakeside, one mile in Glencoe, 4,100 ft. in Ravinia, 2,000 ft. in Highland Park, one and a quarter miles in Highwood, 800 ft. in Ft. Sheridan, 6,600 ft. in Lake Forest, 2,400 ft. in North Chicago and three miles in Waukegan. In Lakeside, Wilmette and Waukegan the company has the joint use with the public of the streets through which its tracks run, but in all of the other towns where its tracks run in the street the company has the exclusive use of that part of the street on which its tracks are laid which amounts practically to having a private right of way. In Glencoe the railway company paved a strip of land 25 ft. wide east of its tracks for the use of the public. In Lake Bluff the company has acquired a right of way from 70 to 137 ft. wide in what was formerly a street and this street is being moved over to the east side of the company's right of way for a distance of 6,600 ft. to Shields. From this point north the right of way varies from 80 to 150 ft. in width and the street is being moved to the right of this private right of way for a distance of two and a quarter miles. The minimum width of the entire private right of way is 50 ft. and the maximum width 165 ft.

RIGHT OF WAY THROUGH LAKE BLUFF.

The old part of the line followed the grades and curves of the streets, which were quite numerous and which prevented any attempt at very high speed service, but this part of the line is now undergoing very thorough reconstruction and when this work is finished 1-degree curves will be the maximum curvature of the line. One of the illustrations shows the Bloom St. bridge in Highland Park where the company is putting in a long embankment and moving the track off from the street. The car shown in this illustration stands on the old track in the street, which is about to be removed, following the policy of the company in keeping off the streets wherever possible. The city of North Chicago granted the company a perpetual franchise in the street for a distance of 7,000 ft., but the company has recently surrendered this franchise and purchased a private right of way through the city. The same thing was done in Highwood, where the company had secured a 50-year franchise in the street.

BLOOM ST BRIDGE, HIGHLAND PARK.

The recent extensions of the road commence at Lake Bluff from which point a branch line runs west to Rondout, Libertyville and

Rockefeller. This branch is eight miles long and runs exclusively on private right of way. At Libertyville, which is 5½ miles west

CONSTRUCTION WORK ON ROCKEFELLER EXTENSION

of Lake Bluff, a new sub-station has been built for operating the west division of the road. Two bridges have been built at Lake

CUT ON WEST BRANCH, LAKE BLUFF

Bluff where the west branch leaves the main line. One of these is a highway bridge for the main line and the other is for a subway under the Chicago & Northwestern tracks through which the west branch passes. In addition to the old line of the road on the east side of the Chicago & Northwestern Ry. the company also owns private right of way from 100 to 125 ft. wide on the west side of the Chicago & Northwestern Ry. running north from Lake Bluff. This line is 12¼ miles long to the state line and extends through Waukegan, Zion City and Winthrop Harbor. This gives the company two parallel lines, one on either side of the Chicago & Northwestern from Lake Bluff to Waukegan, and the line on the west side, which is entirely on private right of way except for a distance of a quarter of a mile in North Chicago, is the one which will be extended north. From the state line to Kenosha the distance is 6.3 miles, and from Kenosha to Racine, which is as far as the survey has been carried at the present time, is 8.8 miles.

All of the new work is being built for a four track road. The bridge abutments, culverts, etc., will accommodate four tracks, although at present only two tracks are being laid. The two lines either side of the Chicago & Northwestern Ry. will be connected by means of a subway under the steam road tracks just north of Waukegan and the passenger business of the road will be carried on the east side of the Chicago & Northwestern Ry. to North Chicago. From this point the cars will alternate, one going to Waukegan only and the other to Kenosha, Racine and Milwaukee. The west branch and the line on the west side of the Chicago & Northwestern Ry. will be devoted largely to freight traffic. At Rondout connections are made with the Elgin, Joliet & Eastern R. R. and the Chicago, Milwaukee & St. Paul Ry. and at Rockefeller there is a connection with the Wisconsin Central. Owing to these steam road connections, the company expects to do a large freight and express business, especially with the cities along its line from Lake Bluff north.

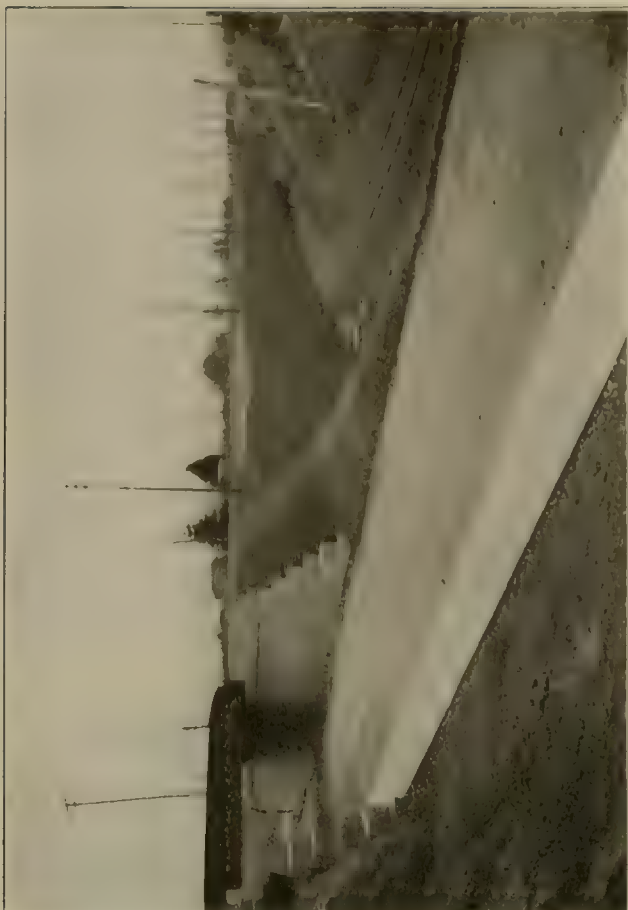
The character of all the new construction is of the very best and when the changes on the old line are completed the steepest grade on the entire road will be 1½ per cent. The maximum grade on the new work is .8 per cent for a distance of 1,400 ft. and the next heaviest grade to this is .4 per cent. There will be no curve sharper than 1 degree and there is a tangent 32 miles long between Lake Bluff and Racine. There are a large number of cuts and fills along the road for the purpose of reducing grades and avoiding railroad grade crossings which are entirely absent on this road. The maximum cut is 30 ft. deep and the maximum fill 25 ft. high.

Track and Bonding.

The track is laid with 65-lb. T rails in the country and 85-lb. girder rails through some of the towns. The rails are bonded with Thomas soldered rail bonds, type D, of 400,000 c. m. section. These bonds are made by the Lord Electric Co., of Boston, and consist of a series of flat strips of soft rolled copper, soldered together at the ends and having a central flexible portion where the strips are not soldered. The ends of the bonds form flat plates which are soldered to the rails, while the flexible portion is bent into a loop that projects through an opening in the rails at

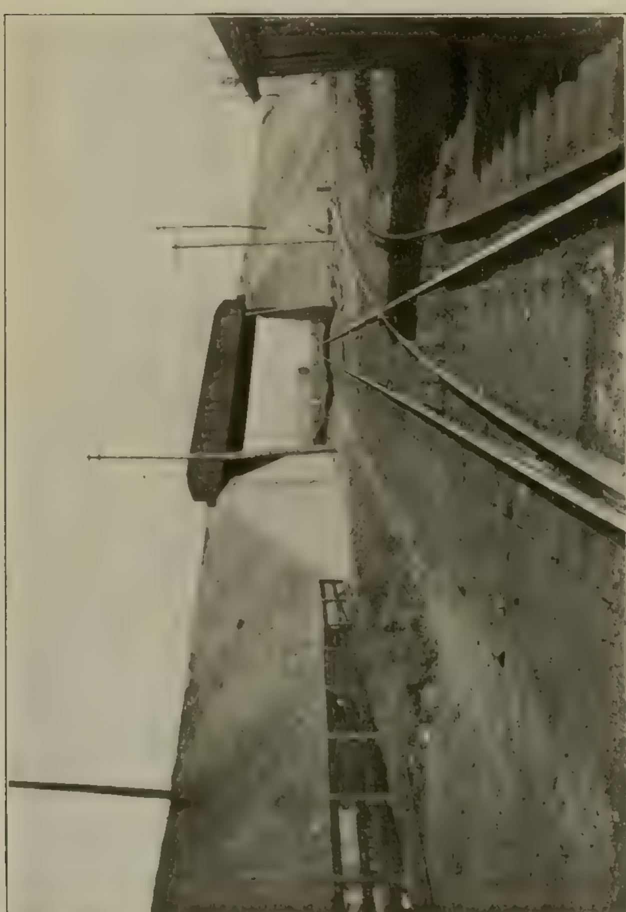
DEPOT AT HELMS' CROSSING.

the joint. The punching of the necessary opening at the ends of the rails is accomplished when the rails are piled by means of a



HIGHWAY BRIDGE AND APPROACH TO SUBWAY, LAKE BLUFF

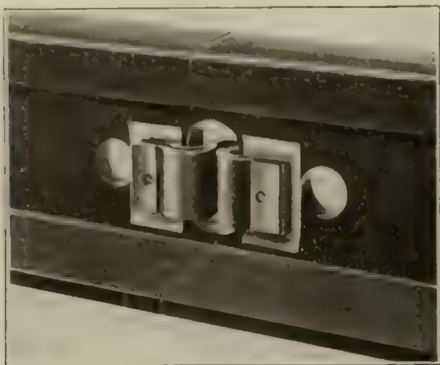
OVERHEAD RAILROAD CROSSING ON LIBERTYVILLE LINE.



OVERHEAD RAILROAD CROSSING AT RONDOUT.

HIGHWAY CROSSING ON LIBERTYVILLE LINE.

hydraulic press. A view of a joint with the fish plate removed showing the bond in place is given herewith. A soft copper strip is placed on the ends of the bonds, extending between the head and foot of the rail, giving a large contact area between the bond



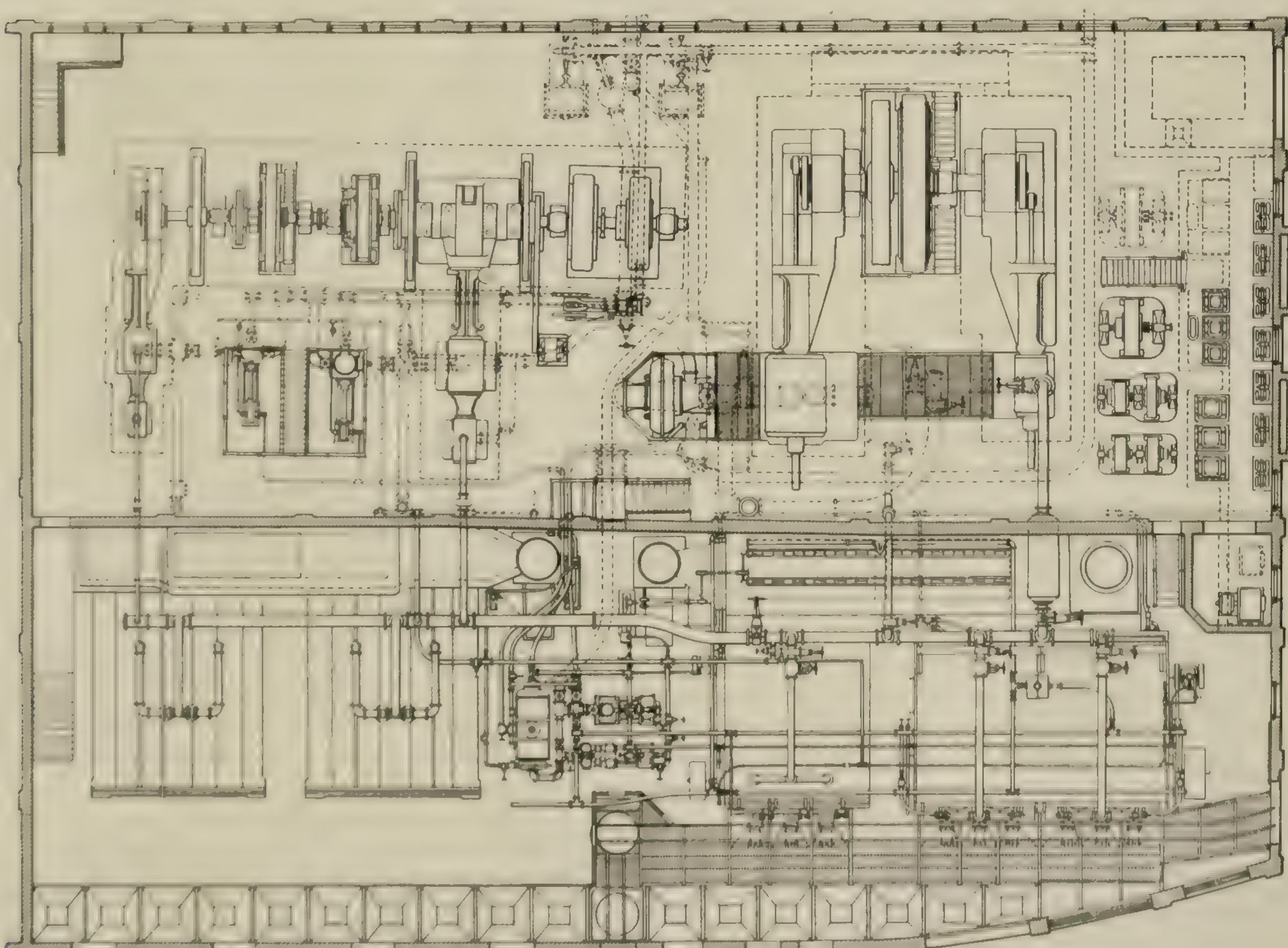
VIEW OF THOMAS BOND IN POSITION

and the rail. As an additional element of strength, a cap screw is put through the web of the rail and tapped into a nut fastened on the foot of the bond. This serves to hold the bond in place while it is being soldered and to draw the bond into intimate contact with the rail when the solder is melted. The cap screw becomes soldered into both the rail and bond during the process so that it is impossible for it to become loose and it relieves the solder of all mechanical stress, permitting it to fulfill its purpose as an electrical connection between the bond and the rail. A noticeable feature of this bond is its very short length, being but four inches long between the attaching surfaces, thus using a greater length of rail and a shorter length of bond than usual, which correspondingly reduces the resistance of the joint. Each strip composing the bond is separately tinned before the bond is built up so that the contact between the different strips is complete and uniform.

There are 24 waiting rooms which have recently been built along the line of the road of which the one ilustrated herewith is a type.

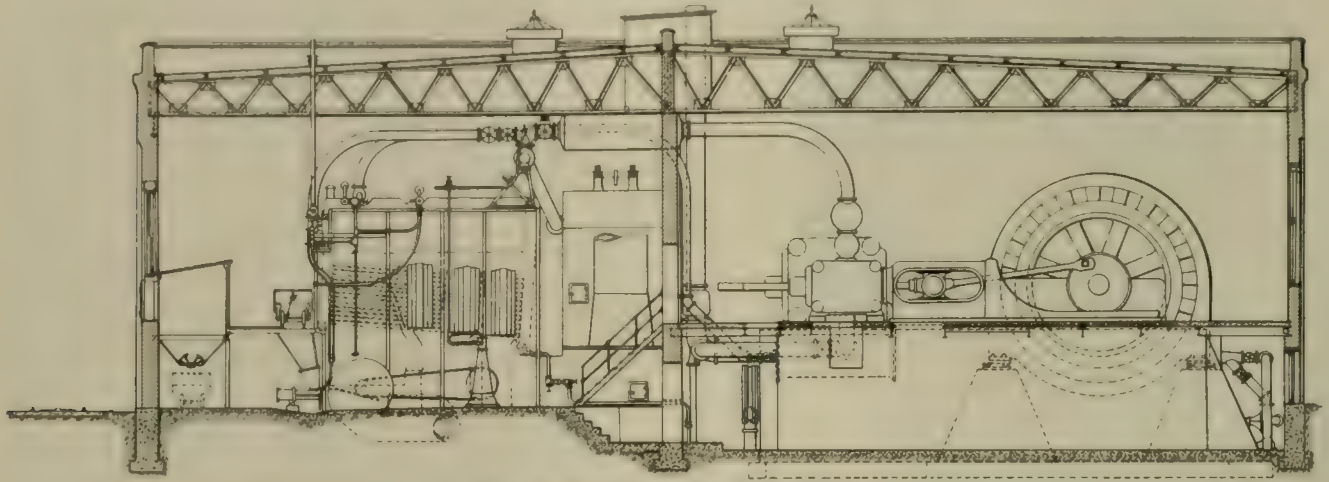
New Power House Installation

The power house is located at Highwood at about the center of electrical distribution and an addition to the old building has been made for which the original plans provided. A plan and elevation of this station are shown in accompanying illustrations and it will be noted that the new equipments of both boilers and engines are larger than the original plant. The addition to the power house equipment and the redesigning of the sub-stations was done by the Arnold Electric Power Station Co., of Chicago, which built the original plant. The boiler room is located on the west side of the building, forming a continuation of the old boiler room, but at the present time the old equipment is merely being held in reserve for emergencies. The new plant consists of three batteries of boilers, one battery consisting of one Babcock & Wilcox boiler of 500 h. p., the others being two Edgemoor boilers of 500 h. p. each, giving a total boiler capacity for the entire plant of 2,500 h. p. The new boilers are equipped with Jones automatic underfeed stokers and are provided with both forced and induced draft. A special arrangement for feeding the coal to the stokers has been provided, which is shown in the plan and elevation of the station. A number of hoppers are arranged on the west side of the building into which coal is unloaded from the cars on a spur track. Just inside of the building underneath these hoppers is a track on which a small coal car travels and which leads to a hydraulic elevator built by Kaestner Bros., of Chicago. The coal car is filled with

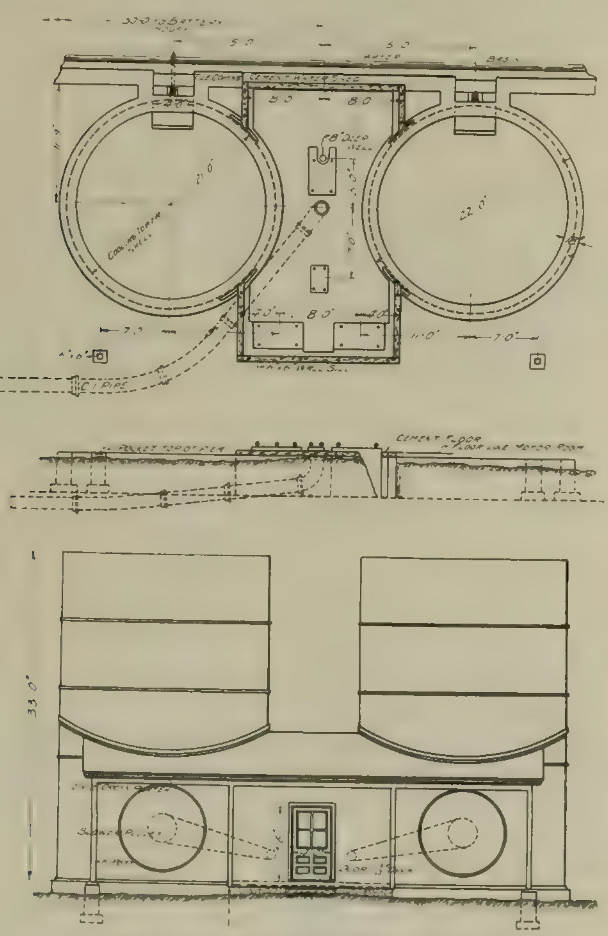


PLAN OF POWER HOUSE, HIGHWOOD

coal from the hoppers overhead and is run onto the hydraulic elevator, which raises the car to a coal balcony about 10 ft. high which extends along in front of the boilers. On reaching the balcony, the car passes onto a Fairbanks scale, by means of which the coal is weighed, after which it runs along a track on the balcony and discharges its load of coal into a row of hoppers which lead to the underfeed stokers. The forced draft is provided by means of two blowers, one 40 in. and one 6 ft. in diameter, operated respectively by 17-h. p. and 27 h. p. engines, built by the Troy Engine Machine Co. The induced draft apparatus was furnished by the Sturtevant Co. and includes an 8-ft. blower. The boilers are also connected to a 125-ft. steel stack, 5 ft. inside diameter, built by the Aurora Boiler Works.



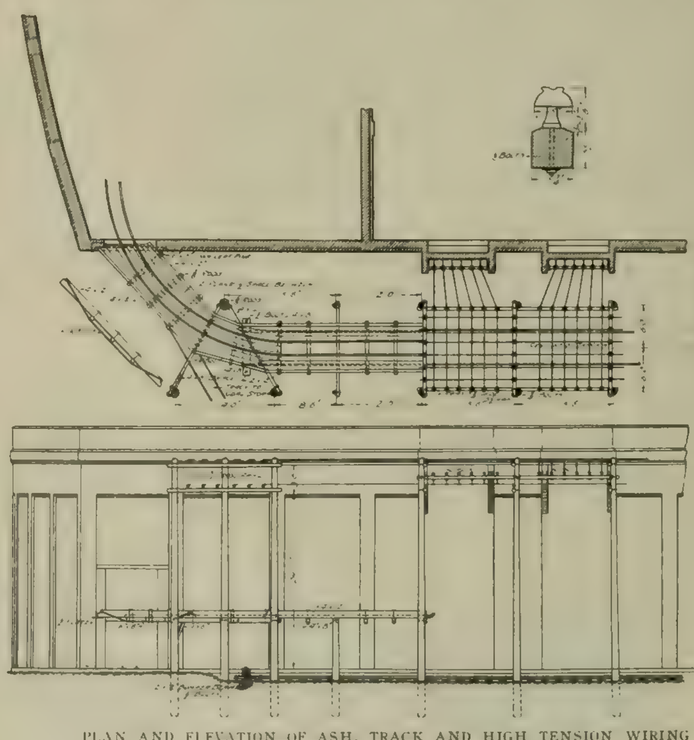
CROSS SECTION OF POWER HOUSE, HIGHWOOD.



PLAN AND ELEVATION OF COOLING TOWERS

The ashes are shovelled into cars which are elevated on the hydraulic lift to the coal balcony and the cars are pushed out onto an ash trestle, the details of which are shown in one of the illustrations. From the hand car the ashes are dumped into one of the railway company's dump cars and distributed along the line for ballast. The Green fuel economizer system, which was installed in the old plant, has been continued in the new plant.

The water supply has heretofore been taken from the city service and there is a reservoir 80 x 150 ft. in area by 9 ft. deep where the necessary supply of water for the station is stored, and, in addition to this, the company has just completed boring a deep well which it is expected will have sufficient capacity to operate the station without making use of the city service. There is one Snow duplex steam boiler feed pump 12 x 7 x 12 in. in size which takes its suction from a Cochrane heater usually but which also can take water from the reservoir or from the city water supply. The boilers are fed either through the main feed line or through an auxiliary feed line to which a water meter is connected. A back feed to the boilers has been provided for cases of emergency and an extra feed pump is located in the basement of the station. The boiler room also contains a Knowles fire pump 18 x 10 x 12 in. in size



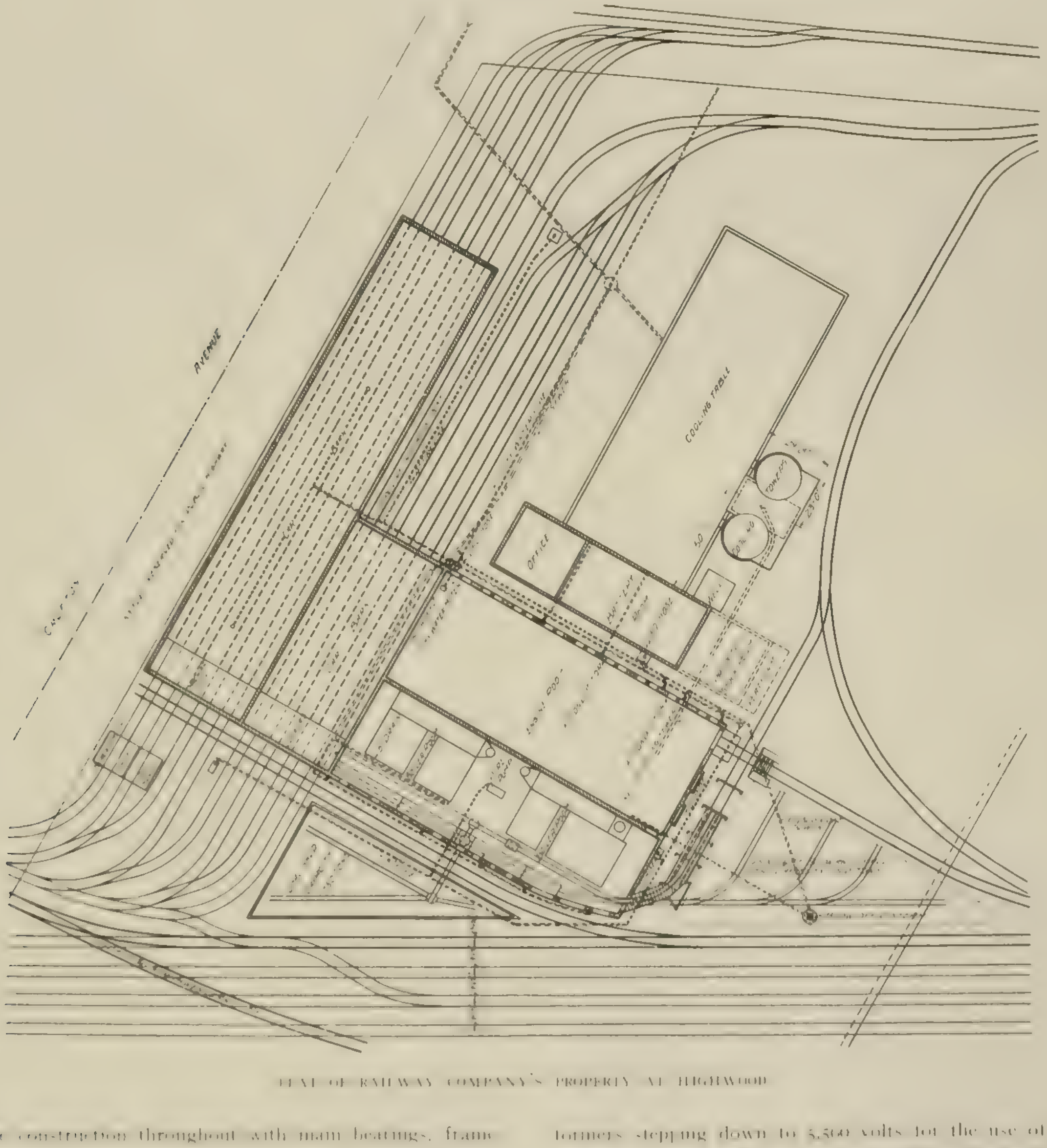
PLAN AND ELEVATION OF ASH, TRACK AND HIGH TENSION WIRING OUTSIDE OF BUILDING.

which can also be used for boiler feeding if necessary. The Cochrane heater is of 2,500-h. p. capacity and all auxiliaries exhaust into this heater.

The new engine room equipment consists of a cross compound condensing engine with cylinder dimensions 34 and 68 by 54 in., operating at 94 r. p. m., and devoloping 2,250 h. p. at best economy. The main shaft is of hollow forged fluid compressed steel, 29 in. in diameter, with main bearings 26 x 48 in. The crank pins are 11 x 11 in. and the crosshead pin bearings 9 x 13 in. The wheel, which is of the segmental type, is 19 ft. in diameter and weighs 175,000 lb. This engine and the two tandem compounds which are operating at 125 r. p. m. in the old part of the station, were built by the Filer & Stowell Co., Milwaukee, Wis.

The frame of the new engine is of the Filer & Stowell Co.'s well breaking of the valve stem. The steam and exhaust valves on both cylinders are operated by separate eccentrics, and disconnecting hooks are attached to all steam and exhaust valve rods, so as to permit of the working of all the valves by hand.

This engine is direct connected to a 1,500-kw. alternating current General Electric generator which operates at 13,200 volts. There is one exciter consisting of a 125-volt 400-ampere multipolar generator direct connected to a 75-h. p. direct current motor, also one booster set for the storage battery and one 300-kw. rotary converter for supplying direct current to a portion of the road near the power house. A switchboard gallery about 10 ft. high is built at one end of the station beyond the new engine and underneath this gallery are located the transformers and oil switches. There are three 250-kw., 25-cycle trans-

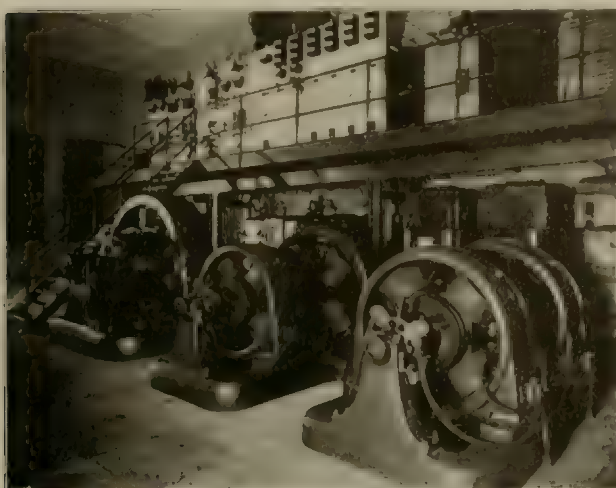


PLAT OF RAILWAY COMPANY'S PROPERTY AT HIGHWOOD

known [illegible] construction throughout with main bearings, frame and guides made in one casting having a contact with the foundation for its entire length. The design of the main bearings is such that the side and bottom shells may be removed by simply raising the shaft one-eighth of an inch. The governor operates at a higher speed than the ordinary corliss engine governor, thus permitting the employment of smaller parts and the enclosing of the entire mechanism in a dust proof case. The variation in speed of this engine when operating on changes of load from minimum to maximum does not exceed 1 per cent. The design of the valve gearing is such that all valves are brought as nearly as possible in the same plane and the drop lever which is keyed to the valve stem is supported in the bonnet, thus relieving the valve stem from all transverse strain. This is an important feature as it prevents any possibility of the formers stepping down to 5,500 volts for the use of a motor generator set which feeds to the center of the line and there are also three 110-kw. transformers for use with the rotary converter. There are seven oil-break motor-driven switches arranged in a row along the end of the building under the switchboard gallery. One of these is connected to the circuit of the main generator, four on the outgoing lines, one on the rotary converter and one between the bus bar and the transformer. There are two blowers for maintaining the air pressure in the bus bar compartment, one of which is driven by a direct current shunt motor and the other by an induction motor. A complete oiling system has been installed for all the machinery in the station, the general arrangement of which is shown in the accompanying illustrations. The oil is fed by gravity from overhead tanks and is piped to all bearings. The oil drips are

all collected and carried down to a [illegible] tank in the basement, after passing through which the oil is elevated by means of a steam pump to the overhead tanks.

The Alberger condenser for the new engine unit is situated in the basement at about the center of the engine room togther with the dry vacuum pump. The circulating water is supplied by two centrifugal pumps, each direct connected to an 85-h. p. General Electric motor. After the circulating water has passed through the condenser, it is carried to two Alberger condensing towers, located at one side of the reservoir, the details of which are shown herewith. The water is cooled by fans which are belt driven by 40-h. p. General Electric motors. From the cooling towers the water is discharged into the reservoir. The condensation from the condenser is pumped by a wet vacuum pump to the heater and a Cochrane vacuum oil separator is used in connection with the condenser. A Sorge vacuum grease trap takes oil from the exhaust steam and delivers it to the sewer. An auxiliary pipe is run from the circulating water discharge of the condenser to the heater. The engine has a high pressure steam connection to the low pressure cylinder for use in emergencies. The power house also contains a 288-cell storage battery of the Electric Storage Battery Co's. make.



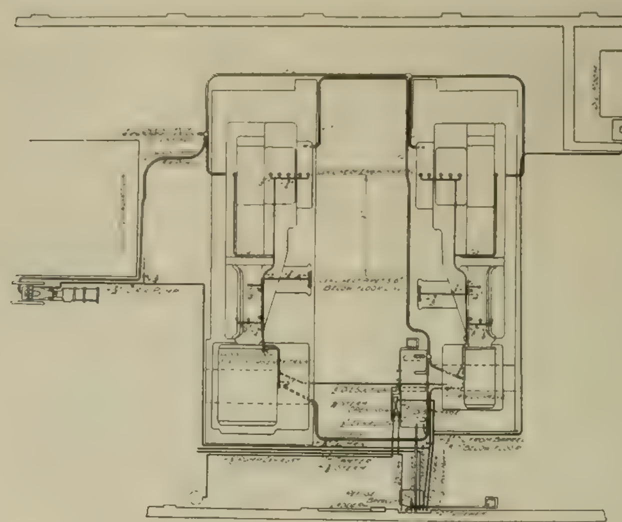
SWITCHBOARD GALLERY IN POWER HOUSE.

Electrical Distribution System.

In considering the electrical distribution of the road, that part of it which is now in operation may be divided into four sections. The first section is the southern part of the road which is fed from the sub-station in Winnetka; the second section is the central part of the road which is fed by the 600-volt circuit from the power house at Highwood; the third section is the northern end of the line which is fed from a sub-station at North Chicago and the fourth section is the west branch fed from a sub-station at Libertyville. The high tension circuits from the power house run south to Winnetka sub-station and north to the North Chicago and Libertyville sub-stations.

ELEVATION OF OILING SYSTEM.

The direct current machinery in the power house which supplies current for the central part of the main line and includes one 300-kw. rotary converter and a motor generator set of 225-kw. capacity which was originally part of the first machinery installed. As the road formerly operated on a 5,500-volt high tension circuit, the transformers for this set step the current down from 13,500 volts to 5,500 volts. The sub-stations at both Winnetka and North Chicago have been entirely redesigned and contain none of the old equipment with the exception of the storage batteries. The interiors of both of the sub-stations are handsomely finished, the floors being laid with tile and the side walls being painted red with cream colored ceilings. An interior view of the Winnetka sub-station is shown herewith and its equipment includes two 500-kw. rotary converters, six 185-kw. air-blast transformers, four remote control oil switches and one 22-kw. booster for the battery, giving 370 amperes at 60 volts. The storage battery, which is located in a wing of the building, consists of 288 cells with tank capacity to allow for an increase of 75 per cent. There is a second story to the Winnetka sub-station which is used for the living apartment of the sub-station attendant.



PLAN OF OILING SYSTEM.

The North Chicago sub-station is an entirely new building, separated a few feet from the former sub-station. The interior finish of this building is practically the same as that of the Winnetka sub-station and it contains two 300-kw. rotary converters, six 110-kw. air-blast transformers and one 22-kw. booster, giving 370 amperes at 60 volts. This sub-station also contains a battery of 288 cells with tanks of sufficient size to permit an increase of 55 per cent.

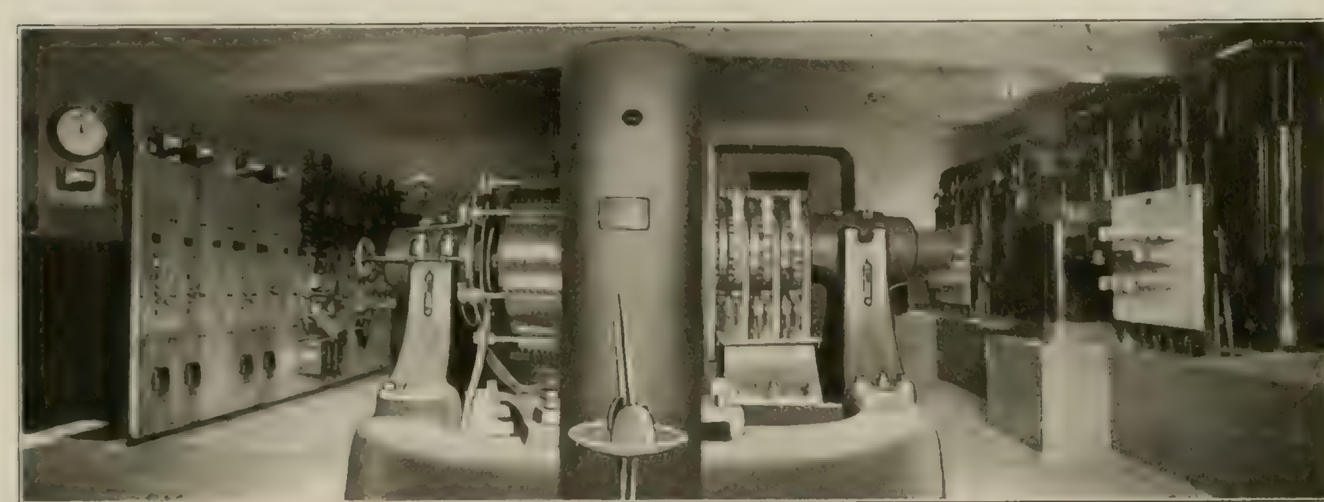
The Libertyville sub-station, a general view of which is given herewith, differs from the other sub-stations in being used for both a passenger and express station as well as a sub-station. Its electrical equipment includes one 300-kw. rotary converter and three 110-kw. stationary transformers, with the necessary auxiliary apparatus. There is no storage battery used in this sub-station.

The machinery thus far mentioned includes all of the equipment at present installed. It is expected, however, that by September, 1905, a double track extension of 19 miles from North Chicago through Zion City to Kenosha will be put into operation and, as this line is as soon thereafter as possible to be completed up to Milwaukee, a distance of about 60 miles, it has been decided to equip this part of the system with the single phase alternating current of 3,000 volts and 25 cycles. A new power house will probably be built on the lake front near Kenosha, which is near the electrical center of the new line and which also offers the most favorable facilities for coal and water. For the extension up to Kenosha, which is now building, a combined transformer sub-station and freight station will be erected in Zion City. This will contain two oil-cooled transformers, each of 300-kw. capacity, one of which will feed the south section and the other the north section of the new line. This sub-station will be fed from the Highwood power house and the transformers so arranged as to change the three-phase cur-

rent to a two-phase three wire system, having 3,000 volts pressure between the common return, which will be connected to the rail, and the two outside wires.

Rolling Stock.

The company has 32 closed cars and 25 open cars, some of the latter being used only as trailers. These cars are of three different sizes, being 38, 48 and 52 ft. long and all motor cars are equipped with four motors each. The smaller cars are equipped with G. E. 57 motors and the larger cars with G. E. 74 motors. The cars are of various makes, including Stephenson, Brill, St. Louis, Pullman and Jewett cars, all of which are mounted on double trucks. The trucks are of the Brill and Curtis types. About half of the cars are equipped with type M control and the other half use General Electric K 14 controllers. Part of the cars are heated with electric heaters, although the majority use hot water heaters, part of which are the Western car heaters and the remainder Peter Smith heaters. A number of new cars have just been received from the Jewett company which are very handsomely finished. These have a passenger and a smoking compartment and are furnished in inlaid mahogany and have half empire ceilings. The motormen's cabs cover about one-third of the platform and are enclosed by double leaf doors which, when folded up alongside of the controller, leave practically the whole of the platform available for the use of passengers. The lighting is provided by 25 frosted incandescent lamps and there are continuous parcel racks of generous proportions. There are twin windows along the sides of the cars, the upper sashes of which are filled with green art glass which is also used in the deck sashes. The standard color of all the company's cars is olive green and the lettering is in gold. The seats are all transverse with center aisle and are of the Hale & Kilburn "walkover" type. The company also has two baggage and express cars 48 ft. long which use the same equipment as the passenger cars. There are also one McGuire-Cummings double-truck sweeper, one Ruggles rotary snow plow and two combined work cars and snow plows, which were built in the company's shops, and which are fitted with drop shear plows. All of the passenger cars are equipped with Ohmer fare registers and Christensen straight air brakes with motor compressors. The company has also purchased 10 of the cars used on the Intramural Railway at the St. Louis World's Fair and these cars will soon be added to the company's rolling stock.



INTERIOR OF WINNETKA SUB-STATION

In addition to the rolling stock already described for the use of passenger and express service, the company has a well equipped construction department for the building of its new lines and the reconstruction of the old ones. The construction equipment includes five steam locomotives, one derrick car with a capacity of from 5 to 10 tons, according to the position of the boom, one pile driver, 84 side dump cars of 5 and 6 yd. capacity and 11 center dump cars of 10 yd. capacity, built by the Western Wheeled Scraper Co. It also has 94 narrow gage industrial railway dump cars of 1½ yd. capacity and 70 wheeled scrapers and 1 grader, all made by the Western Wheeled Scraper Co. The grader has a capacity of about 600 cu. yd. of earth per day, varying somewhat with the character of the soil. The company owns a hydraulic press for punching out the ends of the rails for the Thomas bonds. In addition to the equipment just mentioned, the construction department is provided with tents, boarding cars, etc., sufficient to accommodate 500 men.

Repair Department

As will be seen on the plan of the company's property at Highwood, giving the location of all of the buildings and track connections at this place, the repair shops are located in one end of the car barn, and, although the growth of the company's equipment has outgrown the facilities of the repair shop, all of the repairs to rolling stock have been carried on in this shop which is soon to be considerably enlarged. The machine room contains a band saw, lathe, two drill presses, wheel boring machine, shaper and wheel press. Above this room, on the second story, is a winding room where armatures and fields are rewound. The company formerly formed its own armature coils, but it now finds it more economical to buy the coils already formed. The pit track, where armatures and motors are repaired

LIBERTYVILLE SUB-STATION AND WAITING ROOM

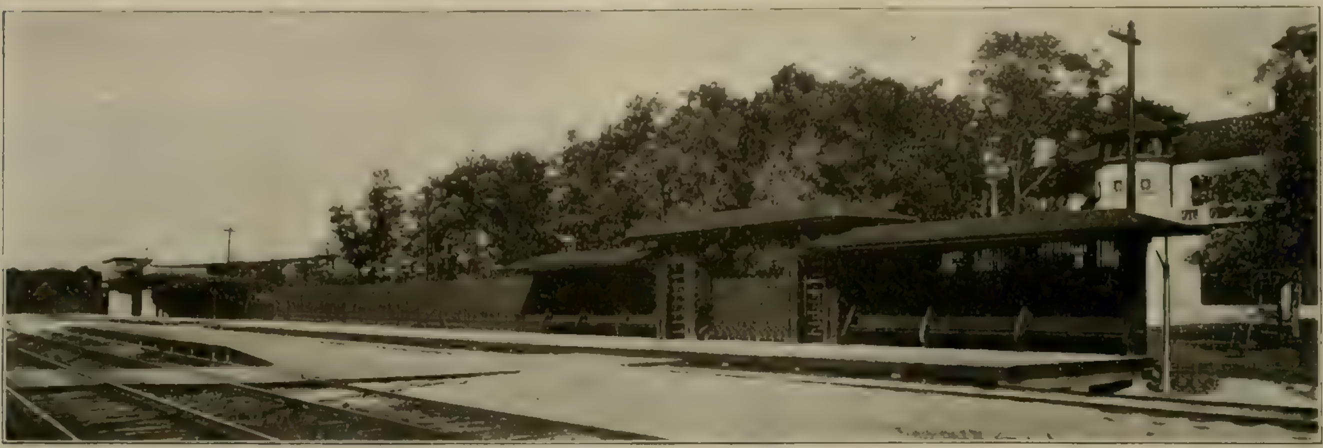
and removed is provided with an air hoist by means of which the machines are lowered from the trucks. The air hoist is then transferred to the end of the pit, where an overhead traveler picks up the machinery from the hoist and transfers it either to the repair shop floor or to the lathe. The company uses cast iron wheels which are pressed on and off in the shop. The

wheels weigh 575 lb., are 33 in. in diameter and have 11 in. but 3-in. treads and ⅞-in. flanges. On the small size cars 4½-in. axles are used and on the large cars 5½-in. axles. The most noticeable piece of work in the shop at present is the McGuire-Cummings sweeper which was originally a single truck machine. Owing to its oscillation when run at high speed it was determined to lengthen it and put double trucks under it. To do this the body was cut in two near the center and about 20 ft. of body inserted, making it 44 ft. long. over all. This is being equipped with four G. E. 57 motors and a long shear plow is swung under the center of the body, which will remove the snow for some distance on either side of the track.

The location of the company's tracks through Highwood as shown is to be changed. At present these tracks run on the east side of the power house and car barns, but these tracks are to be moved to the west side of the building on a private right of way which has been secured close to the line of the Chicago & Northwestern Ry. Between this private right of way and the company's buildings a street is to be laid out and the present street, through which the cars now run, will be closed up, and, together with some of the land adjacent to it, will be added to the government's Ft. Sheridan reservation. Just south of the power house and facing the new street which is to be opened the company has planned to erect a new two-story office building for the use of the operating departments located at Highwood. This has been made necessary, as, owing to the increase in the company's forces, the present offices have been outgrown. The plans for the new building have not yet been fully decided upon, but, in addition to providing ample space for office facilities, the building will contain accommodations for the uniformed employes.

Parks and Amusement Features.

The route of the Chicago & Milwaukee Electric R. R. passes through a very beautiful section of country, which contains many institutions of note and places of attraction, outside of those conducted by the railway company. In most of the towns along the road are located country clubs and golf clubs, those in Evanston, Glencoe, Highland Park, Lake Forest, Lake Bluff and Waukegan being celebrated for their magnificent grounds. Among other points of interest may be mentioned the Northwestern University at Evanston, the Northwestern Military Academy at Highland Park and Fort Sheridan, which is considered one of the finest military posts in America. It comprises about 600 acres of land which is handsomely laid out and contains many buildings of imposing architecture. Lake Bluff has an elevation of 110 ft. above Lake Michigan and has been selected as the site of the United States Naval Training Academy, which will add largely to the population of the town and make it a point of unusual interest for sight-seers. It is expected that the government will expend from $3,000,000 to $5,000,000 on this station and provision will be made here for the training of about 3,000 boys between the



ENTRANCES, RAVINIA PARK

CASINO, RAVINIA PARK

ages of 14 and 18 years, and, with the officers and attendants, will probably add in the neighborhood of 5,000 people to the population along the line.

The company owns and operates two parks, Ravinia Park, located between Glencoe and Ravinia, and Ft. Sheridan Park, which is adjacent to the government reservation. Ravinia Park covers 40 acres, located in a grove of oak, maple and elm trees, and, aside from its natural beauties, no expense has been spared in the addition of amusement and entertainment features. The three most prominent buildings in this park are the theater, the casino and the stadium, and, in addition to these, there is a circle swing, built by the Traver Circle Swing Co., and an electric fountain. The park has its own water works and electric lighting service, both of which are operated by means of current supplied from the railway circuit. Opposite the park the company has erected a large hotel for the use of the park attendants and the theatrical troups performing at the theater.

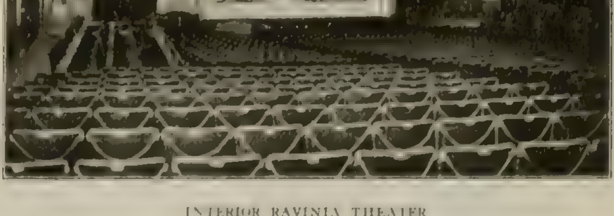
The general view of the entrance shown herewith gives a view of a number of ornamental gateways which open into walks leading to the different buildings. The theater is located opposite the entry gateways and views of the exterior and interior of the building are shown herewith. The theater, as well as the casino and stadium, are probably the handsomest buildings to be found in any railway park, and they were designed by Mr. P. J. Weber, architect, of Chicago. The buildings are all of gray cement plaster [illegible] and present the general appearance of gray stone. The decorations are in "art nouveaux" style throughout. The theater has a seating capacity for 1,100 people and has a large stage 85 x 135 ft. in area, well equipped for staging almost any theatrical production. The appointments of the building throughout are as handsome as can be found in any of the metropolitan theaters.

A general view of the casino is also given, as well as an interior view of one of the parlors. On the first floor is located a cafe, where light refreshments of almost all kinds are served. On the south of this is the ladies' parlor with retiring room and lavatories, and to the north of the cafe is the men's smoking room. The furnishings of all these rooms on the ground floor are similar and the decorations, draperies and lighting effects are all in the utmost harmony. The entire second floor of the casino is devoted to a ball room, having a floor space of 40 x 100 ft. There are balconies on three sides of this floor and on the fourth side is a space for musicians. This ball room is rented to private parties for social functions subject to regulations of the management, but no public dances are permitted here.

The stadium, a view of which is shown herewith, is a steel structure 280 ft. long, which seats 2,000 people, and which faces a large athletic field laid out for football, baseball and other sports. It is similar in its style of architecture to the buildings just described. Ravinia Park has been laid out by the company with a view to furnishing a refined and exclusive resort for the inhabitants of the north shore towns, and the development of this resort cost $200,000. The cost of the theatre was $65,000, the casino $25,000 and the stadium $20,000. Only the highest class

RAVINIA THEATER.

A CORNER IN THE CASINO.



INTERIOR RAVINIA THEATER.

theatrical performances are given in this park and no intoxicating liquors are permitted on the grounds. Ravinia Park has been designed for an all the year around resort and a pond 500 ft. square, used for a skating rink, is being flooded on the athletic field in front of the stadium. A toboggan slide is also being built in the park for use this winter which will have a 100 ft slide and 150-ft. run beyond the slide. The general admission to Ravinia Park is 25 cents.

STADIUM, RAVINIA PARK.

BALL ROOM IN CASINO.

Ft. Sheridan Park, the company's other resort, covers 8 acres and is designed for a summer park only. The admission to this park is 10 cents, and, while everything in it is conducted in an orderly and thoroughly respectable style, the park is less exclusive and the management here caters more especially to the general public. The park contains an open air theater, covered with a canvas roof, to which no admission is charged except for reserved seats, which cost 10 cents. In this theater vaudeville is given exclusively. There is also a large dancing pavilion which is opened after the close of the vaudeville. The charge for dancing is 25 cents a couple for the evening. Refreshments, including liquors, are sold in this park but the latter are only served at tables and no drinking over the bar is permitted. Afternoon band concerts are given at this park throughout the summer season.

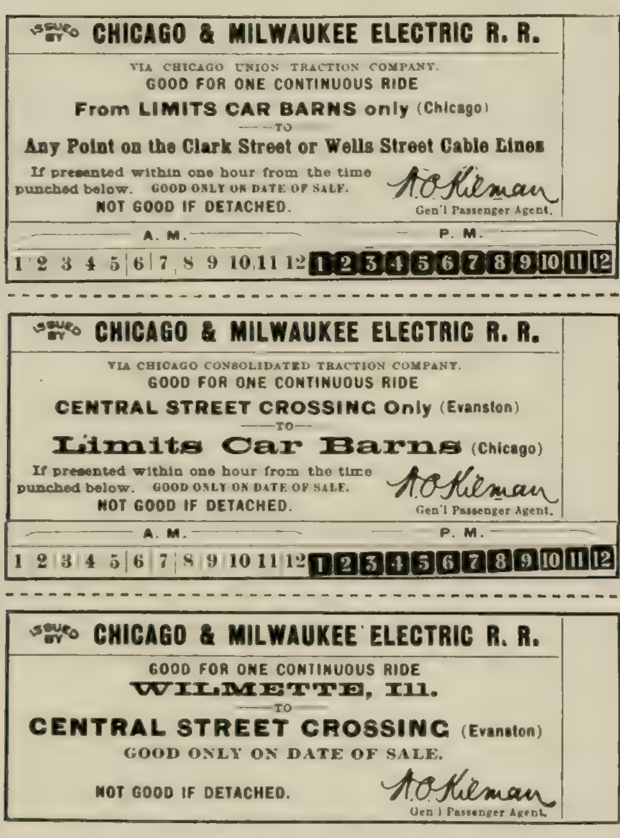
At Libertyville a fine mile race track and exhibition grounds were built last year on the line of the Chicago & Milwaukee road by interests associated with the railroad company, the track being owned and operated, however, by a corporation distinct from the railroad company. The Lake County annual fair is to be held on these grounds. The track contains winter quarters for 200 horses and summer quarters for 300 horses. The track was completed last summer and the first meeting was held in September for which 175 horses were booked. The grand stand at this track is of the same style of architecture as the stadium at Ravinia Park, and has a seating capacity for 4,000 people.

Some Operating Features.

It is the aim of the management of the Chicago & Milwaukee Electric Railroad to arrange the details of its operation to conform as closely as possible to the arrangements which are standard on steam railways. Tickets are on sale in each of the towns through which the road passes and are sold at the most prominent drug store. Theater tickets for the Ravinia theater are also on sale at the same places. The company issues card tickets of the usual pattern for one way and round trip rides between all points. There are also 10-ride and 25-ride bearer tickets, which are sold between any two points for which the single trip rate is 10 cents or over. No tickets are sold where the single trip

GRAND STAND, LIBERTYVILLE RACETRACK.

rate is less than 10 cents. Fifty-ride individual tickets are also issued at a considerable reduction in rate. The round trip tickets are good for 10 days from the date of sale, the 10-ride and 25-ride bearer tickets one year and the 50-ride individual tickets 60 days. A special ticket is about to be issued both in single and round trip forms between Wilmette and any point on the Clark Street or Wells Street cable lines of the Chicago Union Traction Co. The single trip form of this ticket is illustrated herewith. It is divided into three coupons, the first being good for Wilmette to Central St., Evanston. The second coupon is good to the limits car barn in Chicago, the third being good for the remainder of the trip. The last two coupons have time limits similar to the ordinary transfer and must be used within an hour of the time punched. The rates for the round trip, bearer tickets and



commutation tickets are based on the single trip rate, as shown in the following table:

Single trip rate.	Round trip rate.	10-ride bearer rate.	25-ride bearer rate.	50-ride individual rate.
$0.10	$0.20	$0.90	$2.00	$3.00
15	25	1.20	2.50	4.00
20	35	1.70	3.50	5.00
25	40	1.90	4.50	6.50
.30	.50	2.40	5.50	7.50
.35	.60	2.80	6.50	8.75
40	70	3.25	7.50	10.00

The company also does considerable business in renting special cars to large parties. On one day last summer about 800 people were handled in 10 special cars made up into three trains. The rates for special cars are as follows:

	One way.	Round trip
15 cent fare distance	$10.00	$15.00
20 cent fare distance	12.00	18.00
25 cent fare distance	15.00	22.50
40 cent fare distance	20.00	30.00

The schedule is arranged so as to give a 10 minute headway over part of the line and a 20 minute headway over the entire line. Every alternate car runs through from Evanston to Waukegan at 20 minute intervals and between these through cars another car is run as far as Ft. Sheridan during the summer and to Winnetka during the winter, giving a 10 minute service to the latter places. The first car leaves Evanston at 6 o'clock in the morning and the last car at 12:40 at night. This schedule is varied, however, according to the advance sale of theater tickets. Each of the ticket agents is in communication with the operating department at Highwood, and, if there is a specially large sale of tickets at any point, sufficient cars are run from this point to accommodate the traffic. The largest day's traffic this year reached 33,000 passengers without the use of special cars. The Sunday sales of tickets at Evanston have run as high as $1,700.

The theater at Ravinia is advertised in the amusement columns of the Chicago daily papers, by means of 300 bill boards along the line and by posters carried on the cars. The general admission to Ravinia Park is 25 cents, and the admission to the theater is charged at the usual prices of the best Chicago theaters. The ball room in the Casino rents for $25 an evening, the music being extra. This room is used exclusively for private social functions and no public dances are ever permitted here. During this winter individual season tickets and family season tickets are to be issued for the use of the members of the various country clubs along the line who have arranged for the joint use of the skating pond and toboggan slide at Ravinia Park. The individual tickets are $5.00 each and the family tickets $10.00.

The officers of the Chicago & Milwaukee Railroad Co. are A. C. Frost, president; G. M. Seward, secretary and treasurer; C. W. Merrilles, traffic manager; W. A. Blanck, electrical engineer; F. J. Geraghty, civil engineer; E. L. Des Jardins, superintendent; W. O. Kilman, general passenger agent.

Street Railways of Constantinople.

In the city of Constantinople the use of electricity for traction purposes, or in fact for almost any other purpose, is strictly prohibited but there are in the city four horse car lines, all of which are operated by the Societe des Tramways de Constantinople. The company has a total of 21.2 km. of track and operates 135 cars. The length of these several lines and the number of cars normally operated on each are as follows:

Line	Cars	Length
Galata-Pera-Chichli	75	5.20 km.
Azap-Capou-Ortakieui	24	6.04 km.
Emmenu Akserail		3.73 km.
Akserail-Yedicoule	36	3.60 km.
Akserail-Topcapou		2.63 km.

The officers of the company are: President, C. Weise; vice-president, H. E. O. Hamdy Bey; manager, C. Perdicaris. The other members of the board of directors are: S. Doctor, G. Chassiotis, A. Huber and C. Jenke.

Accidents.

November 20th, eight persons were seriously injured and several bruised and shocked in a collision between a street car on the Highland Park suburban line and an electric motor and train of freight cars, Des Moines, Ia.

November 23rd, a dozen passengers were badly cut by broken glass and bruised in a collision between a trolley car on the Hoosac Valley Street railway and a freight train on the Boston & Maine railroad, North Adams, Mass.

November 23rd, several persons were injured in a collision between two electric cars on the Boston & Northern Street Ry., at Wakefield Junction, Mass. Four were reported seriously injured and several bruised and cut.

November 25th, six persons were injured in a collision between a cab and an 18th St. car of the St. Louis Transit Co. The accident was due to the carelessness of the cab driver.

November 26th, two persons were killed and twenty injured in a collision between a trolley car of the Northern Ohio Traction & Light Co. and a train on the Pennsylvania Railroad near Bedford, Ohio.

November 27th, one man was killed and several persons injured when one of the large cars of the Public Service Corporation in rounding a curve overturned at Roselle, N. J.

November 28th, one man was killed and fifteen persons injured by the overturning of a Bellefontaine line car of the St. Louis Transit Co.

Piping and Power Station Systems. —II.*

BY WILLIAM L. MORRIS, M. E.

Piping Systems.

In this chapter will be considered the different systems of connecting up machinery and the various systems will be separately shown by diagrams, this method being the most convenient one for studying and determining the requirements for each class of service. The form in which these different systems are shown would ordinarily be the form used for "studies" previous to laying out the complete station diagram. The separate diagrams would be somewhat more distinct than a general diagram of all the lines, but the former would not serve to call to the attention of the pipe work designer and erector, such other lines as come in close proximity, and for which provision must be made. The general diagram of all the lines on the same sheet, each in approximately its correct position, acts as a constant reminder and greatly reduces the labor of laying out lines as well as the possibility of overlooking some of them. This is the kind of drawing that should be furnished to the piping contractor, showing the desired results but permitting him to lay out the details so as to accomplish these results in the simplest and most economical manner.

In case the contractor should fail to provide for any lines shown on this diagram he would necessarily be obliged to make changes so that the work would conform to the diagram, and as such changes would be due to an oversight on his part he could make no charge for them. The common practice, however, is to detail a portion of the work, leaving the uncertain and indefinite features to be covered by some general clause in the contract which protects neither the purchaser nor the contractor, but which merely leaves a loop hole for the engineer to shift the responsibility upon the purchaser or the contractor. Contractors, however, can protect themselves by adding the following clause to all quotations:

"This proposal covers only such materials as are definitely shown or listed on drawings or in specifications."

Contractors are not at the mercy of engineers when it comes to making bids. When an engineer has certain work to do he is compelled to place an order for it. If he cannot place the order on his own terms he must accept the contractor's terms. If he ignores all of the contractors who use this clause in their bids they can notify the purchaser to this effect, and as the purchaser is invariably a business man, he will readily appreciate the fairness of such a clause. The result would be that the engineer would be careful to make a study of the requirements instead of spending his time in the study of pipe work details. He would lay out a diagram of every line and system required, make the contractor familiar with the situation and make him responsible for the design, details, location and the support of all lines. The contractor would look after his clearances and would take nothing for granted as he would have to do if the engineer furnished the working drawings.

The various systems will now be described and later on the parts of each system will be considered in detail. Fig. 8 shows the plan of a station having three generators and five boilers at one end of the station and the exciters and pumps at the other end. The dotted lines indicate future extensions. This plan will not appeal to the reader as unusual for he probably has in mind several stations similarly arranged. Generally it may be assumed that the piping and machinery should be laid out as shown, but instead of using the piping arrangement given in Fig. 8 it may be desirable to employ some system; that is, some arrangement that will provide for continuous operation of the plant and by means of which at least two-thirds of the plant may remain in operation during the time that repairs are being made. Fig. 9 shows the pipe work of this station redesigned so as to conform to such a system. It may be noted that two generators out of the three, three boilers out of the five, also one feed pump and one exciter engine can be used at any time, that permitting the shutting down of any portion of the steam main which may need repairs. The value of laying out a diagram before ordering the machinery shows itself clearly when considering whether a better system could be laid out. Fig. 10 shows a better balanced system in which there are no double lines of piping, and this arrangement allows the use of two boilers for each of the two engines in case repairs are being made.

To lay out a station system requires full consideration of a great many details besides piping, but these details must be considered as only a part of the system and nothing pertaining to the station should be ordered, or even considered as final, until all of the details of the system have been thoroughly digested and determined. It is very easy to refer to the diagram in Fig. 8 and say that it should have been arranged as in Fig. 10, although the conditions may have been such that the arrangement shown in Fig. 9 might be the best solution with possibly a change in the number of boiler

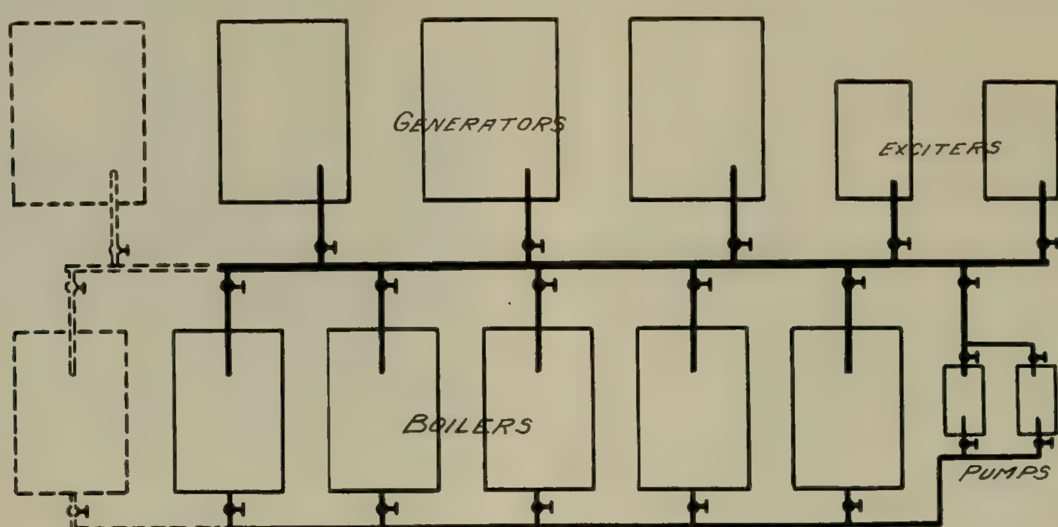


FIG. 8.

units. No plan nor system can be styled a priori the "best" for that one is the best in each case which best complies with all of the conditions. Nevertheless a fixed plan for securing the most satisfactory results can be followed and no matter what the surrounding conditions are, some system can be employed.

The fundamental requirements of station systems are reliability, accessibility and durability. The requirements of the station must

than three units all of the same size. No unit should be so large that the station can not be operated without it by overloading the other machinery to the permissible limit. The practical advantages in having units of the same size and pattern are too great to be abandoned on account of the petty economies that may be secured under certain conditions by using one large unit. As an illustration of this the following case of a break down is instruc-

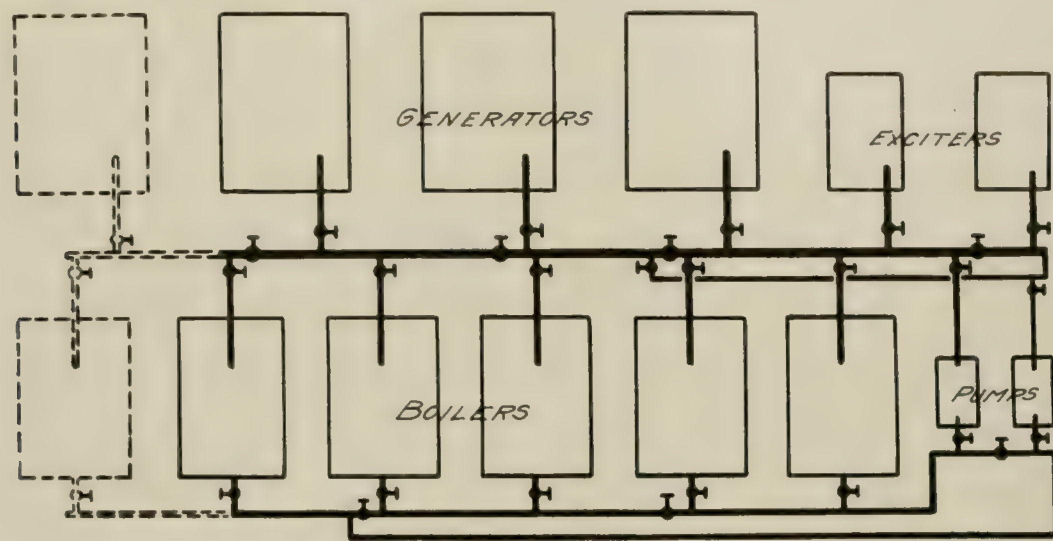


FIG. 9.

be first determined and some system adopted that will meet these requirements. If the requirements are that the station should run as many hours a day as is convenient for the station operators, the system for such a condition needs practically no valves, no reserve capacity nor any emergency provisions. However, this class of station work does not come into the hands of an engineer to lay out. He is engaged to design stations that will never require a shut down of the system. It is the conditions of service that must determine the system. If the service is 20 hours a day the station

tive. Three units were installed, all of the same kind, size and pattern. One unit was out of service, the wrist pin boxes having been removed for rebabbitting, fitting, etc. Two engines were required to carry the load, and while this engine was out of service, a valve eccentric rod broke which necessitated running one engine with almost a double load. The valve rod was immediately taken from the engine out of service and fitted to the engine that broke down, so that in a short time the latter was in service again. The single engine could not have carried this overload except for a

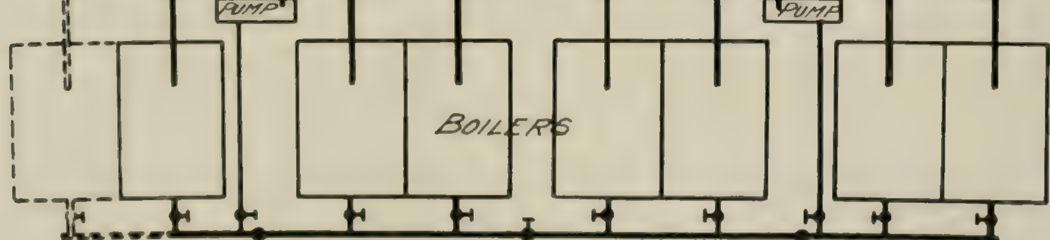


FIG. 10

should be laid out with this in view. If it must run 24 hours a day, running for eight hours at half load only, then the system should provide for repairs being made and at the same time maintaining the capacity.

The method of determining the most suitable size of units for a station will not be considered in detail as the question is quite foreign to piping and piping systems except insofar as the number of units is concerned. If the station is required to generate at all times two-thirds of its total capacity, the plant should not have less

very short time, and having all the engines of the same pattern avoided a shut down. If the engines had not been all similar the plant would have had to be shut down at least a day in order to finish the repairs.

In any case the original installation should be for a two-division, three-division or four-division plant with provision for future divisions. If the plant is to be a two-division plant it may be built with two units each of a capacity slightly larger than the minimum load conditions demand, and the future unit may be made twice the

capacity of these smaller units. This arrangement of units would be permissible in a plant which ordinarily delivers only half of the power called for on Sundays, holidays, etc., and this condition is quite an unusual one in power stations. It has been found ordinarily that a three-division plant is more suitable for permitting repairs to be made and also requires less investment for reserve capacity. If the plant is to be a three-division plant, the boilers should be in three divisions, say six, nine or twelve in number. The auxiliaries should be in pairs, not necessarily together, but each sufficient for the entire plant, and they should be connected to the different divisions so that when one division is out of condition the other auxiliary will be on an operating division.

In order to more fully explain the features to be determined by diagrams as well as the laying out of the diagram the requirement of a sample station will be considered and the method of selecting machinery, etc., followed up. It will also be shown that by this method can be determined much of the station lay out and the auxiliaries required at the same time the piping system is developed.

Let it be assumed that the station will require now three units for an output of two-thirds of the total capacity of the units and later will require an additional unit such as shown in the diagram Fig. 10. There is but one solution of the problem under these conditions, and that is that the station shall ultimately be a four unit plant for output of three-quarters of the total capacity of the units. The boilers must be arranged in three units so as to allow one to be out of condition for cleaning and repairs. Boiler cleaning must not be considered a contingency but a requirement that is certainly unavoidable.

Assuming the engines to be of 2,000 h. p. each, then two 500-h. p. boilers would be required for each engine, but by assuming three engines of 2,000 h. p. each or a total of 6,000 h. p., there would be 3,000 h. p. in boilers to be divided into five units, so as to allow one boiler to be out of service. This would give five 600-h. p. boilers. If the fourth engine unit is likely to be ordered before the three units are called upon to carry full load for a large part of the time it would be safe to estimate on 8,000 h. p. of engines or 4,000 h. p. of boilers or seven boilers each of 555 h. p., which is a somewhat better arrangement for the four unit plant.

When it comes to determining auxiliaries there should be considered only that future unit for which space has been provided in the building. More than this is useless speculation, and further, such apparatus as would be provided today, it is possible that no one would think of using in the future when it came to be required. The present installation may include one of the two condensers for the completed plant, in which case it would be advisable to provide a 5,000-h. p. condenser which would be larger than required for two units, but somewhat small for the three units. A loss in vacuum would be so infrequent that its effect on the station economy would be imperceptible. If the fourth unit is to be installed at an early date it would then be more economical to put in two condensers at the time the three units were installed. These are points that the engineer must determine, and he may decide that he would not wish the plant to run non-condensing even during the short time required to make a repair. As this would be the case if one condenser were installed, it is assumed that two are wanted.

The atmospheric exhausts must be so designed that a repair to one must not interfere with the others as the atmospheric exhaust is one of the vital lines of the plant and must be as well safeguarded as the steam header. Assume that the condensers will be of the elevated jet type, with electrically driven centrifugal circulating pumps. Economizers will be installed and, as no steam will be required to heat the feed water, the installation can be simplified by using motor driven circulating pumps instead of engine driven. In case the lift be slight engine driven circulating pumps may be used and the exhaust carried to the heater, but the engines ordinarily used for this service are so uneconomical in steam consumption that together with the other auxiliaries they would deliver more exhaust steam than the heater could condense. The difference in economy between engines exhausting part of their steam to the atmosphere and electrically driven pumps is so slight that the better practice is to adopt that which requires the least labor to operate, which is unquestionably the motor drive. One, two, three or four circulating pumps can be used for the two condensers and only such as are required to deliver the necessary cooling water be operated. It may be assumed for the present that three circulating pumps will be used, each sufficient for one condenser, although when the circulating water is extremely hot all three pumps may be required for the two condensers.

The requirements to be met by the dry vacuum pump are so variable, due to changes in the temperature of the water, amount of vegetable matter it contains and the air leaks in the pipe line, that it may be necessary to run the air pump at a very high speed some days and possibly it can be run very slowly a week later. Any motor drive is very unsatisfactory for the air pump, so it will be considered that this will be of the steam driven fly-wheel type. It is possible to vary the speed of the dry vacuum pump within a wide range, and as it is important to minimize the labor for attendance one dry vacuum pump for both condensers will be chosen.

In regard to the boilers, they will be taken to be of the water tube type set two in each battery, and in order to include more piping details in the plan it will be assumed that underfeed stokers are to be used and also induced fan draft. As previously stated, economizers will also be used.

(To be continued.)

Transit Notes from Chili.

Construction work on the lines of the Compania de Tranvias Electricos de Valparaiso has been under way for some time, 2½ miles of single track and almost 2 miles of double track being finished at this writing. It is expected that this portion of the line will be ready for operation January 1, at which time 12 cars will be run. The total equipment for the 15 miles of track that is to be constructed will be 60 motor cars and 40 trailers.

Besides the electric traction plant that is being installed by the company, cables for some 30,000 16-c. p. lamps are being installed as well as equipment for the complete street lighting, which for the near future will consist of some 200 arc (9 continuous current lamps of 9 amperes between the two outers of the 3-wire 2 x 200 volt system), 700 Nerst lamps (½ and 1 ampere and 200 volts) and some 800 incandescent lamps of 25 c. p. each.

The water power plant which is being constructed by the Compania de Tranvias Electricos de Valparaiso will develop 3000 h. p. from a 900-ft. fall, which is some six miles from the sub-station in the town. A steam plant of two 450-h. p. engines has also been installed, which will be used for traction and lighting purposes until the water power plant now in construction is completed.

Chicago Union Traction.

Two petitions have recently been filed by the receivers for the Union Traction Co., and the North Chicago, and by the receivers for the Union Traction Co. and the West Chicago, asking for the authority to borrow money and issue receivers' certificates in order to carry the companies through the winter months, to make such improvements as may be found necessary and to put the railroad company in first-class running shape. The Illinois Trust & Savings Co., the Northern Trust Co., the Fidelity Trust Co., the Central Trust Co. and the Guarantee Trust Co. appeared before the court at the hearing held at 10 o'clock on the morning of December 15th. These companies, who hold bonds, and whose attorneys declare the receivership must come to an end, are opposed to the above plans.

Judge Grosscup decided that the Union Traction Co., which in this case means its underlying companies, must pay for the 100 new cars over which there has been a dispute. The report of C. G. Goodrich, vice-president, secretary and treasurer of the Twin City Rapid Transit Co., whom the judge had called in as an expert, sustains the action of the majority of the receivers.

It is believed that before Jan. 1, Judge Grosscup will probably direct the receivers for the Union Traction and the West and North Chicago companies to electrify the cable systems on all lines on which the franchises have not expired. Estimates on this matter were submitted by General Manager John M. Roach, at the request of Receiver J. H. Eckles, which place the outlay at approximately $1,350,000.

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Next meeting, 1905.

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Next meeting, 1905.

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Date and place of next meeting not decided upon.

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Next meeting at Denison, Tex., April, 1905.

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Date and place of next meeting not decided upon.

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Next meeting at Dubuque, spring of 1905.

New Lines and Extensions.

November 21st, regular service on the Illinois & Iowa interurban road was inaugurated, the first car leaving Clinton and Davenport simultaneously at 6.30 o'clock.

November 21st, the Davenport & Suburban line opened up its new LeClaire St. line, this being the completion of the extension work for the season.

November 21st, the new extension of the Twin City Rapid Transit Co.'s line circling White Bear lake and going through the village of White Bear was completed.

November 23rd, the extension of the Hagerstown Railway Co. line from Hagerstown to Myersville, Md., was completed and the first car run over the new line.

November 24th, the construction of the Fargo & Moorehead Street Railway Co.'s line was completed and the first cars were run over the road.

November 26th, the Campbell cut-off of the San Jose & Los Gatos Interurban Railway Co. was completed and the parlor car "Edith" was the first to make a trip over the new line.

CHICAGO THE LONDON

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SUMMARY OF CONTENTS.

EXPERIMENTS TO DETERMINE AIR RESISTANCE.

Train resistance is a very important matter to the designing engineer in the railway field, and the subject has been an attractive though not a particularly fruitful field for investigation; we do not mean that there has been anything wanting in the volume of the results achieved, but that as yet there have been no general formulas of wide application and recognized reliability developed. The leading authorities are not even agreed upon the nature of the functions of the numerous independent variables that should enter into the ideal train resistance formula. There are reasons why the investigation of train resistance has been especially difficult; the number of elements entering is large, and it has been almost impossible to so exactly control the conditions that all elements can be kept constant except the ones under examination; also the magnitude of the forces and speeds to be dealt with makes the practical problems serious even could a perfectly satisfactory theory of experiment be assumed.

Existing formulas are largely empirical and are accurate only for a short range of the variables which enter into them. Any extension, beyond the range of the experiment, of such results is quite as apt to be wrong as to be right, perhaps more so. Numerous attempts have been made to determine the effect of certain elements of the problem by experiments upon models, but these results can be accepted only as qualitative and are perhaps most valuable in pointing out the direction which further experiments under actual conditions should take.

It is now generally accepted that no single formula can cover the entire range of conditions, and that the most satisfactory results are given by a formula involving several terms each modified by a coefficient to be determined experimentally for each class of service. The principal variables to be thus modified are journal friction, rolling friction and air resistance, this last being a very important factor for high speeds.

The Railway Test Commission appointed on the occasion of the Louisiana Purchase Exposition, early decided as part of its work to investigate the subject of the air resistance to moving cars, and to try and separate this into its components of head, side, and stern resistance. The experiments are about to be undertaken on the tracks of the Indiana Union Traction Co., the special car designed for the work being practically completed.

The car the air resistance of which is to be measured consists of an electric car body mounted on a motor-driven flat car, and provided with separate front and rear vestibules. The car body is supported on wheels which rest on rails laid upon the flat car, the wheels being mounted on roller bearings. A delicate dynamometer designed to indicate and record the tendency of the body to move with reference to the flat car platform will show the resistance of the air to the passage of the car. By using vestibules of different shapes it is expected to determine the effect of a "wind splitter." An imporant feature of the design is that the dynamometer may be used to measure the resistance of the vestibule itself, that is, the vestibule can be mounted separately from the car body and connected to the dynamometer. This applies to either the front or rear vestibule.

Aside from the practical value of the more exact air resistance coefficients which these tests are expected to give, the experiments are of peculiar interest because they promise to show the truth or falsity of various existing ideas as to the relative importance of the shape and dimensions of the several parts of the car. It will doubtless be found practicable to extend the scope of the experiments, and by placing the test car at different points in a train investigate the side resistance as affected by the position of the car in the train.

FREIGHT ON ELECTRIC LINES.

At the October meeting of the Ohio Interurban Railway Association the principal subject for discussion was the handling of freight by electric railways. Up to the present, experience of electric lines in "goods traffic" has been for the most part with what should be called express rather than freight, although the term "freight" is used by some companies handling express matter only. The word "freight" is used because "express" is thought to imply a delivery service. Doubtless this loose use of descriptive words accounts in large measure for the peculiar trend taken in the freight

discussion mentioned, when there was a jump from the consideration of a parcel business to a car-load business.

It was brought out before the Ohio association that a few cars handling small shipments could earn a good revenue, but that the operating expenses might be too high to render the business profitable. Also that on nearly all lines represented at the meeting the conditions of short curves, heavy grades, weak bridges, and restrictions in city ordinances, would effectually prevent hauling standard steam railroad freight cars over the road, while the motive power available would restrict the number of cars in a train to very few. The optimistic arguments were that admittting existing adverse conditions as preventing the handling of freight in carload lots, these same conditions were a handicap in improving the passenger service, and that changes in grades and alignment to make the road practicable for freight would be equally advantageous for passengers.

The belief appears to be widespread that because of the success of electric railways in appropriating the local passenger business of competing steam lines, the opportunity exists for a similar appropriation of freight business. While there is no reason why electricity cannot be applied to moving freight, equally as well as steam, there is considerable reason to doubt whether its extended application will come about in the way that many electric railway men now hope.

The results achieved by electric lines have been in catering to local passenger business, which requires comparatively small train units, run at short intervals, and at as high speed as conditions permit. On the other hand, the economical transportation of freight means very large train units, run at long intervals and at slow or moderate speeds.

The use of the tracks of urban street railway systems wherever possible is an advantage for local passenger service, but is a distinct embarrassment for freight, because it almost invariably involves restrictions as to the number of cars permitted, and makes it difficult to get suitable terminal facilities.

If electric roads must be relocated in order to make them successful freight carriers is it not more probable that the transportation of car-load freight by electric motive power will come about by the electrical equipment of the steam lines?

THE ERA OF RECONSTRUCTION.

The answer to European criticism that American railroad building was of a "temporary" nature has always been that temporary construction, or rather construction not of the highest class, was enforced by American conditions. The railroad through a new country had first to develop the country before the expenditure necessary for the best class of construction could be considered justifiable.

Similar conditions were considered to obtain in the electric railway field, at least by the earlier electric lines, and some of these now operate at serious disadvantage because the item of first cost was given too much weight when the road was built. In later enterprises the promoters have profited by the experience of earlier builders and made a "permanent" road to begin with, having every confidence that the development of the territory served would be so rapid as to repay quickly the increased first cost, which would render unnecessary and reconstruction to eliminate the bad effects of the initial economies. Numerous instances can be cited where this confidence has been amply justified, and the conclusion is that the earlier lines will eventually have to consider extensive betterments that in some cases will mean not only rebuilding but also relocation of the road.

The "era of reconstruction" marks a great step in progress, and we believe that it is now at hand. The leading article in this number of the "Review" is a description of the Chicago & Milwaukee Electric Railway, a road which was first opened between Evanston and Waukegan, a distance of 27 miles, in 1899. About a year ago the work of complete reconstruction was undertaken, making the property a double-track one throughout, and all of the new grades, [illegible] and bridge abutments have been designed and constructed for four tracks.

It is also interesting to note that this road, which was built five years ago, was the first road in this country to be equipped with a high-tension alternating current station with direct current rotary converter sub-stations, and it is also, we believe, the first road of this character to have established a traffic which warranted its almost complete reconstruction. It is further of interest to examine the principal changes which are being introduced upon this road. When the road was first built it followed the highway for considerable distances and frequently made sharp curves at street corners to avoid obstacles. It also followed the grades of the streets which in many cases were too severe for high speed running or for carrying heavy loads. The disadvantages of these conditions have evidently been fully appreciated by the company, a fact which is evidenced by the changes which are being made. One of the conditions which has been most strictly followed is that of keeping the road off the public highway, and this is being done in many cases at very great expense. Real estate values along the north shore suburbs have appreciated enormously within the last few years, but notwithstanding the large expense it entailed the company has not hesitated to relinquish perpetual and 50-year franchises in two places and to purchase adjoining strips for private right of way. The cost of keeping off the public highway through Lake Bluff and for some distance north of this town shows the value which the company places upon having a private right of way. For more than a mile in Lake Bluff the street ran close to the Chicago & Northwestern Railway, leaving no available space for the electric road's right of way. To overcome this difficulty it was found necessary to purchase the street and some of the adjacent property, to open a new street some distance to the right of where the old one ran and to move a long row of houses back onto the newly opened street. This work was carried on for over a mile in the town of Lake Bluff and for two miles and a quarter north of the town.

While the traffic on this road has been sufficient to warrant these very heavy expenditures, it is very certain that no such investment for improvements would have been made by a conservatively managed company such as this one unless unquestionable ultimate profits were to be procured by means of these changes. The action of this company, therefore, should be a valuable object lesson to any electric railway builders who may in the future propose to provide any other than the best possible roadbed construction.

NAMES AND ADDRESSES ON FORMS.

In his report presented to the Accountants' Association at the St. Louis meeting, Mr. Elmer M. White called attention to a fault found in the great majority of accounting forms adopted by electric railways, in that the name of the company is placed in the most prominent place on the form and printed in the largest type, while the name of the form itself appears in small type, if at all. The criticism on this design was that the forms of a company being primarily for the use of the employes of that company, convenience would be served best by making the name of the form occupy the most prominent position.

The desirability of making the name of the form prominent is also appreciated when the officers of another company call upon the Accountants' Association for information as to the current and best practice, interchange of which is readily had through the Associations' collection of Blanks and Forms. This point was brought out when inspecting the Accountants' book of "Freight and Express Forms" lent to the Ohio Interurban association. Another minor point wherein improvement could be effected was noted at the same time, when it was found that there are a good many companies assuming they are so well known as to make an address unnecessary. The multiplicity of "Metropolitan," "Union" and "Consolidated" companies sometimes renders identification difficult.

These points, perhaps, may be considered trivial; none the less with interchange of methods and means between different companies recognized as desirable, it is well worth while to do the little things that will facilitate work and avoid mistakes.

INTERURBAN RAILWAYS IN THE HIGHWAYS.

Two interesting decisions affecting the status of interurban electric railways in city streets and country highways are reported in this number of the "Review" and represent the latest pronouncements of Illinois and Indiana courts upon this point, and the extent to which the companies may exercise the right of condemnation under the doctrine of eminent domain.

In Illinois the question was raised by the Illinois Valley Traction Co., which had secured grants for the use of the highway, and later decided that from engineering and operating considerations it would

be better to abandon the highway for the greater portion of the distance. The position taken by the Supreme Court is that the company being incorporated under the Horse and Dummy Act, must accept the theory of that act, which is that the railway is built in the highway to meet a public necessity for better service for users of that highway. If the population adjacent to the highway is so sparse, or the local travel over it so slight as to fail to support the enterprise, then there is no public necessity for the railway. If the company wishes to ignore the highways it should incorporate under the Railroad Act, assuming the burdens imposed by that law as well as the privileges.

In Indiana the point at issue was whether the operation of interurban rolling stock in a city highway constituted an additional burden on the adjacent property. The case was brought against the Ft. Wayne & Southwestern Traction Co. by a property owner in Ft. Wayne. The court held that this question depended not upon the name, nor upon the motive power, nor upon the character of the physical construction, but upon the nature of the traffic. When consistent with the use of the street by the lot owner the use by a railway is not an additional burden. The carrying of passengers, light express and mail matter through city streets in interurban cars is held not to be inconsistent with the use by the property owner.

Reference to this subject in the "Review" for June, page 371, where the policies of several different states on this question were cantrasted. At that time Wisconsin and Louisiana were the only states discriminating against interurban lines as compared with street railways proper, the Indiana case being then undecided, and the case just reported shows that one more state has been added to the list taking the more liberal view as to the rights of electric interurban lines.

ANOTHER NEW ASSOCIATION.

The Indiana Electric Railway Association is the latest addition to the family of associations, an addition well warranted by the great development of electric railways in that state. Preliminary meetings were held in November, and December 9th an organization was formed. The first regular meeting for the election of officers will be Jan. 12, 1905, at Indianapolis. The affairs of the association are now administered by a committee comprising:

Gardner F. Wells, general manager Terre Haute Electric Co.; Paul H. White, general manager Indianapolis & Martinsville Rapid Transit Co.; C. C. Reynolds, general manager Indianapolis & Northwestern Traction Co.; J. W. Chipman, general manager Indianapolis & Eastern Traction Co.; A. L. Drum, general manager Indiana Union Traction Co.

INTERURBAN LINE MODIFIES BUSINESS METHODS.

At various times we have commented in the "Review" on the general effect which interurban electric railways have had in stimulating the business in the territory served by it, and, what is even more important, in developing new business. It may have been considered that we viewed the situation with a prejudice in favor of the electric railways and were inclined to overestimate their effect in this direction. However, in the Iron Age for December 1st is the following interesting statement as to the effect of the interurban railway in modifying the hardware business:

"In cities where interurban railway lines radiate in all directions to the smaller towns and villages the complexion of the hardware business is being changed by the advent of the freight carrying trolley road. Retail dealers in the tributary territory served by such systems are enabled to carry smaller stocks and to avail themselves of the quick transportation facilities from the jobbing and manufacturing centers offered by this new mode of transportation. A dealer who has an opportunity of selling something not in his stock calls up the manufacturer or jobber by telephone and asks that an order for the thing in question be put onto the next interurban car going his way. The result is that within a few hours after the customer has called for an article, and perhaps before he has left town, the article has been delivered from a jobbing center, say 30 miles away. This new mode of doing business is strengthening the jobbing trade in such centers and is also compelling them to carry larger stocks than they would ordinarily, as this method of distribution tends to make the small trade rely upon the jobber for the supply of certain kinds of goods. This influence is one which is developing, too, an important class of local jobbers, who in connection with a fine retail business are able to supply small houses in the outlying country districts."

Relief Associations for Small Electric Roads.

BY CHARLES R. KIMBALL, PORTSMOUTH ELECTRIC RY., PORTSMOUTH, N. H.

Much has been written describing the relief associations connected with the larger systems of electric roads, but little or nothing has been said about carrying out the same idea with the smaller roads, where only a few men are employed.

It is perhaps more difficult to maintain an interest where the membership is necessarily limited, but that an association can be made a success, and of no little value to its members, has been proved. The rules governing such an association must be materially changed from those of similar organizations on the larger roads, and will not admit of any large expenditures for salaries for its officers or for its assessments.

We have in Portsmouth such an organization called the Portsmouth Electric Railway Relief Association; its membership includes conductors, motormen, car barn men, trackmen and linemen, giving a total membership of about thirty-five. It was organized in 1900, and since that time interest in it has tended to increase rather than diminish, and every man is enthusiastic for the success of the association.

Meetings are held annually for the election of officers and to admit new members, and at such other times as the president may direct.

The amount paid to members for disability is $6.00 per week (after the first week), for eight consecutive weeks, and longer, upon a vote of the association to continue the payments.

Upon the death of a member an assessment of one dollar is levied for a burial fund.

No money is kept in the treasury, but assessments are made as occasion demands.

Only one officer is given any salary; he is the treasurer and collector, who is paid a small amount annually.

In this way the yearly cost to members is but a trifle, while the association is a great help to those who are incapacitated from work through sickness or accident.

Early Line Material.

Editor "Review":

I am particularly glad to note the short article appearing on page 893 of your November issue entitled "A Hanger Relic." In the last few years I have undertaken to describe to different people something of the type of hanger we used in early railway construction and this is the identical type that was first employed when the writer entered the street railway construction field in 1887-8. Our span wires were made of No. 6 wire and these hangers with the screw eyes fastened into the wood, as shown in the cut, were hooked over this No. 6 wire, and to keep the hanger from traveling on the span wire we used fine steel or copper wire, wrapping it around the span wire and tying the screw eye in place on the span wire.

The type of ear employed was that of the short, deep groove solder ear, with a loop or eye instead of the hub or boss as now used. The lower screw eye was hooked into this loop or eye in the ear and from this the trolley wire was suspended.

We made our hangers by having this piece of wood, which ran all the way through, turned up as suggested in the article, but our umbrella was made of heavy duck. After the hanger had been completed by making several turns of the heavy duck around the wood to form the umbrella or skirt it was immersed in a white mineral paint and then paraffined. I did not know that any of these hangers were in existence today, but evidently this one as shown is a rare specimen. Your truly,

Chicago. W. R. Garton,
President W. R. Garton Co.

November 21st, the last spike was driven in the line of the Consolidated Railway Co. between Montowese and Wallingford, which was the last link in the trolley chain from New York to Boston.

Physical Features of the Indianapolis Northern Division of the Indiana Union Traction Co.

[illegible] more recently completed portions of the system of the Indiana Union Traction Co., of Anderson, Ind., perhaps more generally known as the Indianapolis Northern Traction lines, are of especial interest as representing the highest standards in railway construction. Too many of existing electric railways have been built without due regard to economy of operation, because the promoters, having in view the original cost or difficulties in securing the most desirable right of way, ignored the recommendations of their engineers. Such a policy is in the end a most costly one, and usually involves the ultimate reconstruction of the line before it can be operated with satisfactory results.

In the location and construction of the Indianapolis Northern the management did not lose sight of the economies in operation [illegible] by securing good alignment, light grades and [illegible] construction.

The engineers having reported upon the best route available, this was adhered to in building the road. While this policy involved extraordinary expenditures for bridges, embankments, rights of way across valuable farm lands, etc., and greatly increased the first cost, the result is shown in the few cars required for operation, only seven cars being needed to give an hourly service over the 80 miles. The limit of the investment in permanent way that that is economical if it will dispense with one car in operating to [illegible] at about $[illegible].

By courtesy of the general manager of the company, Mr. A. L. Drum, we are enabled to illustrate herewith the more important of the construction standards, including earth sections, bridges, culverts, trestles, and overhead work, and also to show completed views of the most interesting structures.

The Indianapolis Northern Traction Co. was incorporated April [illegible] to build and operate electric railways from Indianapolis to Logansport via Noblesville, Tipton and Kokomo, and from Kokomo to Peru, and from Elwood to Tipton.

July 1, 1902, the property of the company was leased to the Union Traction Co. of Indiana for a term of 50 years, the latter company agreeing to guarantee the principal and interest of the bonds of the Indianapolis Northern.

May 27, 1903, the Indianapolis Northern company was merged with the Union Traction Company of Indiana, and the capital stock of the consolidated company exchanged for the stock of the constituent companies.

June 8, 1903, the Indiana Union Traction Co. was incorporated and June 30, 1903, leased the entire property of the Union Traction Company of Indiana.

TRESTLE ACROSS STRAWBOARD FILTER BED, NEAR NOBLESVILLE—2,810 FT. LONG.

General Statistics.

The following statistics give a concise statement of the principal physical features: Miles main track, 105; miles second track, 5.7; miles side track, 4.3; number of sidings, 50; total degree of curvature, 2370 degrees; maximum degree of curvature outside of city limits, 3 degrees; total length of tangent, 84 miles; per cent of tangent, 75; total rise in feet, north bound, 720; total fall in feet, north bound, 1030; number of steel bridges, 35; linear feet of steel bridges, 4600; number of trestles, 3; linear feet of trestles, 3070; number of National Bridge Co. arches, 33; number of standard arches, 6; total cubic yards of earthwork, 1,150,800; total cubic yards masonry in bridges, 20,400; total yards masonry in arches, 4,100; total number of ties, 6 in. x 8 in. x 8 ft., 283,300; total yards of ballast, 270,000.

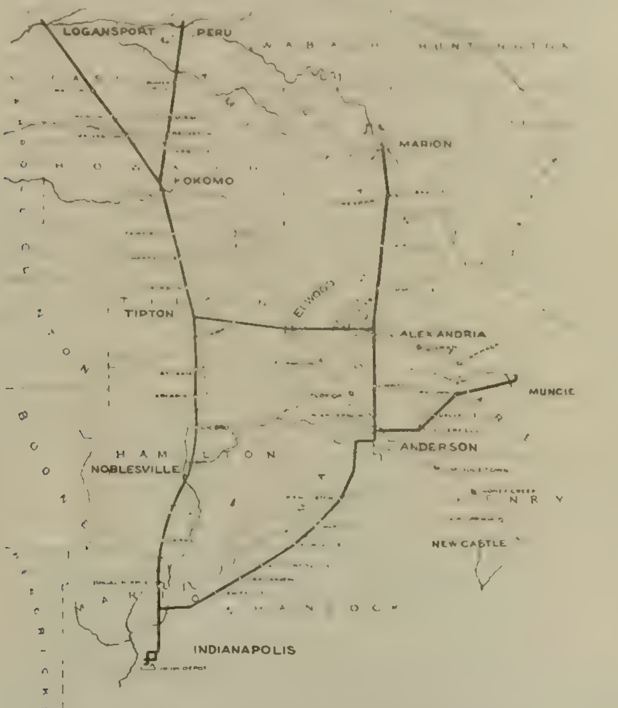
The maximum grade on the line is 1 per cent excepting for 4,000 ft. near Peru where it is 2 per cent, and at approaches to overway and underway crossings where the maxima are between 2 and 2½ per cent.

The only grade crossing with a steam railway outside of cities is

with the Monon. Here a crossing was condemned under the state law and a complete interlocking signal plant with derails installed by the Union Switch & Signal Co. The first cost and maintenance of this plant are charges on the Traction company, it being the junior road.

Territory and Population.

The heavy lines on the accompanying map show the whole of the interurban system of the Indiana Union Traction Co. that is now in operation. Three proposed lines, those from Anderson to Elwood, from Alexandria to Muncie, and from Anderson to New Castle, are indicated by light lines.



MAP OF INDIANA UNION TRACTION SYSTEM.
(Light lines indicate proposed extensions.)

The distances measured from Indianapolis on the new lines are: To Noblesville, 23.6 miles; to Tipton, 40.6 miles; to Elwood, 50.8 miles; to Kokomo, 56.1 miles; to Peru, 75.3 miles; to Logansport, 79.5 miles.

The population tributary to these lines as given by the census of 1900 and as estimated Dec. 1, 1904, is as follows:

County.	City or Town.	Census 1900.	Estimated. Dec. 1, 1904.
Marion	Indianapolis	169,670	200,000
	Broad Ripple	487	536
	Nora	70	77
Hamilton	Carmel	498	548
	Noblesville	4,792	6,000
	Cicero	1,603	1,763
	Arcadia	1,413	1,554
	Atlanta	1,000	1,100
Tipton	Tipton	3,764	5,000
	Jackson	72	79
	Sharpsville	500	550
Madison	Elwood	12,950	14,000
Howard	Fairfield	211	232
	Kokomo	10,609	14,000
Cass	Jewell	100	110
	Galveston	694	760
	Lincoln	170	187
	Walton	498	548
	Logansport	16,204	20,000
Miami	Miami	320	352
	Bunker Hill	568	624
	Peru	8,463	10,000
Total		234,656	278,020
Rural population			15,000

Bridges.

The bridges with longest spans are those across the Big Pipe Creek 5 miles from Peru, and across the Old Jordan and the White Rivers near Noblesville; all these are through Pratt truss bridges.

NORTH ST., NOBLESVILLE.

The first two have each a single span of 104 ft. and the last has two spans of 150 ft. each. At Fall Creek, near Indianapolis, will be a stone arch bridge with three 70-ft. spans and a total length of 250 ft.; this structure is not yet completed, and the company is using temporarily another route for entrance to Indianapolis. The longest bridge is that over the Wabash River at Logansport; this has a total length of 1,040 ft., there being 13 spans of 75 ft. each and two of 30 ft. each, all of the deck plate girder type. The longest bridge structure is a pile trestle across the "filter" of the American Strawboard plant at Noblesville. There being a state statute prohibiting the Strawboard company from turning the waste water from its plant directly into the river, this waste is delivered to a large pond, and after purification by settling, escapes to the river through

STANDARD CONCRETE ARCH—PENNSYLVANIA R. R. TRESTLE IN BACKGROUND.

[illegible] sluiceway. The length of the pile trestle across the pond and adjacent low ground is 2,810 ft,; the spans are 16 ft. each.

All bridges were designed according to Cooper's 1901 specifications for electric railways. The dead load to consist of the weight of the structure itself. The live load is assumed to consist of wheels carrying 25,000 lb. each spaced at intervals of 6 ft., 14 ft., 6 ft., 19 ft., 6 ft., 14 ft., 6 ft., 19 ft., 6 ft., etc., and 100 lb. per sq. ft. for the rest of the floor.

Wind stresses and vibration are provided for by proportioning the top lateral bracing in deck bridges and the lower lateral bracing in through bridges to resist a lateral force of 300 lb. per ft. of [illegible] load. Bottom laterals on [illegible] bridges and top [illegible] on through bridges are proportioned [illegible] per lineal [illegible].

In trestle towers [illegible] per vertical lineal foot of trestle bent [illegible] is added. A variation of 150° F. in temperature is presumed. On curves the centrifugal force of cars is assumed to act 5 ft. above the base of the rail and is taken as live load, the speed being taken at 50 miles per hour. Effect of braking cars on bridges is also provided for.

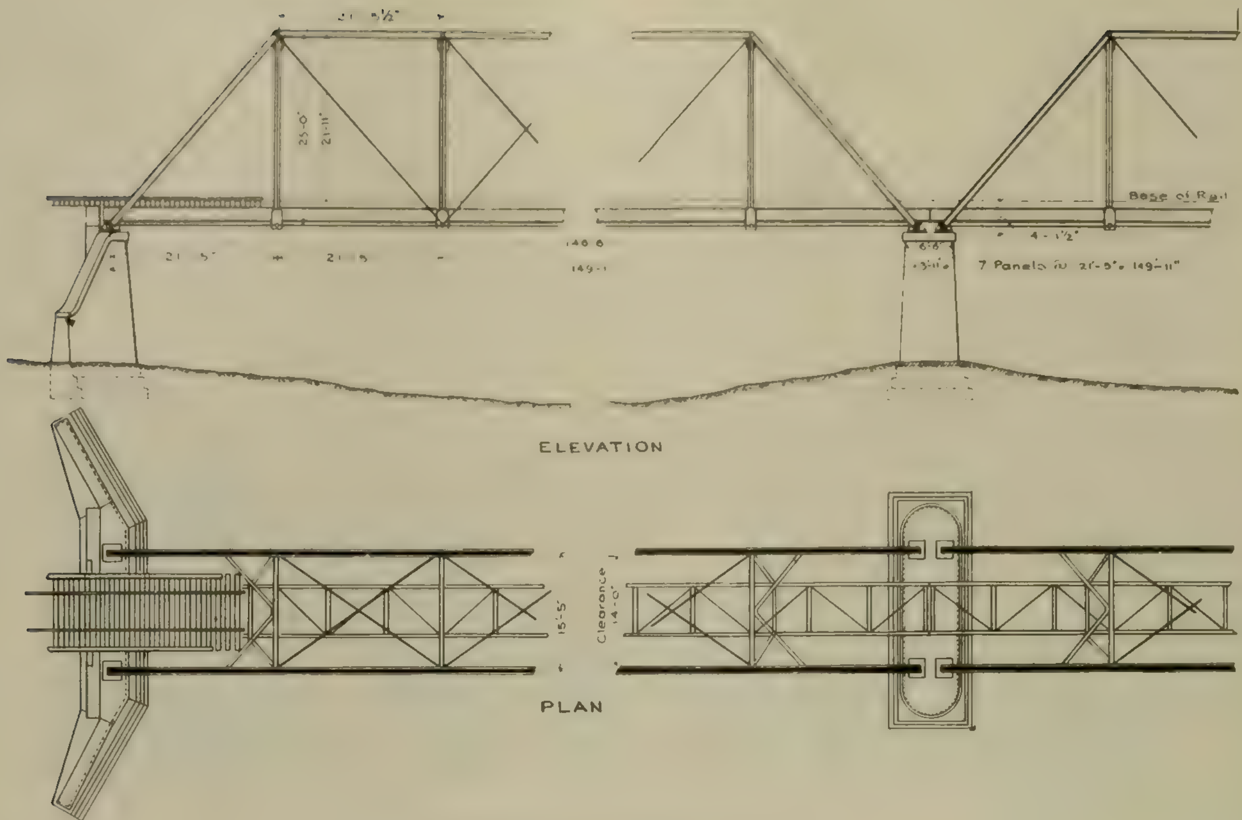
ONE OF THE TWO BRIDGES ACROSS THE WABASH RIVER AT LOGANSPORT

[illegible] OF LAKE ERIE & WESTERN RY. AND HIGHWAY NEAR [illegible]

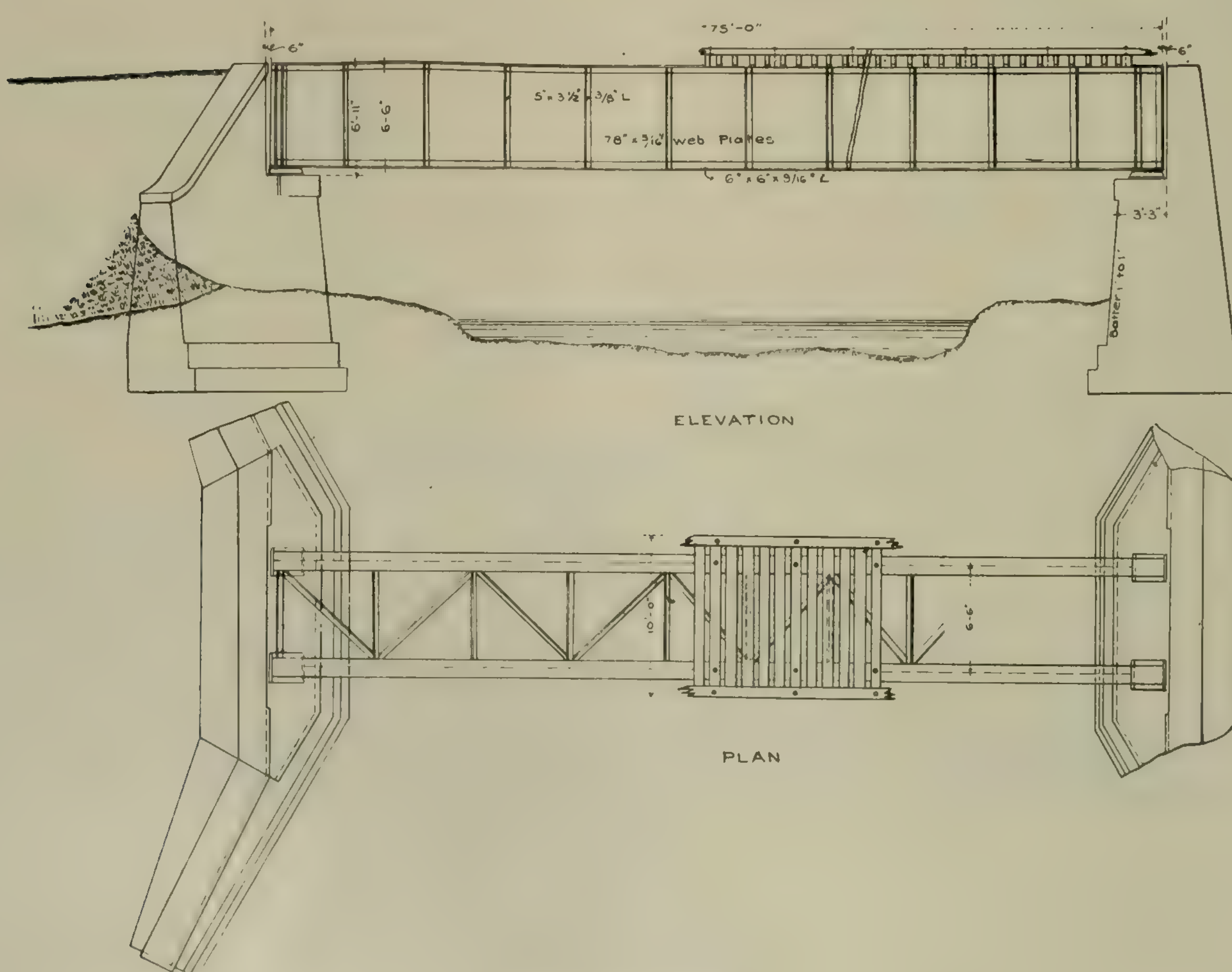
Track.

The track is laid with rails of 80-lb. A. S. C. E. and 72-lb. 6-in. Shanghai sections. The joints are the "Continuous," and the special work was furnished by the Paige Iron Works.

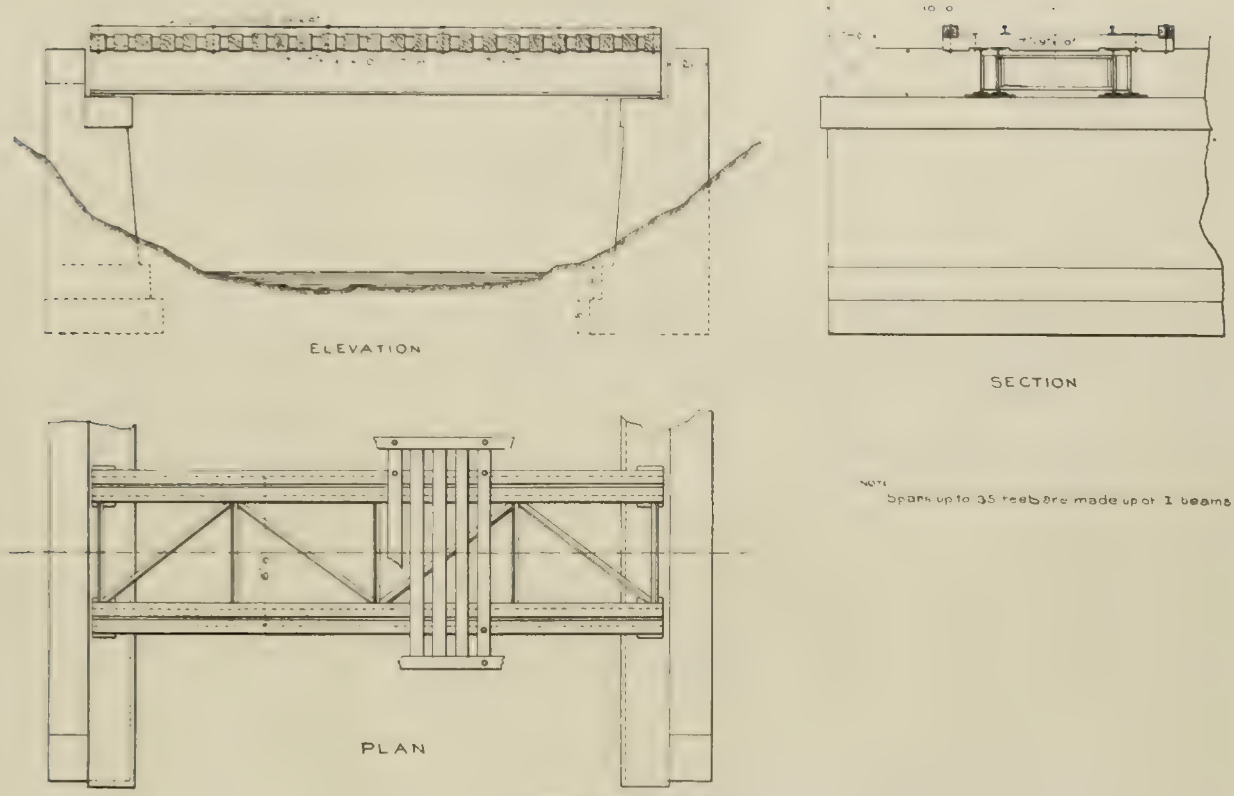
At each rail joint is one 250,000-c. m., Type F-3, 10-in. protected Mayer & Englund rail bond. At all crossings and around special work the standard bonding is as follows. The two track rails are cross connected by two 250,000 cables bonded into the solid rail beyond the first joint at each side of the special work, and these two pairs of cross cables are connected by two 500,000-c. m., cables laid



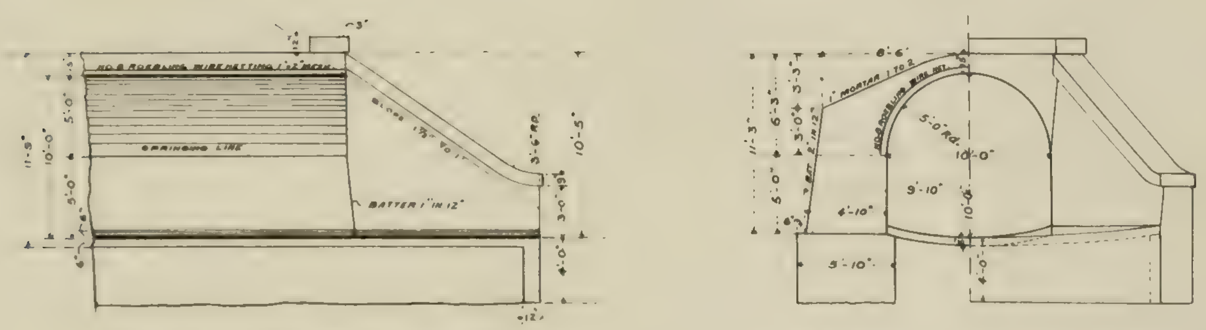
STANDARD 150-FT. THROUGH TRUSS SPAN.



STANDARD 75 FT. GIRDER.

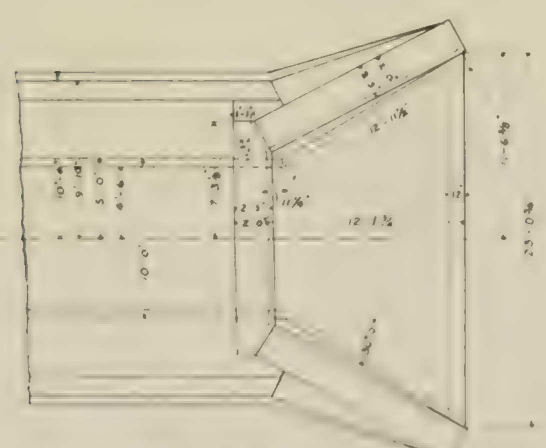


TYPICAL BEAM SPAN.



PART LONGITUDINAL SECTION

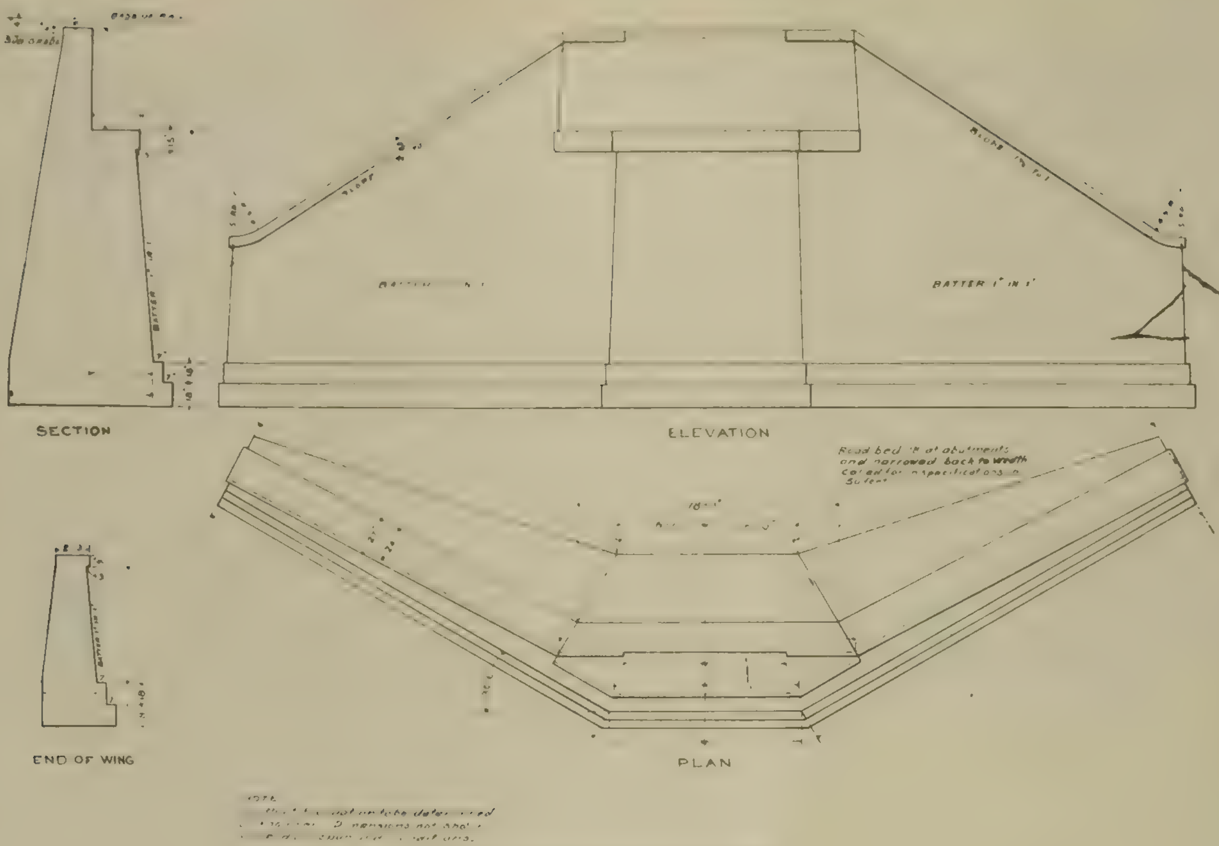
HALF SECTION HALF END ELEVATION



PART PLAN

QUANTITIES	CUBIC YARDS	SQUARE FEET
BARREL LIN FT OF ARCH	3 3	
PAVING LIN FT OF ARCH	0 19	
4 WING WALLS	39 5	
2 APRON WALLS	5 5	
2 APRONS	7 2	
2 PARAPET WALLS	5 0	
AREA OF WATER WAY		87 2
AREA FOUNDATION UNDER ONE WING		55.0

STANDARD 10-FT. × 10-FT. CONCRETE ARCH CULVERT



STANDARD ABUTMENT FOR DECK GIRDERS.

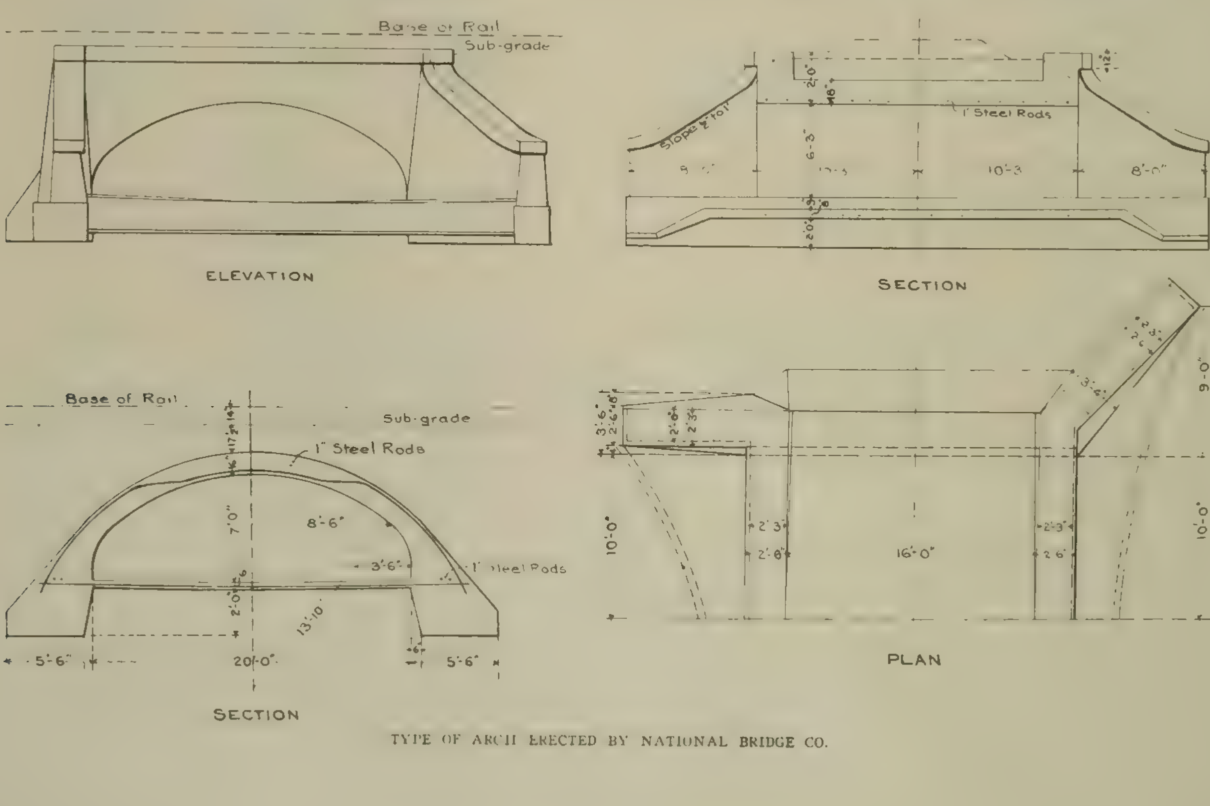
under the ties and at each end soldered to each of the cross-cables.

The most expensive section of the line to build was that comprising about 6,000 ft. just south of Noblesville. In this, beginning at the south end, are the following: Bridge over Old Jordan River bed, 104-ft. Pratt truss span, with abutments having 321 cu. yd. of masonry. Fill 800 ft. long and 10 ft. high, containing 9,000 cu. yd. Bridge over White River, two 150-ft. Pratt truss spans, with abutments and piers having 600 cu. yd. of masonry. Pile trestle 2,810 ft. long. Overhead crossing with Lake Erie & Western tracks, beam and steel girder spans, 934 cu. yd. of masonry. Fill 700 ft. long.

North of Noblesville is a fill 2,600 ft. long, containing 40,000 cu. yd., for approach to a 550-ft. plate girder bridge over the White River; in this section there are 1,800 cu. yd. of masonry.

Power Generation and Distribution.

When the several electric railways operating in and between Anderson, Muncie and Marion were consolidated as the Union



TYPE OF ARCH ERECTED BY NATIONAL BRIDGE CO.

Traction Co. [illegible] and a line from Anderson to Indianapolis decided upon, the plans of the company included a main power station at Anderson. This station, which was completed in 1901, was illustrated and described in the "Review" for April, 1901, page 203. At that time the company operated 163 miles of track, of which city systems comprised 56 miles, and the capacity of the generating station was 3,000 kw. at rated load.

When the extensions, comprising what are generally known as the Indianapolis Northern lines, were decided upon, an addition to the power station became necessary, and the work of construction was carried out under the direction of Mr. A. S. Richey, electrical engineer for the company, following the original design which was by Sargent & Lundy, of Chicago. The limit of the old building [illegible] on the plan view and is also to be seen in the exterior view of the station building, the photograph from which this was reproduced having been taken before the monitor roof on the new portion was completed.

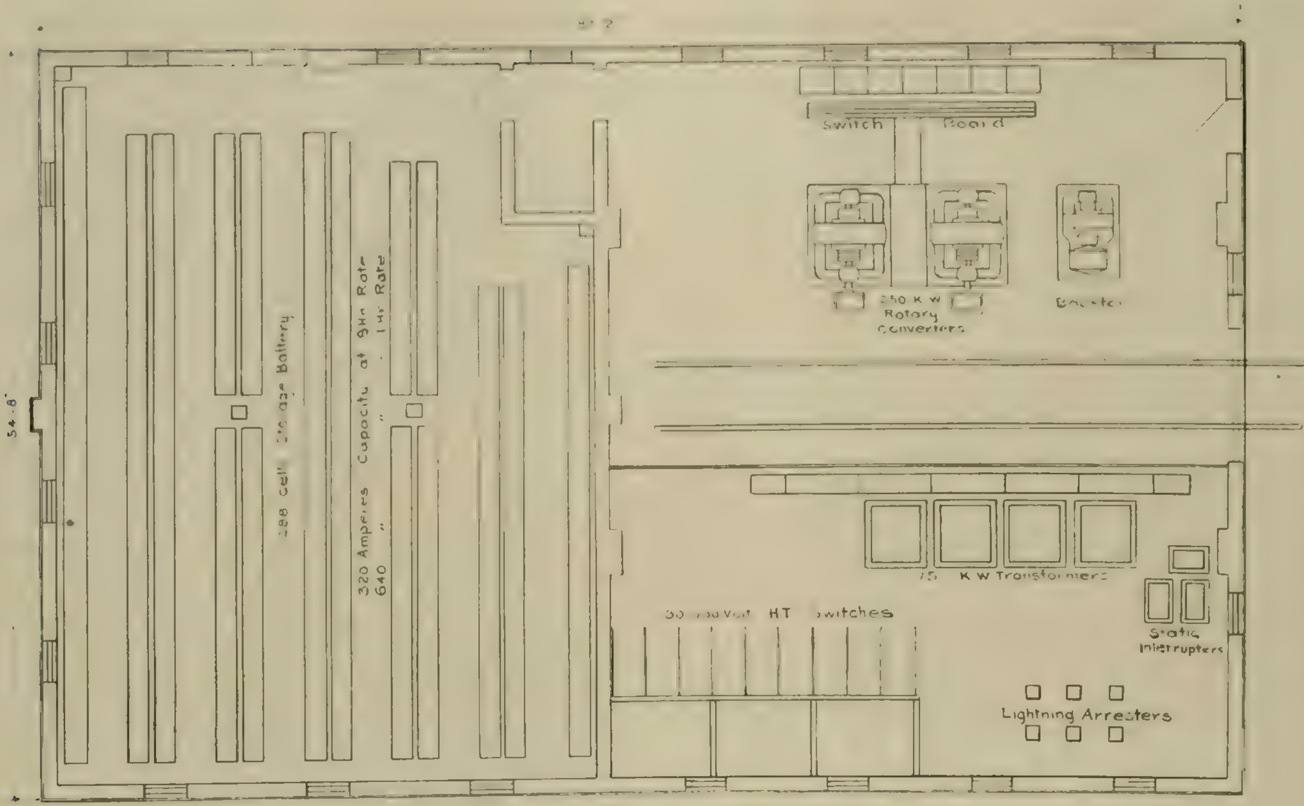
It will be noticed that the original building had space for four 1,000-kw. units and that with the extension there are six such units provided for. The new equipment installed in the station proper included two 400-h. p. and two 600-h. p. Babcock & Wilcox boilers with superheaters and B. & W. stokers; two cross-compound engines direct connected to 1,000 kw., 375 volt, three phase, Westinghouse engine type generators; one 75-h. p. motor driven exciter set; two 1,500-h. p. Knowles condensers; and an extension of 210 ft. to the Mead coal conveyor. Two alternating current generator panels, two transmission line feeder panels, and one exciter panel were added to the switchboard.

The most marked change in the station was the construction of a separate transformer building. This is 30 x 90 ft., two stories high, located near the southeast corner of the main station. On the lower or basement floor are the transformers, comprising the 15 transformers of 250 kw. each of the original equipment removed from the main building, and seven new transformers of 500 kw. capacity each. The smaller transformers step the current up to 15,000 volts for the old system and the larger ones supply the new 30,000-volt lines.

Six 30,000-volt high-tension circuit breakers, six 30,000 high tension lightning arresters, and six static interrupters were installed in the second story of the transformer building, and the 15,000-volt

DIAGRAM OF A. C. AND D. C. DISTRIBUTING SYSTEM

[illegible] high tension wires and direct current feeder lines between Muncie and Alexandria, between Anderson and Elwood and between Anderson and New Castle, also a substation at Sulphur Springs and [illegible] volt [illegible] connecting it with the main power station at Anderson, which are not yet installed. The [illegible] volt [illegible] line between Anderson and Elwood is erected as indicated.



ARRANGEMENT OF SUB-STATION APPARATUS.

circuit-breakers and lightning arresters which were formerly at the south end of the engine and generator room were removed to the transformer building. It will be remarked that on the Union Traction the Westinghouse high-potential circuit breakers constitute the only high-tension switching apparatus; all the normal switching is done on the low tension sides of the transformers.

The scheme of power distribution, both for alternating current and direct current lines is shown in one of the diagrams.

In the diagram, however, there are indicated trolley wires and direct current feeders for the three proposed lines, and also there are shown a sub-station at Sulphur Springs and a three-phase circuit connecting it with the main power plant at Anderson. None of these wire lines mentioned are in position as yet, but it was thought best not to eliminate them from the diagram in order

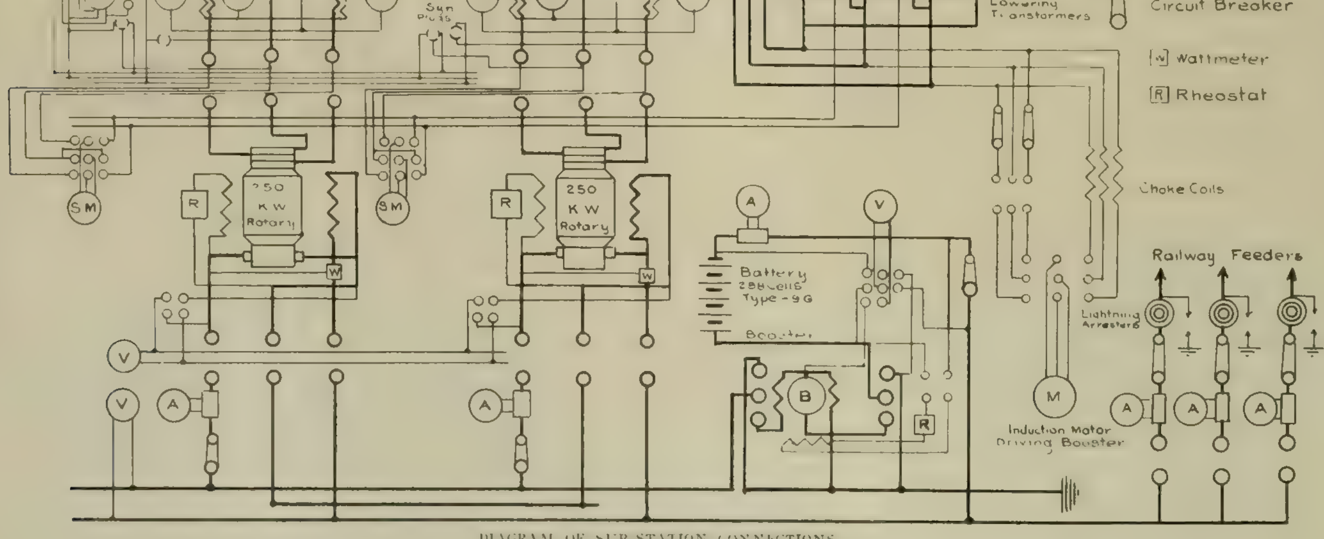


DIAGRAM OF SUB-STATION CONNECTIONS.

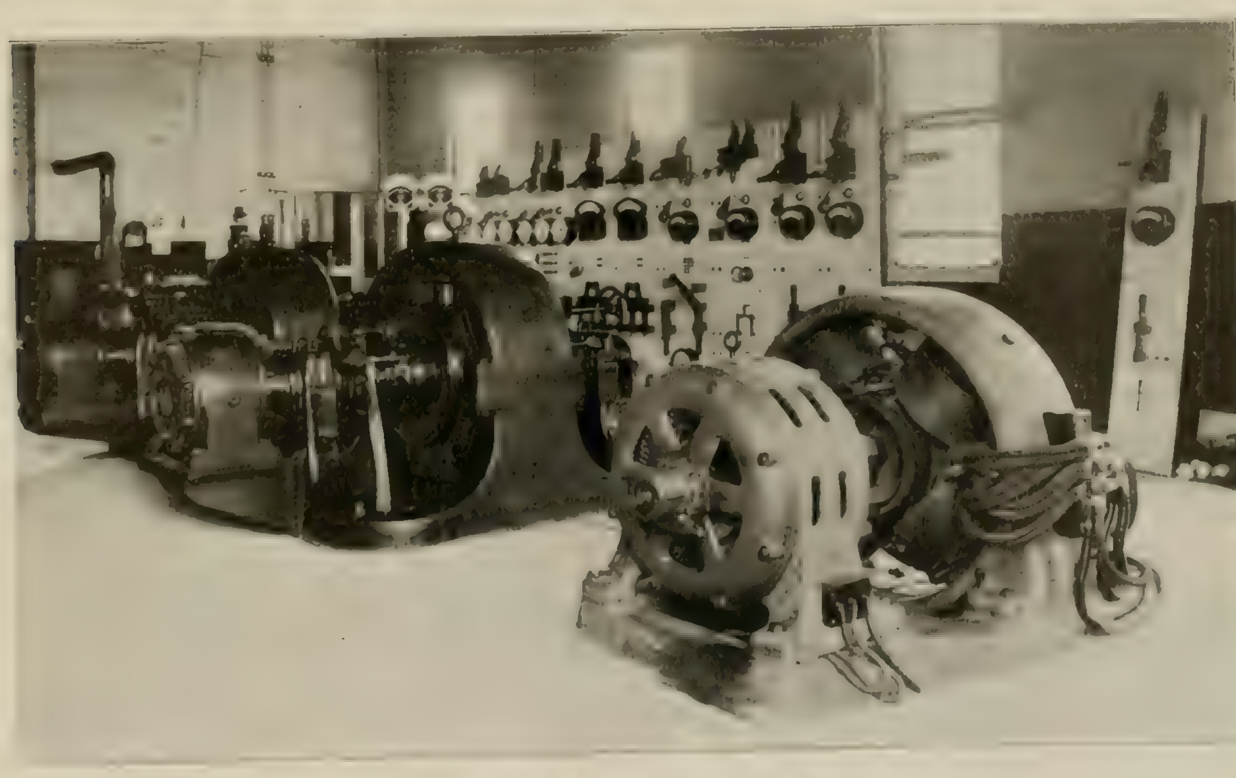
MAIN POWER STATION AT ANDERSON

that the proposed system might be shown complete. The 30,000-volt [illegible] transmission line between Anderson and the Elwood sub-station is installed as indicated, being erected along the route chosen for the Anderson-Elwood division.

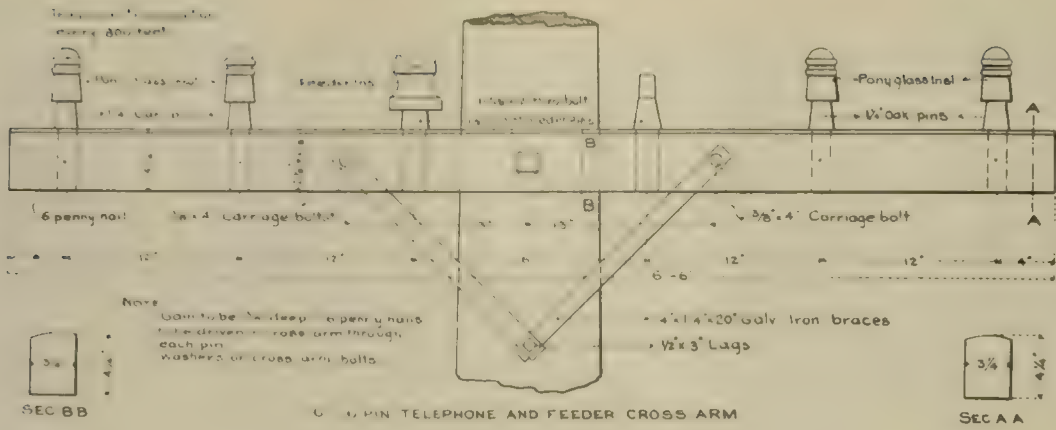
The transmission lines erected for the Indianapolis Northern system, as shown in the diagram, comprise: Two 30,000-volt circuits of three No. 3 wires each from Anderson via Elwood to Tipton; from Tipton a single line of three No. 3 wires south to Noblesville and thence three No. 4 wires to Broad Ripple; two [illegible] of three No. 4 wires each from Tipton north to Kokomo, from Kokomo one line of three No. 4 wires to Logansport and one of three No. 5 wires to Peru.

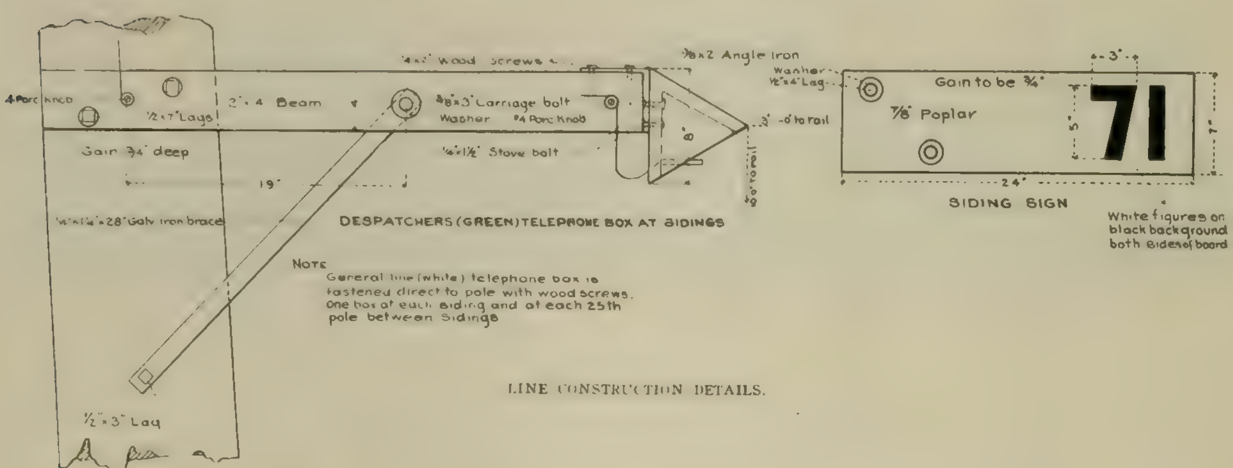
On transmission lines glass insulators 7½ in. in diameter are used; part of these are the Knowles and part of the Hemingray make. The overhead line material was furnished by the Ohio Brass Co.

The several sub-stations are each provided with two 250-kw. Westinghouse rotary converters, four 175-kw. step-down transformers, three static interrupters, three 30,000-volt lightning arresters, high tension circuit breakers with marble barriers, and the necessary switchboard panels. Each of six sub-stations (except

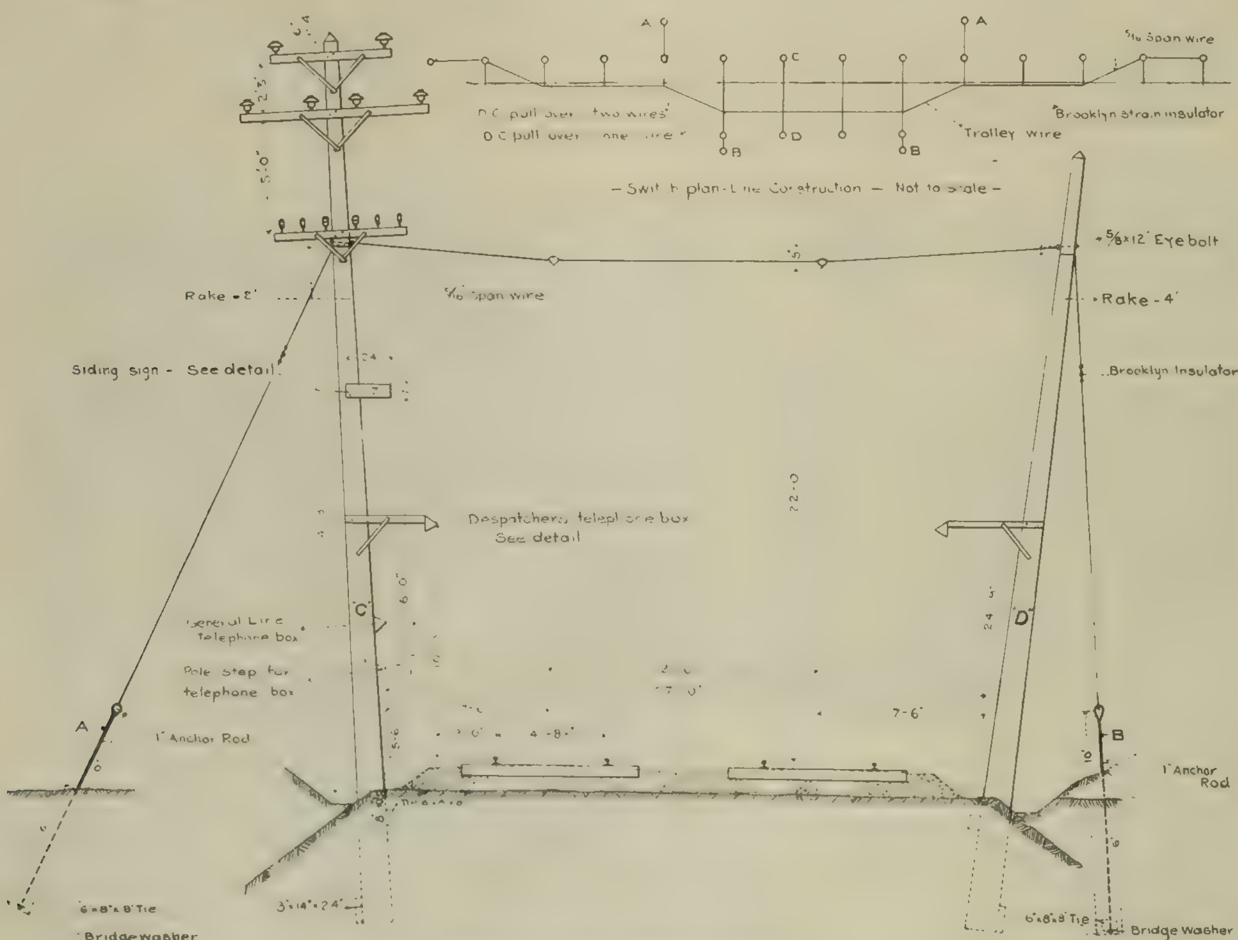


INTERIOR OF SUB-STATION AT TIPTON

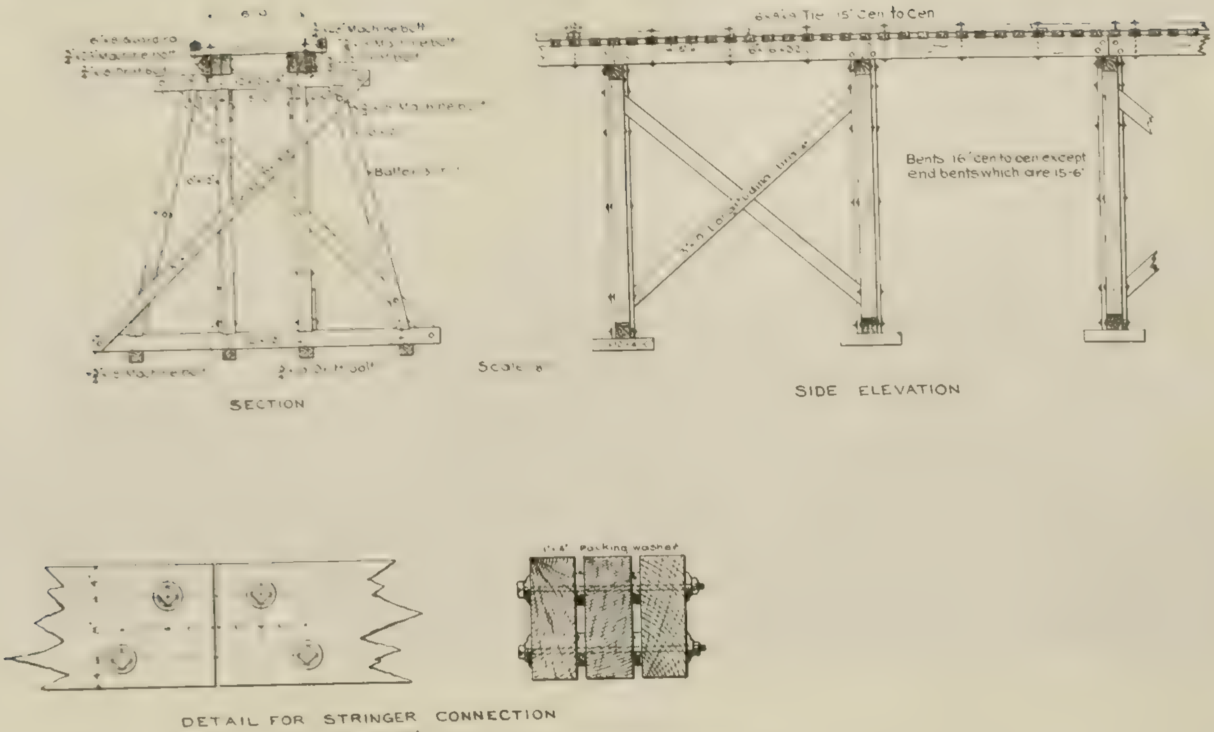




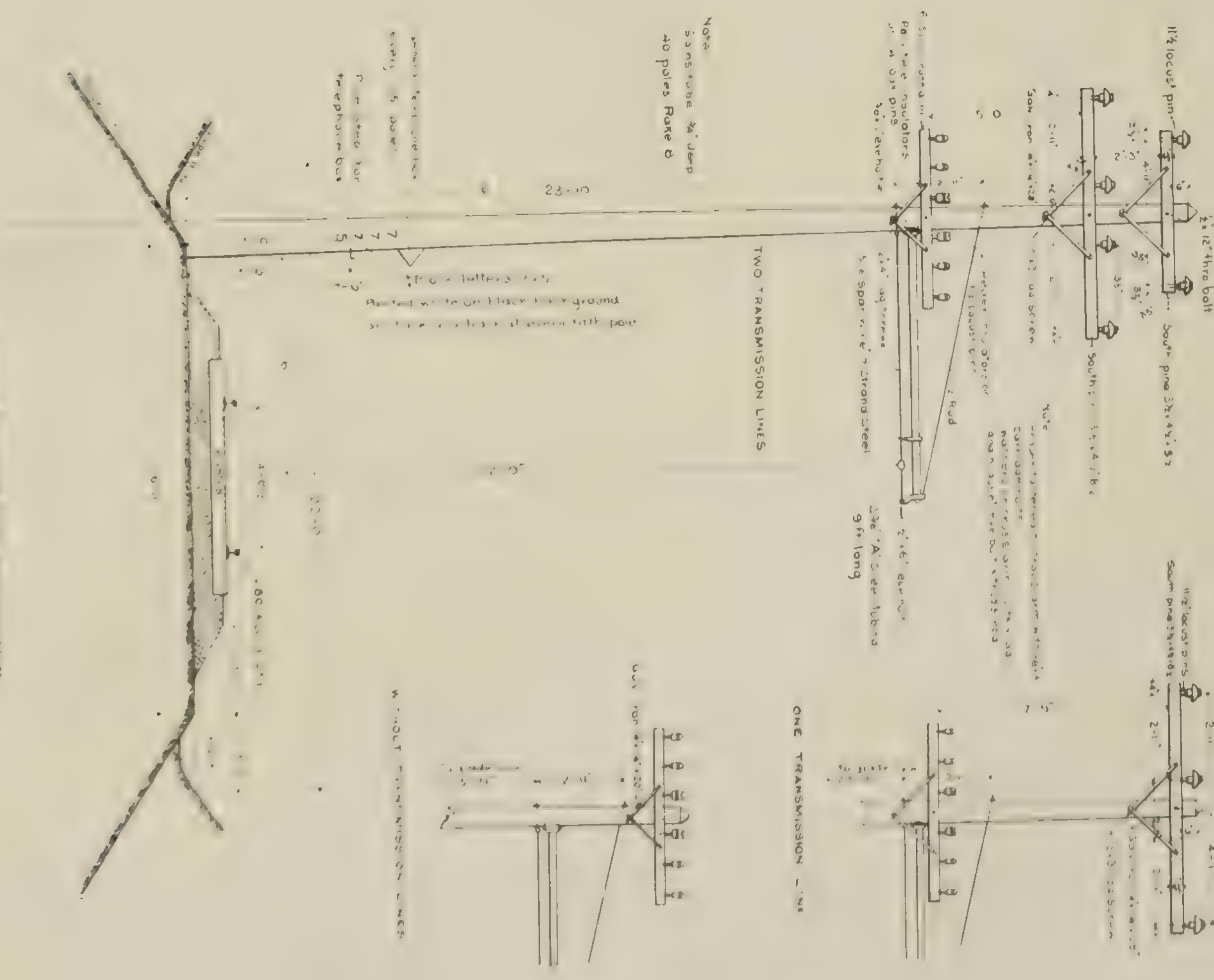
LINE CONSTRUCTION DETAILS.



STANDARD CONSTRUCTION AT SIDINGS.



STANDARD TRESTLE CONSTRUCTION.



STANDARD STRAIGHT LINE CONSTRUCTION.

Broad Ripple) has a 320 ampere storage battery and a 400-ampere booster driven by an induction motor; the Broad Ripple substation has a 640-ampere storage battery and a 515-ampere booster. These batteries were furnished by the Electric Storage Battery Co.

At the Noblesville, Tipton and Kokomo sub-stations both incoming and outgoing high-tension feeders are connected to the sub station bus bars, permitting a considerable degree of flexibility in cutting out high-tension feeders in case of accidents that interrupt service on one or more feeder circuits. The numbers of high-tension circuit breakers at these stations correspond to the numbers of wires entering and leaving, being 6, 18 and 12 respectively.

A portable sub-station car with a 250-kw. rotary converter and three 87½-kw. step-down transformers was also provided.

Rolling Stock.

The rolling stock for the Indianapolis Northern division comprises 20 cars built by the Cincinnati Car Co. The bodies are 41 ft. 7 in. long with front platform 3 ft. 10 in. and rear platform 4 ft. 5 in. long; the over all length is 56 ft., and the width over all 9 ft. 1½ in.; the height to the trolley board is 14 ft. 10 in.; the weight of the body is 37,400 lb. This type of car is provided with seats for 48 persons, and when crowded will carry 150.

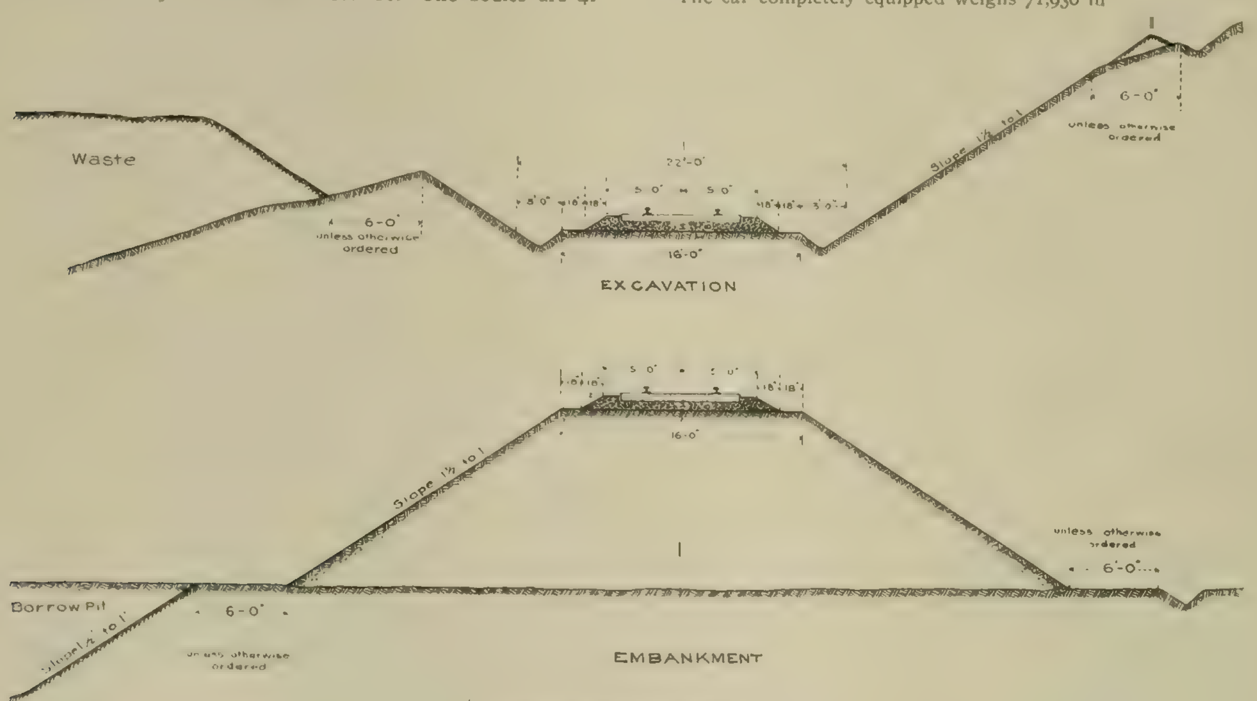
The trucks are the Baldwin Locomotive Works No. 112, weighing 9,565 lb. each.; these trucks have a wheel base of 6 ft. and are placed 29 ft. 7 in. between centers. The wheels are steel-tired with wrought iron spoke center. The diameter of wheels when new [illegible] in.; the flange is [illegible] in. thick and [illegible] in. deep; the tread is 3⅛ in. wide. The axles on these cars are 85¼ in. long over all, with 4¼ x 8 in. journals. The diameter of the axle at the center is 6½ in.; at the wheel and gear fits, 7½ in.

The motor equipment comprises four Westinghouse No. 85 motors rated at 75 h. p. each, with Gibbs suspension. Ten of the cars have 50-tooth gears and 24-tooth pinions, ratio 2.04, and ten have 47-tooth gears and 27-tooth pinions, ratio 1.74. The speed is 52 miles for the smaller ratio and 60 miles for the larger.

FREIGHT AND EXPRESS CARS

The cars have Hale & Kilburn and Heywood & Wakefield seats (19 double seats being placed in the larger compartment, and 10 chairs in the smoking compartment), Van Dorn No. 11 drawbars, Baker hot water heaters, Christensen air brakes and motor-driven compressers, and Mosher arc headlights.

The car completely equipped weighs 71,930 lb

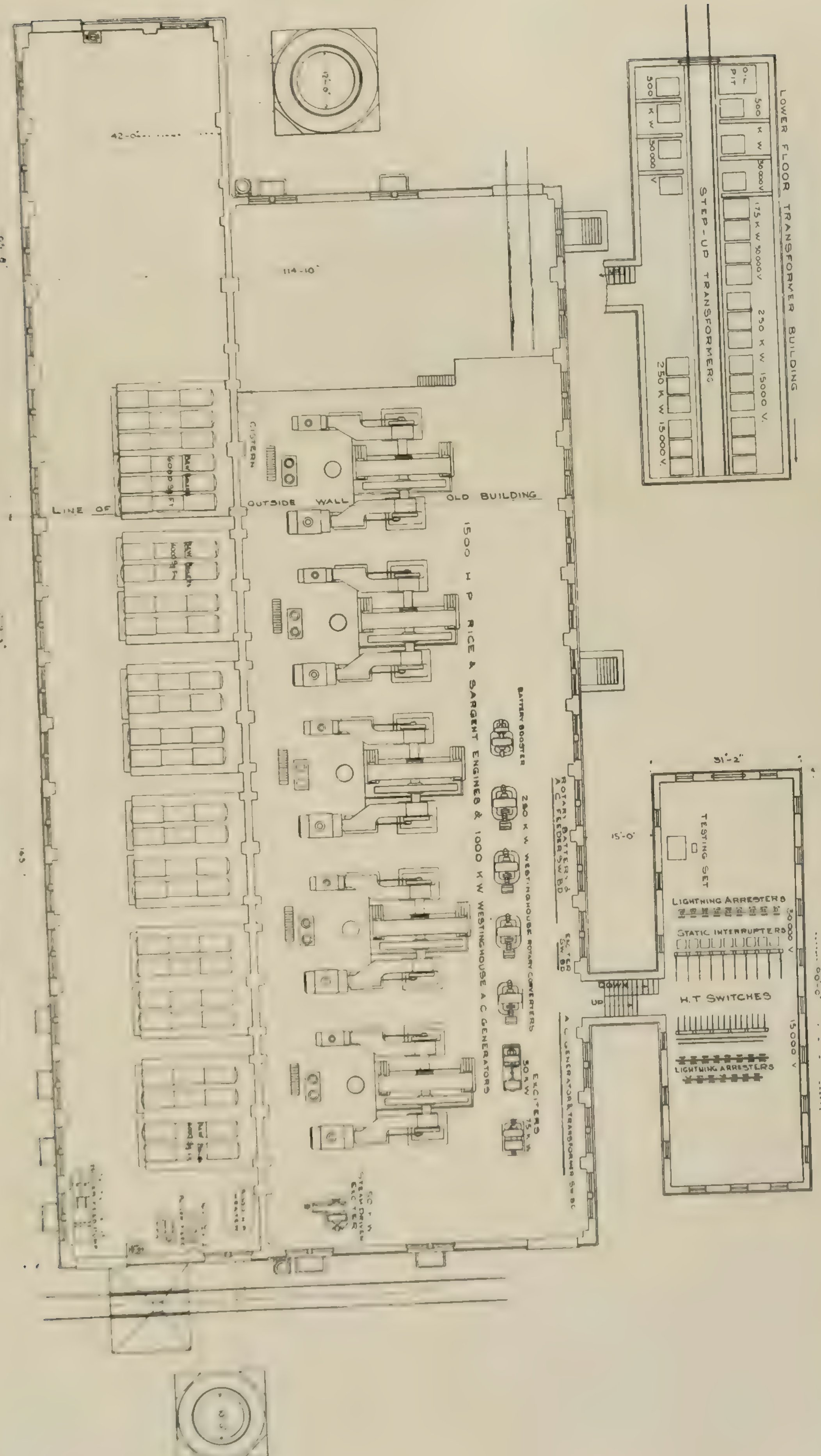


STANDARD EARTH SECTIONS

Engineers and Contractors.

The whole of the new work was carried out under the direction of A. L. Drum, general manager; A. S. Richey, electrical engineer; S. H. Knight, chief engineer, and H. Day Hanford, constructing engineer. The rights of way were secured by Dr. H. Moore.

The principal contractors on the construction of the Indianapolis Northern lines were as follows:



PLAN OF POWER STATION AT ANDERSON, SHOWING EXTENSIONS AND NEW MACHINERY

Grading, J. N. Bick, Toledo, O.; R. G. Kirkpatrick & Co., Anderson, Ind.; Johnson & Berry, Anderson, Ind.; something over one half of the grading was done by the company.

Steel bridges, Indiana Bridge Co., Muncie, Ind.

Concrete culverts and concrete arch bridges, National Bridge Co., Indianapolis; Hoeffer & Co., Chicago, and railway company.

STANDARD PASSENGER CAR

Masonry for abutments, about one-third by Hoeffer & Co., Chicago, and two-thirds by the company.

Overhead work, Electrical Installation Co., Chicago; J. J. Brennan & Co., Indianapolis, and railway company forces.

White oak ties were furnished by the Gray Tie Co., of Evansville, Ind., and the poles by Holcomb, Lobb & Co.

A list of some of the principal construction tools purchased by the company in order to carry out the portion of the work done by it is interesting as showing the magnitude of the work. The company had two narrow gage and six standard gage steam locomotives, thirty 80,000-lb. Rodger ballast cars, 2 Rodger plow cars for spreading gravel, 24 flat cars (50,000 lb. capacity), 20 standard gage and 12 narrow gage Western side dump cars, 12 hand cars, 2 Thew automatic steam shovels, 1 Vulcan traction shovel, 2 Smith concrete mixers, 2 gas engines, 10 pumps of various capacities, 37 wheel scrapers, 2 electric track drills.

Bursting of 4-ft. Fly Wheels.

In a paper presented by Prof. C. H. Benjamin, of Cleveland, at the recent meeting of the American Society of Mechanical Engineers the author described some very interesting experiments in which fly-wheels 4 ft. in diameter of various designs were tested to destruction. A cast iron pulley 48 in. in diameter and 8½ in. wide with 6 arms of elliptical section, being a well proportioned wheel such as is used on shafting for power transmission, burst at a speed of about 230 ft. per second or 100 r. p. m. A wheel of this section should not burst under a speed of 1020 r. p. m. In this case the failure was due to the centrifugal action of a balance weight of 3½ lb., which had been riveted to the rim on the lighter side in order to balance the wheel.

The second wheel tested was of the same general style and dimensions as the first but was made in two parts secured by flange joints, the joints being midway between arms. This wheel burst at a speed of less than 700 r. p. m. The author estimated the speed to have been not in excess of 600 r. p. m., corresponding to a linear speed of rim of 125 ft. per second.

The third wheel had a rim of cast steel made in 10 segments, each joint secured by three prisoners of an I section on the outside face, by link prisoners on the edges and by a dove-tailed bronze clamp on the inside fitting over lugs on the rim. There were 20 arms of phosphor bronze arranged in pairs and bolted to plain faces on a polygonal hub. The wheel was further reinforced by a system of diagonal bracing. It was found necessary to enclose both sides of the wheel with sheet metal disks, as the air resistance of the spokes and braces made it impossible to reach a high speed. At the speed of 775 r. p. m. the wheel burst and broke the heavy cast iron casing, the upper half of the casing weighing one-half ton being thrown about 75 ft. into the air.

New England Street Railway Club.

The New England Street Railway Club held its November meeting in Boston on the evening of the 30th, at the American House. A departure from the usual customs of the club was observed by a dinner in which the members participated prior to the meeting. Several candidates were elected to membership and at about 8:30 p. m. the subject of the evening was taken up. This was a paper by Mr. Clarence Renshaw, of the Westinghouse Electric & Manufacturing Co. on Single Phase Alternating Current Traction.

Mr. Renshaw's paper was illustrated by stereopticon views, a large number of which were shown illustrating the a. c. single phase equipment which has been developed by the Westinghouse engineers within the last few years. In beginning, Mr. Renshaw stated that in all the divisions of electrical work two separate problems are apparent: transmission and utilization. The latter problem was studied first in the early developments, and out of its necessities grew the transmission problem. The three great divisions—from the utilization standpoint—of lighting, power and traction, were all first developed on a direct current basis, because fewer difficulties and less complicated phenomena were apparent. The transmission problem soon came to the front, however, and the disadvantages of the moving machinery required to change voltages, coupled with the loss of power in making such changes, soon made themselves seriously felt. Then, too, the limitations in voltage caused by the commutator came into play, and a factor which caused considerable difficulty was the generation and utilization of power at approximately the same potential. The cost of conductors became excessive when power was transmitted more than comparatively short distances.

The alternating current is easy to transform in voltage and therefore easy to transmit with small loss of power at high potentials. Station apparatus also is simpler. With a high transmission voltage the cost of conductors for transmitting large amounts of power long distances becomes reasonable. This point was realized first in incandescent lighting development, then in a. c. arc lighting work, and then in general power transmission. Electric traction has been the last great field to make use of alterating current. The transmission problem alone led to the use of alternating current. To a certain extent economy has been secured by the invention of the rotary converter, but the lack of a suitable motor has delayed the development of a. c. traction more than anything else.

Alternating equipment must have characteristics reasonably suited to its work and good performance. The polyphase motor requires at least two working conductors in addition to the ground, and it has an inefficient speed control. The advantages gained in transmission are more than offset by the general unsuitability of the induction motor to the requirements of railway work. The matters of starting and acceleration are not a great success with the polyphase motor. The series motor is particularly adapted to railway work as the torque increases in somewhat greater ratio than the current, say three times to twice the current. The induction motor runs at a constant speed regardless of the load, so that a car can run on a level at only the speed with which it ascends the heaviest grade. Great fluctuations in power demand result, with an excessive weight and cost of motor for a given weight of car. With the series machine a smaller motor suffices to do the same work. Experience has shown that the successful a. c. motor must have series characteristics.

All single phase motors for railway service are of one of three types: straight or compensated, repulsion, or transformer series. The two latter types are inferior to the first two. The third type has been used in Europe as the Winter-Eichberg machines, and the second type has been abandoned generally in favor of the first. The straight series motor appears to be the only type suitable for use under American conditions.

It is well known that when the armature and field flux of a motor are reversed simultaneously no change in the direction of rotation occurs. Therefore alternating current may be successfully applied to direct current motors, provided that various difficulties in design are overcome. It is the designer, rather than the operating engineer or the manufacturer, who has borne the brunt of the a. c.

motor development. Given a correct design, there are no special obstacles to the production of a motor whose performance may be predicted with close accuracy. The magnetic circuit of the motor field must be laminated to reduce eddy current and hysteresis losses. At the point of commutation the armature coils immediately connected with the brushes lie beneath the field poles, both armature and field being exposed to the same pulsating magnetic flux. A transformer action therefore takes place in which the field is the primary and the armature the secondary, a secondary e. m. f. being generated in the armature. The armature coils are short circuited when this e. m. f. is a maximum, and unless the design is such as will hold this induced voltage down to a low value, sparking is certain to occur at the commutator on account of the heavy currents likely to flow in the short circuited coils. The sum of the e. m. fs. across field and armature does not equal the voltage measured across the two in series because of the difference in phase. A compensated winding across the field poles is used to make the armature input non-inductive. The field input is practically all inductive because it is the magnetizing element. High power factors require a small magnetizing element. The voltage across the field is also relatively low as compared with that across the armature circuit. A high power factor likewise requires that the product of armature turns and armature speed should be large compared with that of the field turns into the frequency. The field turns must be made as few as possible. This may be accomplished by reducing the air gap's effective length either by shortening the length of the actual air gap or increasing its area. The former course increases the cost of maintenance, especially in the journals, and renders mishaps more likely on account of the tendency of the armature to strike the pole pieces. An air gap of .04 in. was used on each side of the armature in one of the European motors. The e. m. f. in the short circuited armature coils and the tendency to spark depends upon the frequency. The lower the frequency the better is the motor performance. The standard frequency of 25 cycles is successful with single phase railway motors, which are merely standard direct current machines with a compensated winding and laminated poles. There is therefore no guesswork about the satisfactory operation of the a. c. motor.

Mr. Renshaw showed an interesting lantern slide illustrating the front of a 100-h. p. single phase a. c. motor, in which the two field leads could be plainly seen and also the two armature leads which are in series with them and the compensating winding. This winding is threaded through the poles in special slots. There are four main field coils. Views of the rear ends, interior and armature of this motor were shown, after which the four standard sizes which the company has developed were thrown upon the screen. These are 150, 100, 75 and 50 h. p. In principle and construction these machines bear a close resemblance to standard d. c. machines.

The somewhat steeper speed curve of the a. c. mortor is noteworthy, and the efficiency of the motor is slightly below that of the d. c. machine, but this is more than offset by the increase in the efficiency of the system as a whole. At full rated load and above a power factor of 85 per cent may be secured, and at half loads this figure may easily run from 90 per cent up. The speed regulation is generally secured by varying the voltage impressed upon the motor, and the voltage across the field of a 200-volt motor may be 100 volts or more. A much higher relative e. m. f. is required to force any given current through the a. c. motor in starting than in the case of the d. c. machine. The a. c. motor is therefore much less likely to be damaged than the d. c. motor by a too rapid feeding.

Special auxiliary apparatus is naturally required in an a. c. car equipment. The higher trolley voltage which is one of the great sources of economy in a single phase road cannot be used upon the motors, which require current at 250 volts or thereabouts. Hence a transformer is the first additional requisite of the a. c. equipment The auto-transformer—the single coil type—is employed, and it is placed beneath the car. It is provided with a series of up and down air ducts which permit the ingress of air forced in by the breeze caused when the car is running, but which do not allow the moisture and dirt to be carried into the transformer. In some cases the transformer is arranged to ring the current to either high or low voltage taps as may be desired. Mr. Renshaw then showed a slide illustrating the dirt and moisture shields above referred to.

The next problem is how to control and start the motors. An ordinary series parallel and rheostatic control could be used, but with the low voltages employed on the motors the currents to be handled are so large that great difficulty is experienced in the larger powered equipments. With a 250-volt motor the current is practically double the current of an ordinary d. c. equipment. Furthermore, the magnetic blow-out device is of little use with an alternating current, so the making and breaking of the circuit is a difficult matter. For this reason the scheme of controlling the car by means of varying the voltage through changes in transformer taps is applied only to the smaller equipments. The induction regulator solves the problem without opening the circuit. It consists of a transformer so arranged that the primary coil may be rotated with respect to the secondary. The change in the transforming action which corresponds to the movement of this primary enables the voltage generated in the regulator to be changed from a maximum in one direction, through zero to a maximum in the other direction. The secondary is in series with the circuit from the transformer to the motors. The voltage on the low tension side of the auto-transformer is about 200. The motors receive from 125 to 250 volts through the induction regulator, which first opposes and then aids the transformer. The continuous action of the regulator insures a smooth acceleration and a large number of running points with any condition of load and grade. There is no additional source of loss, and the energy required is reduced in proportion to the speed. As the induction regulator has considerable torque it is driven by a small air motor through a worm and wheel. The motor is controlled by electro-pneumatic valves.

The regulator does not open or close the motor circuit and therefore supplies only the voltage variation necessary to control the speed of the car when it is in motion. The switching which opens and closes the circuit is done in the primary circuit of the transformer. This is an advantage in that large currents are not broken and also in the omission of any iron loss in the transformer when the car is standing still. A special circuit breaker and switch is used. It consists in the main, of a plunger which is held by a pneumatic cylinder against a powerful spring. When the air is released the spring throws the plunger back, opens the contacts, and the arc is ruptured by a jet of air which is forced against the contacts. The air pipe is insulated by rubber hose, and the circuit breaker has been built to operate satisfactorily up to 3,000 volts and with equipments of four 100-h. p. motors. At voltages as high as this, and even below it is advisable to get rid of any handling of the trolley pole by the car crew. Hence a trolley pole has been designed which carries a movable bow at an angle of about 30° from the vertical through the joint with the main pole, and which is operated by compressed air. The contact bow is light, and is hinged to the main pole, which is also set at an angle with the car roof. The motorman thus may raise the trolley or lower it at will. The bow and trolley fall flat upon the roof of the car when not in use. The bow will run either forward or backward without adjustment, as it automatically shifts to the right or left of the vertical in accordance with the car movement. The trolley is insulated by four porcelain insulators.

Car lights are operated from a small auxiliary transformer of similar design to the main transformer. The air compressor is driven by a motor of similar design to the main motors, and it takes its current from the same transformer which supplies the lights.

As the motors are all in parallel the car may still be run with three motors if one fails. The use of compressed air and pneumatic valves makes the equipment adaptable to trains and multiple unit control. The preceding description applies to equipments aggregating 150 h. p. per car, or over. Smaller equipments secure their voltage variation by the use of loops from the main transformer. The controls of these smaller equipments are therefore designed to be worked without the use of compressed air. The induction regulator is omitted and the reversing switch placed directly between the motors and the transformer. The weight of these small equipments is approximately the same as that of direct current outfits of the same capacity. The transformer weighs about as much as a single motor. In large equipments the total weight of the equipment is about 15 per cent greater than the same capacity of d. c. apparatus, but this means that the a. c. outfit increases the total car weight by only about 5 per cent.

The a. c. equipments operate perfectly with direct current if it is supplied with the proper voltage. There is some demand for an

a. c. equipment capable of being operated a. c. in the open country and d. c. at 550 volts in cities, but a double system of control introduces serious complications in the apparatus and greatly increases its cost. Compromises must be made in the installation if the car is to run both a. c. and d. c. The transformers must be entirely [illegible] and the switches interlocked so that mistakes cannot be made.

On new interurban and even established through lines there are but few cases where the use of direct current is an absolute necessity. With 1,000 volts or less on the trolley the ordinary type of line construction can be modified so as to work well in single phase operation. Above this voltage an improved form of line construction is needed. This means a grooved copper trolley wire with catenary suspensions from 7/16-in. 7-strand steel messenger cable carried from brackets or span wires. The spans are 60, 80 or 120 ft. apart, and the trolley is suspended by galvanized iron hangers every 10 ft. The length of the hangers varies from 3 to 6 ft., according to the span length. The messenger cable is used as an auxiliary conductor and is supported by porcelain insulators of corrugated form, which in turn are carried on sleeves attached to the line brackets. An iron stirrup depending from the insulator holds the wire in case it falls on account of insulator breakage. No special work is needed in the trolley system as the bow trolley readily adapts itself to any change in alignment occurring at switches and turnouts. Every 1,000 ft. along the track is a supplementary arm design to keep the catenary structure vertical and to prevent side motion. Line construction is now available for a. c. trolley work up to 3,300 volts. Section insulators have also been designed for these potentials.

Sub-stations for a. c. railway work are notably simple in construction. Thus, a building 12 ft. by 15 ft. by 20 ft. affords ample room for the installation of the oil switches, lightning arresters, cooling apparatus and transformer required for a 300-kw. installation with a voltage transformation of 20,000 to 3,000. No more care and attention should be required by such a station than a section of high tension line. The distance between sub-stations depends upon circumstances. The drop in voltage per 100 amperes per mile of line amounts to about 60 volts with 80 lb. rail, single track, 25 cycles. No. 000 trolley and 7/16-in. steel messenger wire. The impedance amounts in this case to about 1.8 times the ohmic resistance. At 90 per cent power factor the a. c. drop comes to about twice the d. c. drop, with 3,000 volts on the trolley wire the drop for a given amount of power transmitted is about 8 per cent of the direct current drop at ordinary trolley potentials. With two 300-h. p. cars located half-way between stations and taking a maximum of 75 per cent of the combined full load current of each, 20 per cent drop and 2,000 volts on the trolley wire, the maximum allowable distance between sub-stations is 13 miles. Under the same conditions with direct current the sub-stations would have to be 5½ miles apart as a maximum, and a 500,000-c. m. feeder cable would be required in addition.

Besides the gain in transmission there is a saving in operating expenses due to the elimination of rotary converters and the resulting reduction in the cost of attendance. There is also a slight saving in power consumption. Mr. Renshaw stated that at present there is no intention on the part of his company to attempt to revolutionize all urban d. c. traction systems by changing over to alternating equipment. Rather is it the idea to introduce the a. c. motor on new or existing interurban lines and especially is it notable that sparsely settled districts can make use of a. c. traction in many cases where direct current would be too expensive. It is probable that transportation companies will follow the practice of lighting companies in using direct current for short distance urban service, and alternating current for the longer distances.

As yet no railway is in complete operation with a. c. series motors, but 45 complete car equipments are under contract by the Westinghouse company; of these, the motors vary in rating from 50 to 150 h. p. and the aggregate horsepower reaches 11,000. In less than two months one of the roads is expected to be in complete operation. The above contracts are made with 9 different roads.

In reply to several questions by members of the club Mr. Renshaw stated that roughly 5 to 15 per cent of the losses of d. c. equipments is saved by the elimination of rheostatic control in the a. c. system, but that against this must be charged a sacrifice of some 5 per cent in motor efficiency. The line voltage of 3,000 allows the sub-station to be spaced a reasonable distance apart, and as one goes about this voltage the troubles with the trolley line construction mount up very fast.

Touring Car Service in Cleveland.

The Cleveland Electric Railway Co. reports a very successful season with its touring car service, which opened July 1st and closed Oct. 23rd, being in operation 115 days. This service has been one of the best mediums for advertising Cleveland that has been introduced and is so admitted by Cleveland business men. The car used for this purpose is one of the convertible type with a seating capacity for 70 people. Only that number of persons were allowed on the car, none were allowed to stand. There was no extra expense for guards as the conductors explained the points of interest along the different routes. Cash fares were collected from each passenger, no tickets being used. The cars started from the public square and passengers were taken only at this point and in the down town district but were allowed to leave at any point upon signal. Three daily trips were made each day at 10 a. m., 12 m. and 2 p. m., the car being run at such hours that it did not interfere in any way with the regular traffic. The trip lasts two hours and the fare was 25c.

CLEVELAND TOURING CAR

Statements for this service show the average number of car miles per day, 95; average number of hours per day, 9½; receipts per car mile, $32.29 and receipts per car hour, $3.33. The accompanying illustration shows the car used in this service. Mr. J. W. Butler is the manager of the touring car service of the Cleveland Electric Railway Co. and has his office at 620 Electric Bldg.

Lewis & Clark Centenial Exposition.

Portland, Ore., is to have the next centennial exposition, that celebrating the Lewis & Clark Expedition in the first part of the 19th century. The exposition will open June 1, 1905, and close Oct. 15, 1905. Grounds aggregating 407 acres have been secured and for the last two years the electric railways of Portland have had the exposition in view in carrying out their extensions so that the new consolidated system will provide the best of transportation facilities for reaching the exposition. It is confidently expected that this exposition in the Northwest will prove of great value in promoting trade between the Pacific Northwest and the Orient. The director of exhibits is Mr. Henry E. Dosch.

Roanoke Railway & Electric Co.

The Roanoke (Va.) Railway & Electric Co., on November 25th, issued a very attractive vest-pocket edition of its official schedule, containing in addition to the schedules, a list of branch ticket offices, a description of Mountain Park, an article on artistic lighting, rules governing transfers, freight rates between Roanoke and Salem, fire alarm signals and a directory of places worth seeing.

Concrete - Steel Arches on the Indianapolis Northern Traction Lines.

During the summer of 1903 thirty-three concrete-steel arches were erected on the Indianapolis Northern Division of the Indiana Union Traction System, by the National Bridge Co., of Indianapolis. The arches were of spans varying from 4 ft. to 32 ft. and were reinforced with steel rods according to the Luten system of arch construction, as shown in the accompanying sections. This type of reinforcement is based on the principle that in any combination of steel and concrete the steel should be so placed as to resist tension, while the concrete is relied upon to resist compressive

FIG. 1. 12-FT. SPAN DURING CONSTRUCTION.

stresses. The steel rods are embedded near the inner surface of the arch at the crown and near the outer surface at the haunches, crossing the arch rib at or near the points where the bending moments are at minimum. The steel, in other words, lies near the tension edge of the arch, reinforcing the concrete at those points where the tension due to live loading would tend to crack the concrete.

Since the points at which the series of rods should cross the arch rib cannot be determined with accuracy, alternate rods are so bent as to cross the ribs at different points. Thus the end rod, say, will cross the arch rib at a given point, the second rod will cross at a point lower down, and the third rod at a higher point, the fourth rod being parallel to the first again, the fifth parallel to the second,

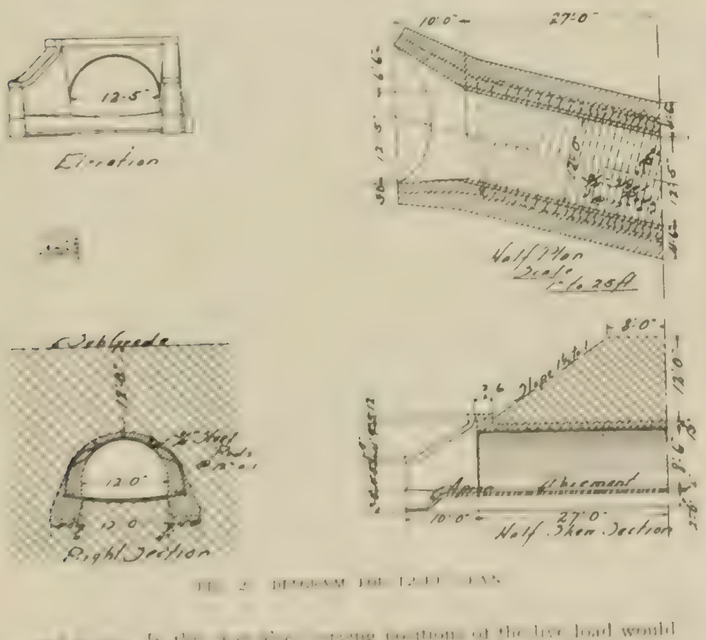


FIG. 2. DIAGRAM FOR 12-FT. SPAN.

and so on. In this way also varying positions of the live load would be provided for.

While this type of reinforced arch lends itself very readily to the use of corrugated or twisted bars, nevertheless in these arches smooth steel rods alone were used, varying in size from ⅜ in. to 1 in. in diameter, and spaced at intervals of from 12 in. to 18 in. Smooth rods were used in preference to deformed steel for several reasons; because there is as yet no good reason for supposing that smooth steel properly embedded will slip even under vibratory loads; because the cost of smooth steel rods was 40 per cent less than corrugated bars; because of the greater ease of securing the

FIG. 3. 12-FT. SPAN ON 45 DEGREE SKEW.

round steel promptly in the open market, while an order for corrugated or twisted bars involves considerable delays; and finally because in this type of reinforced arch the steel is in tension throughout its entire length, and there is not, therefore, the tendency to slip that there is in a bar subjected to both tension and compression in the same piece.

In addition to the steel reinforcement in the arch proper, all of these arches were built with steel ties from abutment to abutment embedded in a 6-in. concrete pavement beneath the bed of the stream. These ties were designed to effectually prevent spreading of the abutments under the thrust of the arch, thus permitting the use of much lighter abutments than would otherwise be necessary. The concrete pavement protects the steel ties against corrosion, and also acts as a strut to prevent the abutments from being forced in by pressure of the earth filling back of the abutments in case that pressure should be so great as to overcome the thrusts of the arch rib. This pavement moreover provides a solid bed for all of

FIG. 4. SKEW OF ARCH DURING CONSTRUCTION.

the waterway under the arch, absolutely preventing scouring of the bed and thus making the bridge flood proof. At up-stream and down-stream ends the pavement was extended several feet downwards into the bed of the stream to form an apron preventing undermining. The pavement and aprons were laid from end to end of wings to protect the wing footings as well as the abutment.

The pavement and ties would of course be omitted in any case where the depth of the water to be spanned would render their placing impracticable, recourse then being had to heavier abutments to resist the thrust and to greater depth of footings to avoid undermining. In all of the thirty-three arches on the Indianapolis Northern, however, the pavement and ties were found to be practicable and economical.

The abutment ties were anchored in each abutment by extending them through to near the back of the abutment where each was bent at right angles and hooked over the next adjacent tie. The reinforcing rods in the arch rib were extended into the abutments and hooked to the abutment ties. All junctions between separate rods were made by means of open hooks, relying upon the adhesion of the concrete to prevent these hooks from pulling out. The arch rods were continuous from abutment to abutment, welds being employed when rods longer than stock lengths were required. The hooks and welds, rough scarf welds, were worked in the shop before shipment to the field so that the steel was received at the bridge ready to place in position.

FIG. 5. 20-FT. SPAN, 6-FT. RISE.

The process of construction was first to excavate for and place the footings for the abutments and wings up to the lower level of the pavement. The pavement was then laid across the bed of the stream, embedding the abutment ties all except the ends which projected over the footings to connect with the arch rods, the pavement itself being extended so as to overlap the inner edges of abutment footings about six inches.

FIG. 6. 10-FT. SPAN, 8-FT. RISE.

To lay this pavement in a water course, it was usually found advisable to divert the stream to back of the abutments, or else allow it to flow over one of the abutment footings while the other half was being laid. In some cases the flow of a small stream was carried through a flume over the pavement.

After allowing the pavement to harden for a day or two, the centers were erected on the pavement which afforded an excellent support to prevent any settlement or distortion of the forms. The arch steel was then placed, the rods being hooked to the abutment ties at their extreme outer ends. And finally the concrete was placed for arch, wings, and copings, the arch being built in ring sections, and the rods being embedded to a depth of at least one inch from the surfaces.

FIG. 7 6-FT. SPAN WITH EXTENDED SPANDRELS.

The specified loading for Indianapolis Northern arches and bridges was a 100-ton car on two trucks, which for these arches was equivalent to a 50-ton concentrated moving load. With the type of reinforcement described, the arch proper was designed for this loading with but about one-half the cubic content of concrete that would have been required by Trautwine's formula for railroad arches of first-class stone masonry. The abutment footings were in all cases carried to a depth of 3 ft. below the surface of the pavement, that is the bed of the stream, this being sufficient to secure good foundations since the pavement prevented all possibility of undermining.

The wings and copings were designed to present a massive appearance, so that to external view the arches appear extremely heavy. Copings on spandrel walls were built 2 ft. 6 in. wide by 12 in. thick, projecting 3 in. over the front face of the spandrel. Copings on wings were 2 ft. 3 in. wide by 9 in. deep, with 3-in. projection. Faces of spandrels were vertical front and back, and face of wings battered one in twelve with base one-third the height. And the line of junction of spandrel and wing faces was made always to pass through the point of springing of the arch, with the bench walls produced to meet the wing face below the springings.

On small spans of six or eight feet across ditches having slow currents, the wings were omitted and the spandrel walls were extended to hold the fill assuming the slopes at one and one-half to one, as in Fig. 10.

Wings and spandrels were joined to the body of the arch by rods lengthwise of the barrel and extending from end to end of wings, usually five in number for each arch, one or two at the base of each abutment and the rest distributed at crown and haunches.

Designs for all of these arches were submitted by the National Bridge Co. to the chief engineer of the Indianapolis Northern and, upon his approval, the work was executed according to the plans and guaranteed by the Bridge company to remain safe and sound for the given loading, and flood proof. By this arrangement the engineering department of the Indianapolis Northern was relieved of a considerable amount of detail work, relying almost wholly upon inspection and guarantee to insure satisfactory construction. This is an item of considerable importance to a railway under construction, when delays in the bridge work so frequently retard all the work of construction.

The arches have now been in service for a year under heavy traffic and have all of them passed through one of the worst floods in the history of the state, that of March, 1904, yet not a cent of repairs has been required.

The National Bridge Co. was well equipped to rush this work so as not to interfere with the grading gangs, and at times had as many as seven gangs of skilled men at work on as many different arches at the same time.

The cost per cubic yard for concrete for this work, including all excavation, forms, etc., was higher of course than is usually paid for more massive construction, being as high as $10.00 or $11.00 per yard for the smaller arches, yet the total cost of the work was at a considerable saving to the Traction company as compared with the usual type of plain concrete arches.

Fig. 1 shows the general appearance of a 12-ft. span at Station 927 on the Kokomo-Peru Division, and Fig. 2 is a design sheet for this bridge reproduced to an actual scale of one inch to twenty-five feet. Fig. 3 is a 12-ft. span on 45° skew, making the skew span at face of arch 17 ft., and having a total length over all of over 80 ft. to accommodate a 15-ft. fill. Fig. 4 shows this arch under construction with the partly completed grade in the background. Fig. 5 is a 20-ft. span arch with an opening 6 ft. in height. The arch

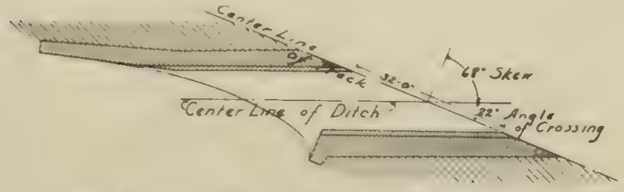


FIG. 8. LAYOUT OF 12-FT. ARCH ON 68 DEGREE SKEW.

is a right arch, but the alternate wings stand at 90° and 45° with the roadway to accommodate a skewed stream. The details of the 12-in. copings on spandrels and 9-in. copings on wings are clearly shown in this view.

A 10-ft. arch with 8-ft. height of opening, used as a driveway and stock pass, is shown in Fig. 6. This view is taken from within the stone arch of the same span on the L. E. & W. Ry. which parallels the traction line at this point. Fig. 7 is a 6-ft. span near Broad Ripple, having extended spandrels instead of wings. One of the arches had a right span of 12 ft., but with a skew of 68°, so that the span in face of arch is 32 ft. The crossing angle is but twenty-two degrees. Such an extreme skew would hardly be feasible for any other construction than reinforced concrete. The lay-out of the

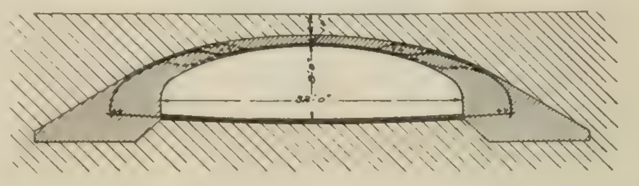


FIG. 9. SECTION PARALLEL TO ROADWAY.

arch is shown in Fig. 8, and a section taken parallel to the roadway is shown in Fig. 9.

While all of the arches on the Indianapolis Northern are of comparatively short span, the principles on which they are designed have been applied and tested on highway arches of much greater spans. One of these highway arches has been built with a span of 80 ft., height of opening 16 ft. and width of roadway 16 ft. The concrete pavement was laid in the bed of the stream under 3 ft. 6 in. of water. The arch was designed to carry a uniform live load of 200 lb. per sq. ft., and a concentrated live load of a 20-ton road roller. The contract price for this bridge complete was $2,695.00 or about the same as the cost of a temporary steel bridge for the same location.

Jones Underfeed Stoker Awarded John Scott Medal.

The City of Philadephia holds in trust under the legacy of John Scott, of Edinburgh, a sum of money, the interest of which is to be used for the encouragement of "ingenious men and women who make useful inventions." The legacy provides for the distribution of a medal and a money premium to such persons whose inventions shall merit this recognition. The examination of the inventions submitted as worthy of the medal and premiums has been delegated by the Board of City Trusts, of Philadelphia, to the Franklin Institute, and the Institute, acting by its Committee on Science and the Arts, undertakes to make the investigation and to recommend for the award meritorious inventions.

In March, 1903, Mr. Elwood E. Taylor, who at that time was connected with the Under-Feed Stoker Co. of America, by invitation gave a lecture on the Jones underfeed stoker before the Franklin Institute. The discussion which followed aroused much interest and the underfeed stoker invented by Evan William Jones, of Portland, Ore., was referred to the Committee on Science and the Arts, of which Lewis M. Haupt was chairman. A sub-committee was appointed, consisting of the following: Kern Dodge, chairman; John W. Hartman, James Christie and H. F. Colvin. This committee spent about a year in thoroughly investigating the matter, visiting numerous plants throughout the country where these stokers have been installed. In making its report the sub-committee concluded as follows:

"In view of the fact that Mr. Evan William Jones has done such good work in bringing out the design of the underfeed stoker under consideration, and in view of the simplicity of the device from a mechanical standpoint, both in construction and operation, we recommend that the John Scott Legacy Premium and Medal be awarded to him." This report was adopted at a stated meeting of the Committee on Science and the Arts, held Feb. 3, 1904.

After advertisement of the action in the Journal of the Institute in order to give opportunity for any protests, the medal shown in accompanying engravings was formally awarded by the city.

McKinley Syndicate Properties of Central Illinois.—II.

The Illinois Central Traction Co. and the St. Louis & Springfield Railway Co.

These two properties may properly be considered together as they form a continuous line with the city of Springfield as the dividing point and have been divided into the two companies merely for the purpose of organization. Both of these lines will, moreover, be practically a continuation of the Illinois Traction system within the next two years, after the existing gap between Decatur and Champaign, which is to be built, is completed. These two lines are operated from one power house situated at Riverton, about six miles from Springfield, and this plant, which is thoroughly modern in its equipment and engineering details, has been designed with an ultimate capacity sufficient to eventually supply current for the entire system, including some branches which it is proposed to build in the near future.

HAMILTON-CORLISS ENGINE AND GENERAL ELECTRIC ALTERNATOR IN RIVERTON POWER HOUSE.

The Illinois Central Traction Co. is the name of the system running from Springfield east to Decatur and the St. Louis & Springfield Railway Co. runs from Springfield southwest to Carlinville and will be completed down to East St. Louis within a short time as work on the lower portion has already commenced. While this part of the system as a whole may be considered under construction, some parts have been in operation since last June. The line from Springfield to Riverton has been operating on an hourly service as has also the line from Springfield south to Auburn. The power house at Riverton was first put into partial operation near the end of August and during September the entire distance from Decatur down to Carlinville was opened to service.

The Springfield-Decatur line parallels the Illinois Central for about 2½ miles out of Springfield and then parallels the Wabash R. R. to Decatur. This part of the line has four railroad crossings at grade, these being with the Wabash, Illinois Central, the Baltimore & Ohio and the Cincinnati, Hamilton & Dayton. The line from Springfield to East St. Louis is entirely completed as far as Carlinville and contracts for the completion of the line from Carlinville to East St. Louis have already been let. The part of the line now completed passes through a number of towns, some of which are of considerable size, and Springfield being the capital of the state naturally draws considerable traffic from all of the surrounding cities. Springfield has a population of 45,000 and the population of some of the principal cities on the line are as follows: Riverton, 2,500; Dawson, 800; Buffalo, 1,200; Lanesville, 400; Illiopolis, 800; Nantic, 600; Harristown, 400; Decatur, 2,500. On the line running south from Springfield the populations of the pricnpial towns are as follows: Chatham, 1,500; Auburn, 2,000; Thayer, 1,200; Virden, 4,000; Girard, 2,500; Nilwood, 800; Carlinville, 4,000.

The city line at Springfield is not owned by the McKinley syndicate, but traffic arrangements have been made with the local company whereby the interurban cars run over the local tracks within the city limits. The starting point of the interurban roads in Springfield is on Monroe St., in the central part of the city, and the tracks of the interurban companies begin near the city limits. These tracks are laid with 70-lb. T-rails of the A. S. C. E. section and run entirely

on private right of way, excepting for short distance in some of the cities through which the lines pass. In most places the interurban rights of way are adjacent to the rights of way of the steam railroads which they parallel. The grades are very slight throughout the

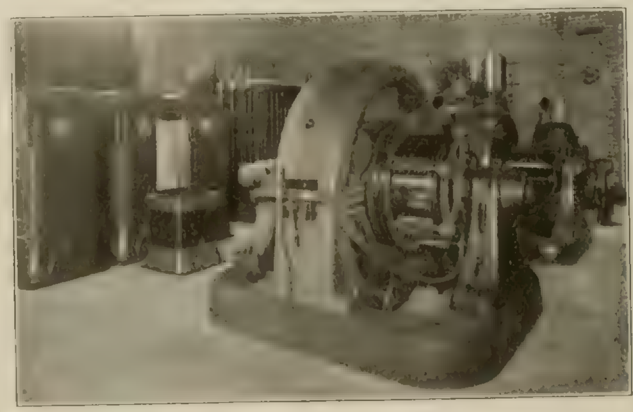
GENERAL VIEW OF POWER HOUSE

whole length of the lines and outside of the cities there are comparatively few curves, all of which have been constructed with a view to high speed operation.

The track is laid on standard size ties spaced 2 ft. between centers and is ballasted with gravel ballast. There are a number of bridges on the line which are built of steel with concrete foundations and all of the culverts are also built of concrete. The construction of the roadbed is very substantial, and was done under the supervision of Mr. R. D. Smith, superintendent of construction for the McKinley syndicate. Part of the work was done by the Central Illinois Construction Co., of which Mr. R. D. Smith is president, and part by the Chicago Engineering & Constructing Co. The overhead work has also been very substantially built and consists chiefly of bracket suspension. A double line of poles is erected, one of which carries

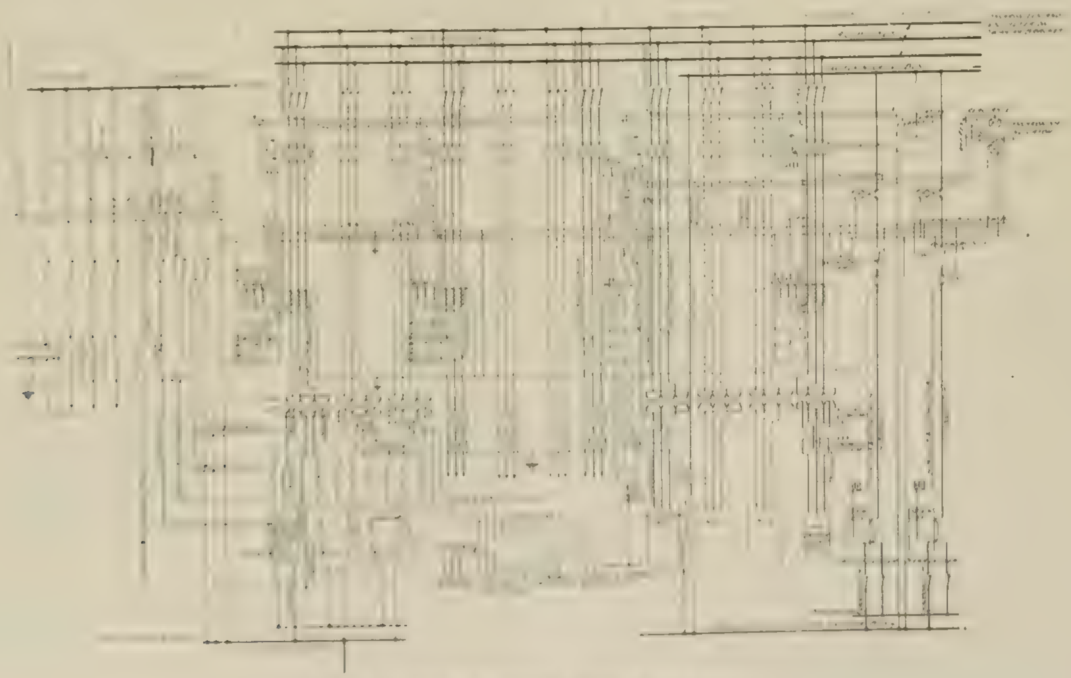
three lines, are carried on the opposite side of the roadway on the second line of poles, this construction being used in order to isolate the high tension system entirely from the rest of the overhead work.

The new power house which has recently been completed has been designed with sufficient capacity to operate the entire system from Decatur to St. Louis. It is situated at Riverton, which is seven miles northeast of Springfield, and is located on the bank of the Sangamon River. The exterior of the building is shown in one of the accompanying illustrations. The foundation and walls to the first floor are of concrete. The basement floor is one foot higher than the highest recorded high water mark of the river. The superstructure is of yellow brick and the building contains numerous high arched windows which light the entire interior very satisfactorily. In addition to these side windows, the roof of the building is provided with skylights. The building has been constructed with a view to future extension and its design as well as the selection and ar



ROTARY CONVERTER IN POWER HOUSE

rangement of the machinery which it contains is due to Messrs. Sargent & Lundy, engineers, of Chicago. A noticeable feature of the building is its absolutely fire proof construction. It is built entirely of concrete, brick and steel, and the only wood it contains is in the window frames and doors. The roof of the entire build-



WIRING DIAGRAM OF POWER HOUSE SWITCHBOARD

two composite telephone wires on the cross arm near the top, the bracket supporting the trolley wire and the continuous 0000 feeder, which is supported on insulators and iron pins fastened directly to the poles. The high tension lines, which consist of a single system of

ing is supported on steel trusses, and is of concrete and expanded metal construction.

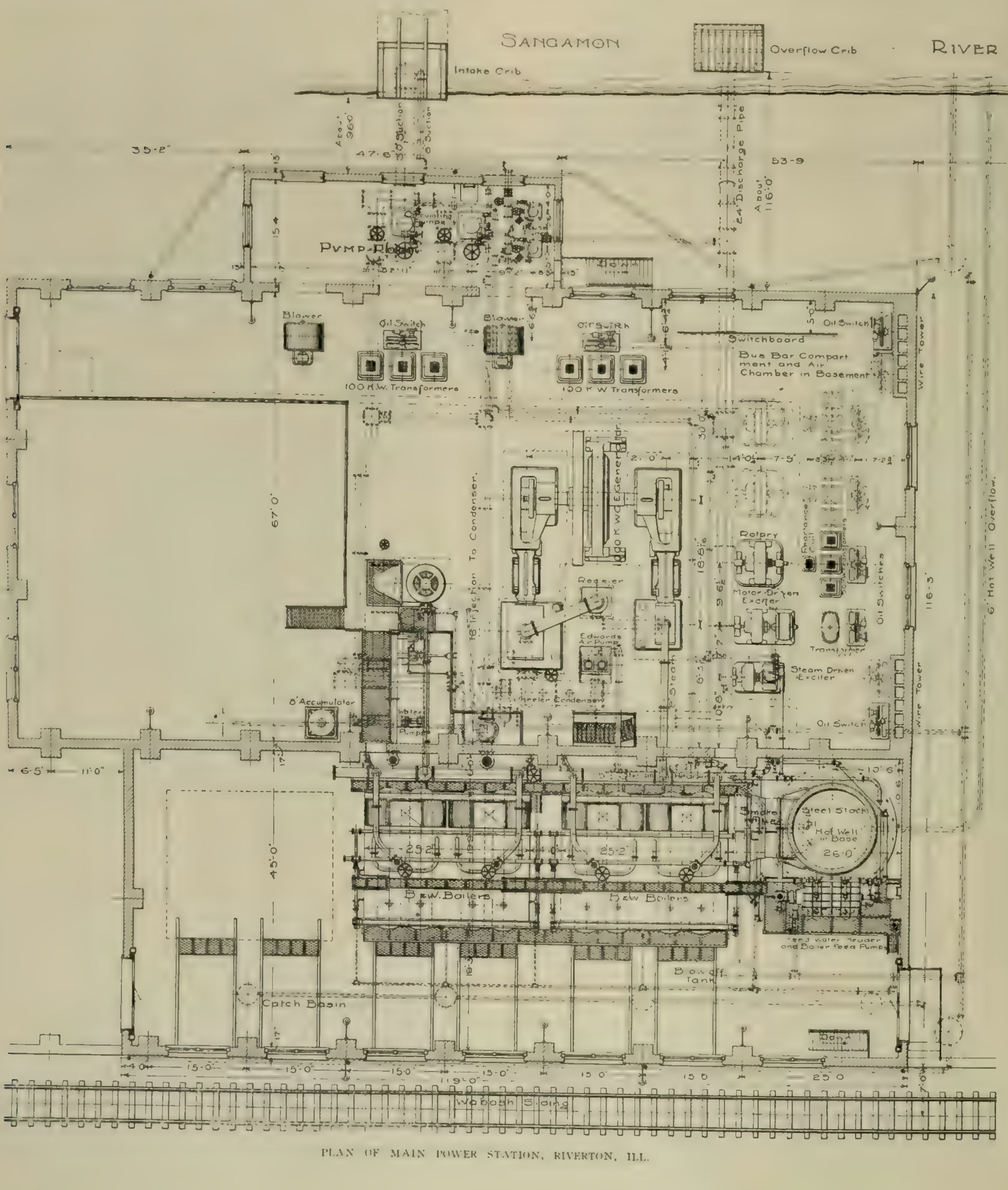
The boiler room, which is shown in the plan and elevation drawings of the building, is 45 ft. wide and 116 ft. long. It contains four

Babcock & Wilcox boilers, each of 400 h. p. capacity, which are provided with superheaters. They carry 150 lb. pressure and superheat to 120° F. The boilers are arranged in two batteries of two boilers each, and provision has been made for the addition of a third battery when required. They are also equipped with extended furnaces and provision has been made for the attachment of mechanical stokers in the future. The roof trusses over the boilers, which are shown in the elevation drawing of the power house, have been made sufficiently heavy so that coal bunkers can be installed over the boilers without necessitating any change in the structure.

At present the furnaces are stoked by hand and coal is delivered to the boiler room in carload lots by means of a spur track from the Wabash Railroad, which runs close to one side of the building. Under the windows in front of the boilers are iron doors which are hinged into the wall and which fold down so as to form chutes into which the coal from the cars is shoveled.

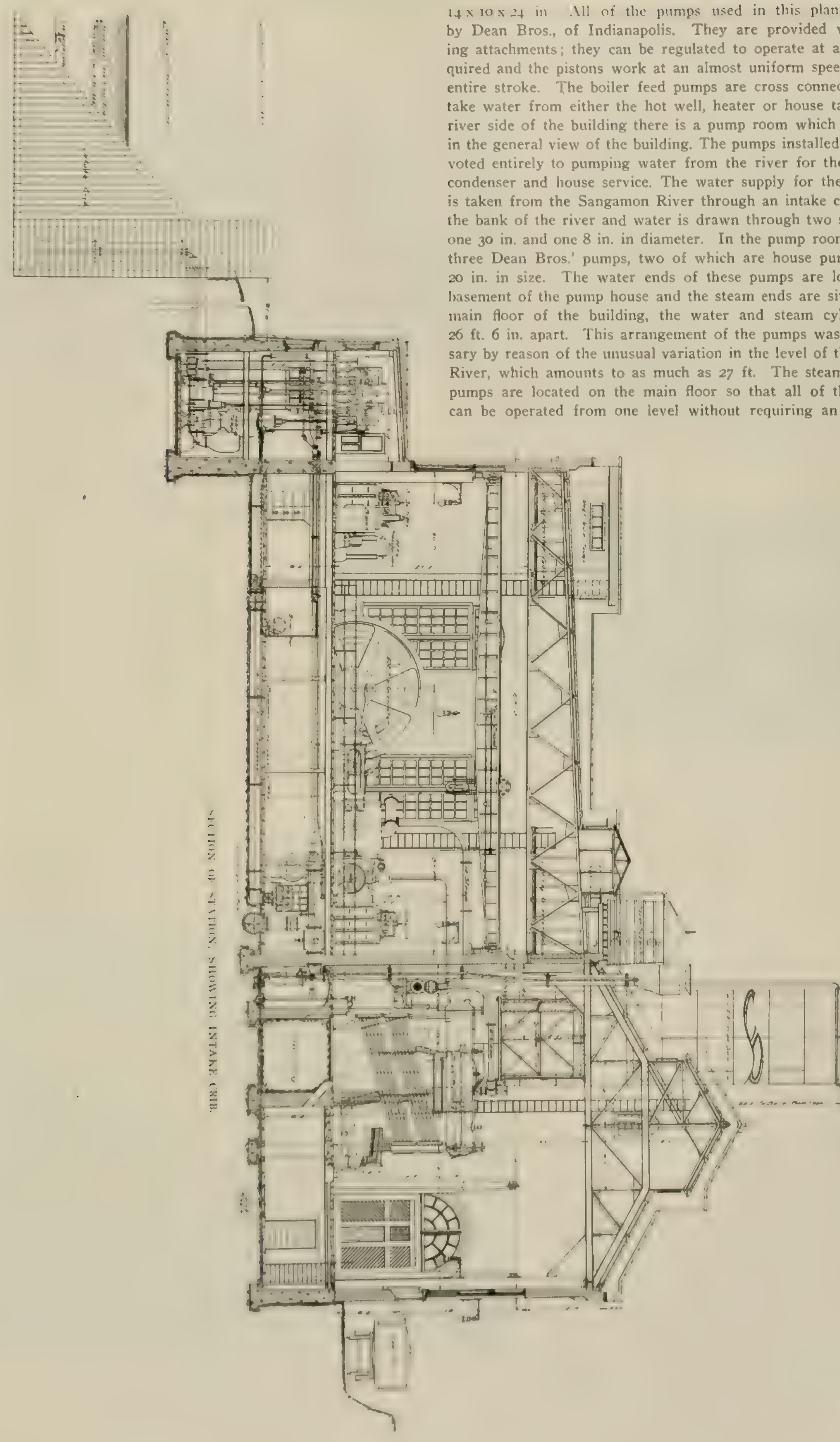
At one end of the boiler room is located a self-supporting steel stack 12 ft. inside diameter and 180 ft. in height from the boiler room floor. The breeching opening is 13 ft. 6 in. x 9 ft., and is 23 ft. 4 in. above the boiler room floor. The stack is anchored to a concrete foundation about 20 ft. deep with twenty 2½-in. foundation bolts. This foundation is hollow and is used as the hot well.

Directly in front of the stack are located three pumps, one of which is a hot well pump and the other two boiler feed pumps. The hot well pump, used for pumping water from the hot well to the heater, is 12 x 10 x 20 in. in size. The boiler feed pumps are each



PLAN OF MAIN POWER STATION, RIVERTON, ILL.

14 x 10 x 24 in. All of the pumps used in this plant were built by Dean Bros., of Indianapolis. They are provided with self-oiling attachments; they can be regulated to operate at any speed required and the pistons work at an almost uniform speed during the entire stroke. The boiler feed pumps are cross connected so as to take water from either the hot well, heater or house tank. On the river side of the building there is a pump room which may be seen in the general view of the building. The pumps installed here are devoted entirely to pumping water from the river for the boiler feed, condenser and house service. The water supply for the entire plant is taken from the Sangamon River through an intake crib built into the bank of the river and water is drawn through two suction pipes, one 30 in. and one 8 in. in diameter. In the pump room are located three Dean Bros.' pumps, two of which are house pumps 12 x 10 x 20 in. in size. The water ends of these pumps are located in the basement of the pump house and the steam ends are situated on the main floor of the building, the water and steam cylinders being 26 ft. 6 in. apart. This arrangement of the pumps was made necessary by reason of the unusual variation in the level of the Sangamon River, which amounts to as much as 27 ft. The steam ends of the pumps are located on the main floor so that all of the machinery can be operated from one level without requiring an attendant in



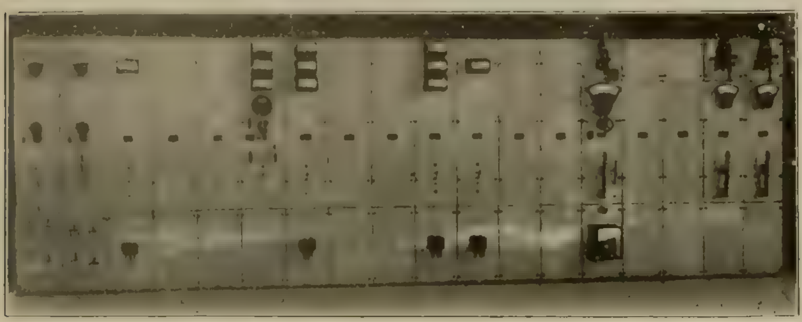
SECTION OF STATION, SHOWING INTAKE CRIB.

the basement, and the water cylinders are placed as low as possible so as to be able to take water when the river is at its lowest point. The house pumps are connected to an 8-in. suction pipe and they have 6-in. discharges. The circulating pump, which is 24 x 40 x 24 in. in size, has a 20-in. suction connection and a 16-in. discharge to the condenser. The water end of this pump is also located 26 ft. 6 in. below the steam ends. The condenser is the Wheeler "Admiralty" surface type, having 4,000 sq. ft. of condensing surface, and is provided with a 16-in. outlet connecting to the 24-in. overflow pipe running to the river, which discharges into an overflow crib, giving it a water seal so as to act as a syphon. The air pump is of the Edwards vertical type.

A platform is built alongside the stack directly over the boiler feed and hot well pumps previously mentioned, and on this platform is located a 5,000-h. p. Webster "Star" vacuum feed water heater.

The engine room is 133 ft. 7 in. long by 67 ft. wide and at present contains but one generating unit, which occupies but a small part of the available space in this room. This unit consists of a 28 x 56 x 48-in. Hamilton-Corliss cross compound condensing engine running at 94 r. p. m., direct connected to a 1,000-kw. three-phase 2,300-volt 25-cycle alternator made by the General Electric Co. The engine has a 20-ft. fly-wheel with a 19-in. face, and weighs 110,000 lb. The 2,300-volt circuit of the generator is led to three air-blast transformers which step the current up to 19,100 volts delta or 33,000 volts Y.

STEEL BRIDGE BETWEEN VIRDEN AND GIRARD.



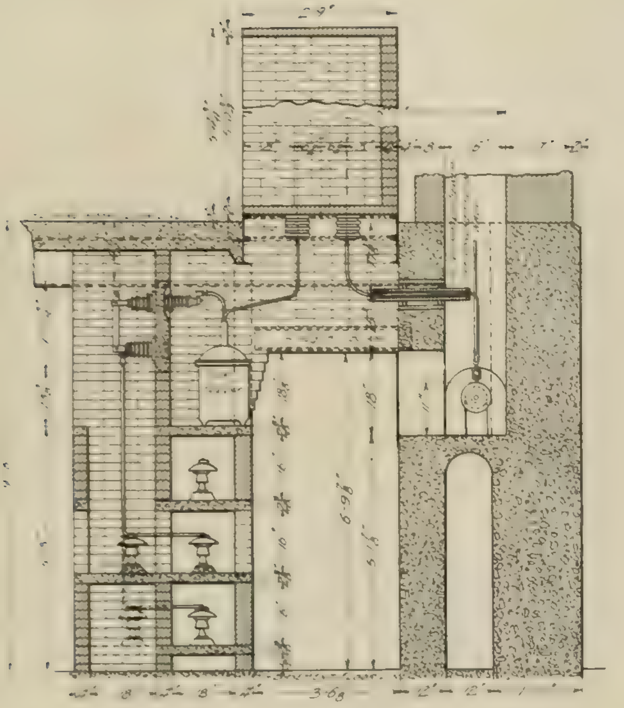
POWER HOUSE SWITCHBOARD.

The engine room also contains two exciter sets, one of which is driven by a 100-h. p. General Electric induction motor. The generator has a capacity of 75 kw. and operates at 125 volts. The other exciter set comprises a 50-kw. generator driven by a General Electric vertical marine type engine with cylinders 12 x 11 in.; this runs at 280 r. p. m. In one corner of this room is located a sub-station equipment, a view of which is shown herewith. The high-tension current passes through motor-operated oil switches to three air-blast transformers which step the current down to 370 volts. This current then passes through the reactance to one rotary converter of 500 amperes capacity which furnishes 600-volt direct current for the portion of the road adjacent to the power house. The switchboard, located in one corner of the engine room, is built of marble supported by a steel frame; a general view of the board is shown in one of the engravings. It will be noticed that nothing but the indicating instruments, handles for operating the switches, etc., are shown on the surface of the board. It is located about 5 ft. from the side wall of the building, giving ample room for passage way behind the wiring, resistance boxes and other apparatus contained on the back of the board. A diagram of the circuits on the board is given in one of the accompanying illustrations.

The engine room is spanned by a 15-ton hand-power crane, built by the Northern Engineering Works, of Detroit. This crane has a span of 67 ft. and travels the entire length of the engine room. This completes the present equipment of the engine room, but the capacity of the plant is about to be increased by the addition of a 1,000-kw. Curtis steam turbine, which has been ordered for immediate installation. This turbine is a 4-stage machine with a speed of 800 r. p. m., and a Wheeler condenser and Edwards air pump of the same kind used with the present generating unit will be used with turbine unit. The turbine is vertical and the lower bearing is a step bearing made of lignum vitae which is lubricated with water. In connection with the step bearing, an R. D. Wood 8-in. accumulator with cast iron weights is used, by means of which the pressure of water in the bearing is automatically regulated. The upper bearing is lubricated with oil. A complete pressure oiling system is also being installed in this plant with oil pumps, tanks and filters. This oiling system is to be extended to all the pumps, engines and other machinery in the plant.

The high tension lines drop from the step-up transformers down to the bus bar compartments in the basement, which extend around two sides of the building in the form of an L. The air pressure in the bus bar chamber is maintained at about one-half an ounce by a Buffalo Forge Co. blower, which is driven by means of a direct connected 350-volt induction motor. Located between the transformers and the bus bars are three-pole,

VIEW IN BOILER ROOM.



METHOD OF TAKING HIGH TENSION HEADS FROM BUS BARS

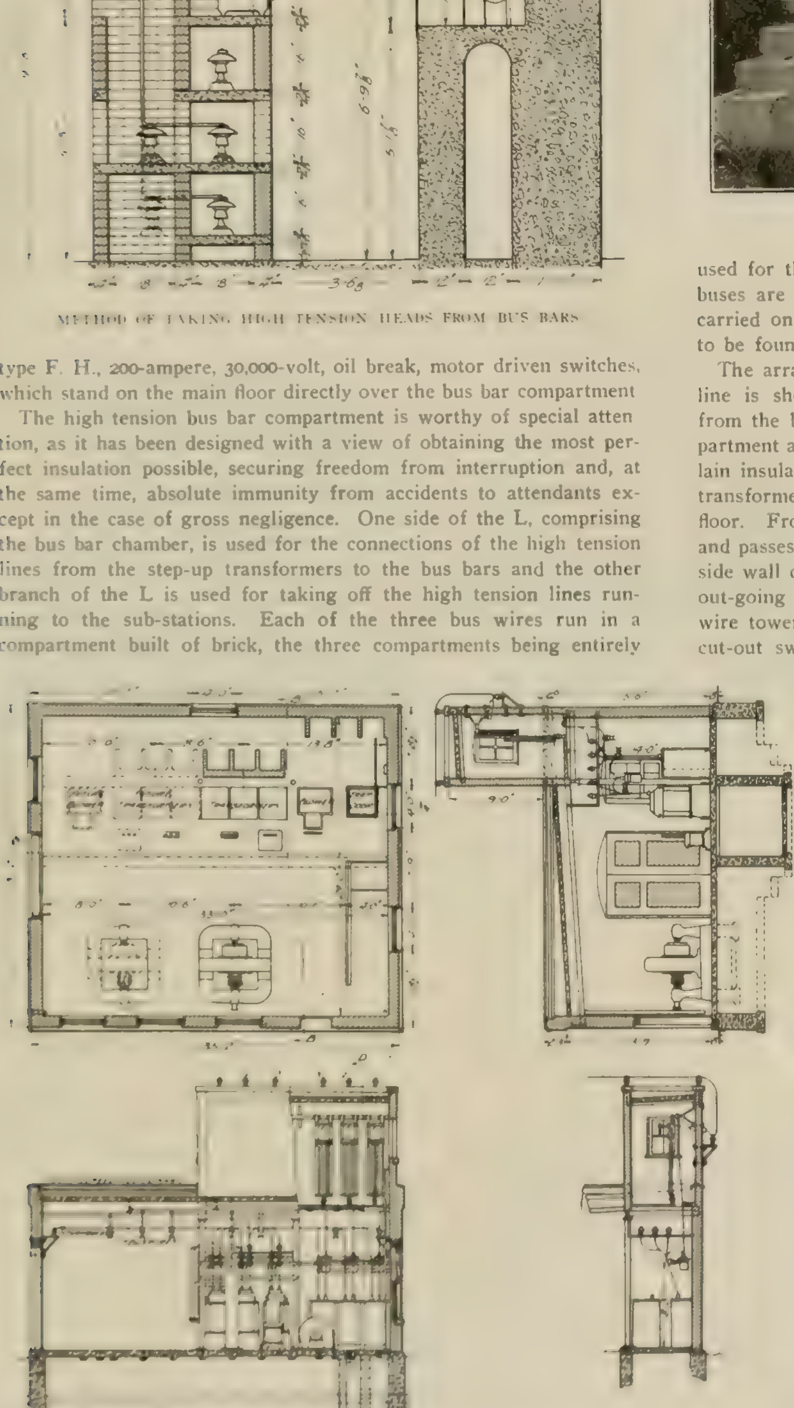
type F. H., 200-ampere, 30,000-volt, oil break, motor driven switches, which stand on the main floor directly over the bus bar compartment.

The high tension bus bar compartment is worthy of special attention, as it has been designed with a view of obtaining the most perfect insulation possible, securing freedom from interruption and, at the same time, absolute immunity from accidents to attendants except in the case of gross negligence. One side of the L, comprising the bus bar chamber, is used for the connections of the high tension lines from the step-up transformers to the bus bars and the other branch of the L is used for taking off the high tension lines running to the sub-stations. Each of the three bus wires run in a compartment built of brick, the three compartments being entirely closed to each other. These compartments are 17 in. square inside measurement, and openings on either side of the compartments are made wherever connecting wires are brought in or where insulators are located. These openings are arranged so as not to come vertically over each other and a heavy concrete slab is built into the wall at the top and bottom of each opening. Strain insulators are provided at the ends of the bus wire compartments so that the slack in the wires may be taken up. Heavy porcelain insulators are

TYPE OF CONCRETE CULVERT

used for this purpose, while the other insulators for supporting the buses are the standard pole line insulators. The insulators are all carried on iron pins and no wood or other inflammable material is to be found in the bus bar compartments.

The arrangement for taking off the leads to the high tension pole line is shown in one of the accompanying illustrations. A tap from the bus wire is brought out through the opening of the compartment and carried up to a disconnecting switch mounted on porcelain insulators. From this switch the line passes through a current transformer, thence up to an oil-break switch located on the main floor. From the other side of this oil switch the line drops down and passes through a wall to a vertical flue or conduit built into the side wall of the building. There are two sets of these flues for the out-going high tension lines and the wires run up these flues to wire towers on the roof, which contain the lightning arresters and cut-out switches. The bottom ends of the wires in the flues are provided with turnbuckles to keep them taut. From the wire towers on the roof the high tension lines are carried over to the pole line, a set of wires running out in either direction from the station.



PLAN AND ELEVATIONS OF SUB-STATIONS

The overhead pole line includes a No. 000 trolley wire, a No. 000 continuous feeder and No. 2 high tension lines. The continuous feeder is tied into the trolley wire every quarter mile. The high tension circuits from the Riverton power house are carried to sub-stations in Decatur, Illiopolis, Chatham, Virden and Anderson, and these sub-stations furnish direct current for the entire line of the road between Decatur and Carlinville. The high tension line insulators were furnished by the Locke Insulator Co., of Victor, N. Y.

The sub-stations, while differing slightly in dimensions, are essentially alike and their general arrangements are shown in one of the accompanying illustrations containing a plan and elevation views. Like the power station, they are so constructed as to be absolutely fireproof, the only materials employed being concrete, brick and steel. Their equipment is identical with that of the sub-station in the Riverton power house and in every case provision has been made for duplicating the present equipment.

The distance from Springfield to Carlinville is about 40 miles and from Springfield to Decatur is also 40 miles. This 80 miles of road was put into operation this fall when the generating plant at Riverton was practically completed.

The company owns 11 combination passenger and baggage cars, four of which are 46 ft. long built by the St. Louis Car Co., and seven of which are 51 ft. 6 in.

TWO-SPAN STEEL BRIDGE BETWEEN WOODSIDE AND CHATHAM.

long, built by the American Car Co. The general arrangement of of the interior of these cars is similar to those described in the "Review" for September, 1904, which operate on the Champaign-Danville interurban line of the McKinley syndicate. The St. Louis cars are equipped with four 65-h. p. motors and the American Car Co. cars with four 75-h. p. motors, all having Westinghouse straight air brakes. The St. Louis cars are heated with Peter Smith hot water heaters and the American Car Co. cars with "Western" heaters made by the Franklin Railway Supply Co., Franklin, Pa.

The cars are all operated with the General Electric type M multiple control. The longer cars made by the American Car Co. are here illustrated by an exterior view. These cars are 45 ft. 1½ in. long from the outside of the sheathing on the front end to the end panels at the rear. The width over outside sheathing is 8 ft. 10 in. The passenger compartment is furnished with leather upholstered 36-in. seats with stationary backs. These cars are handsomely finished inside and excellent lighting effect is produced by placing the incandescent lamps upon the arches of the roof. The bronze trimmings throughout include a continuous parcel rack handsome in design and of generous proportions. Stained glass is used in the arched deck sashes and in the upper part of the windows which adds greatly to the appearance of the car from both within and without. A toilet room of standard steam car design is located at one corner of the car. A single sliding door is placed between the passenger and baggage compartment. The latter compartment is arranged for the use of smokers when it is not occupied by baggage and it contains net doors to guard the side door openings, for use during the warm weather. The location of the motorman's cab may be seen in the illustration through the open door of the baggage compartment.

The organization of the officers and operating staff of this company, which is operated entirely as a single property, is shown in the accompanying diagram which is supplementary to the diagram of organization shown for the McKinley properties extending from Danville to Decatur. Mr. W. B. McKinley is president and general manager and Mr. L. E. Fischer is manager and purchasing agent of the entire system from Danville to St Louis. Mr. R. D. Smith is the assistant manager of the lines between Decatur and St. Louis and as such reports to Mr. Fischer. Mr. Smith is also president of the Central Illinois Construction Co. which has charge of all new construction for the syndicate, and as such reports directly to Mr. McKinley.

The relations of both the construction company forces and the operating departments of the roads are shown in the accompanying diagram. Mr. W. K. Tarrant is chief engineer of the construction department and the operation of the power plant is in charge of Mr. Frank Brumagin.

All the franchises and rights of way have been secured for the completion of the road between Carlinville and East St. Louis, and contracts for the construction have been let and much of this work is under way, so that the entire distance will undoubtedly be in operation next year. The syndicate also expects to secure a right of way between Champaign and Decatur during the year 1905 and to build this link in the system in 1906. It also has in contemplation building branch lines both north and west from Springfield sometime in the future. As it has ample power house capacity the syndicate will willingly co-operate with other parties desirous of building these extensions before the McKinley syndicate is ready to undertake them.

STANDARD CAR, ILLINOIS CENTRAL TRACTION CO.

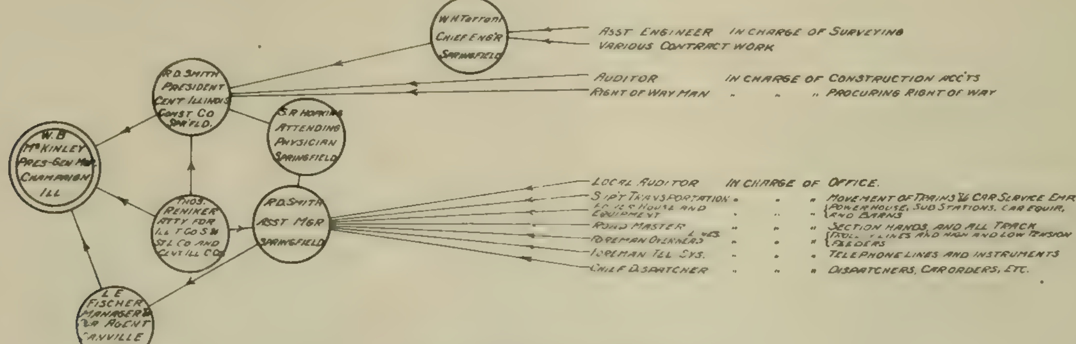


DIAGRAM OF COMPANY ORGANIZATION.

The Butte Electric Railway Benevolent Association has been organized at Butte, Mont., for the assistance of all company employes when sick or injured. The officers are A. H. Van Wart, president; William Hosking, secretary; George Scott, treasurer.

Amusement Parks and Their Influence on Passenger Traffic.

The interest now being taken by street railway companies in amusement resorts is on a par with the remarkable development which has recently taken place in the erection of such resorts throughout the country. Scarcely a city in the United States containing a population of 25,000 or more is without its combination of suburban trolley and amusement park. With the present high standard of trolley service and the large number of amusement attractions, the business of these enterprises is increasing at a rapid rate. During last season the development of park projects in Coney Island increased the summer traffic of the railways over 40 per cent. and the same ratio holds good in numerous other cities.

Chief among the promoters in this line of enterprise is Edward C. Boyce, 302 Broadway, New York City. He is now engaged in erecting six parks in different parts of the country, the aggregate cost of which will exceed $2,000,000. The largest of these is the White City, Chicago.

Mr. Boyce is president of the White City in New Haven and vice-president of both Dreamland, Coney Island, and the White City, Chicago.

In a recent interview at his office, Mr. Boyce said: "The inauguration of high class resorts for outdoor summer amusement, containing a large number of individual devices, is a development which had its beginning not earlier than the year 1900. The chief factor in making possible the remarkable progress which has since been made is the modern street railway system. Prior to the introduction of electricity on an extended scale, it was impossible to transport large numbers of people to any given point with comfort, speed, and at nominal expense.

"By the complete solution of these difficulties the success of amusement resorts has been made possible, and some idea of the magnitude and profit of such enterprises may be conveyed by the fact that one individual resort erected during the season of 1904 cost upwards of $2,300,000 and returned a net profit of close to $500,000 as a result of its first season's operation.

"I am building a number of new amusement parks for various traction companies. The success of last season has convinced these companies that not only is the modern amusement park a safe, sound and very profitable investment, but that it does more to increase summer traffic than any known medium. I may safely predict that within the next few years substantially every street railway company in America will have along its lines a complete and up-to-date amusement resort."

GENERAL VIEW OF DREAMLAND, CONEY ISLAND.

One of the accompanying engravings shows the construction work now going on at the White City, which is located at 63rd St. and South Park Ave., Chicago, a short description of which should be interesting.

This new million dollar park bids to be one of the finest and most complete amusement enterprises in the world and includes among its attractions the largest and latest devices in the field. The Scenic Railroad, which is nearing completion, has a loading station 75 x 100 ft., 744 ft. of track structure and a scene shed 200 x 150 ft. The Canals of Venice is a new attraction and covers 100 x 250 ft. The central feature of the park will be a steel tower 325 ft. high and covered with 40,000 electric lights, erected at a cost of $40,000. The Shoot-the-Chutes is to be the longest ever erected, the chute proper being 500 ft. long; the lake for which is completed and work on the chutes is well under way. The restaurant in the White City will seat 2,400 persons and will be conducted by the Sherman House management, proprietor of the well-known College Inn. The entrance to the park is 117 x 150 ft., where the offices of the company will be erected. A main feature of the park will be its Fire Show, erected at a cost of $65,000, which

will cover ground space 250 x 200 ft. Three hundred and twenty-five people will be used in the production, in addition to trolley cars, automobiles, delivery wagons and two complete companies of firemen, with the most modern fire-fighting apparatus. In addition to these large attractions there will be the Midget City, the Baby Incubators, the Circle Swing, the Monkey Theater, General Bumps, the Bowery Building, the Arcade Building, a band stand, a ball room and several smaller buildings. The White City is laid out with a board walk 50 ft. wide in front of its buildings. This walk forms a square inside of which is a sunken garden and the chutes lagoon; inside the sunken garden a band stand will be erected and across the lagoon will be a bridge. The management will make a point of having good music and has already engaged for its opening feature the Banda Rosa.

All buildings will be divided by brick walls and a complete system of fire protection installed. A complete sewerage system with 20-in. main, and complete water system with 6-in. main will be installed. Construction work was begun September 29th and without any rush or overtime work the park will be finished for the formal opening, which will occur Friday, May 26, 1905.

The White City is being erected and will be operated by the White City Construction Co., of which Joseph Beifeld is president; Edward C. Boyce, of New York, vice-president; Aaron J. Jones, secretary and treasurer; Paul D. Howse, general manager; John Crute, of New York, is superintending construction work. Mr. Beifeld is the proprietor of the Sherman House, Chicago. Mr. Howse was for five years connected with the management of Sans Souci Park as superintendent and has conducted many other similar enterprises in the middle west.

The White City is reached by the lines of the Chicago City Ry., the Calumet Electric Street Ry., the South Chicago City Ry., and the South Side Elevated R. R., and 25,000 persons per hour can be handled with ease.

THE WHITE CITY, CHICAGO, NOW UNDER CONSTRUCTION

St. Joseph River Traction Co.

The St. Joseph River Traction Co. is the owner of the new line that is now under construction from Benton Harbor, Mich., to Dowagiac via Eau Claire. The line is to be 27 miles in length and will pass through the center of the great Michigan nurseries and the heart of the fruit belt via Indian Lake to Dowagiac. For 12 miles the line follows the St. Joseph River, along which many beautiful summer cottages and several pleasure resorts are built and which will be served by the new road. Private right of way has been secured and 14 miles of the grading has been completed. Franchises have been secured in Benton Harbor, Dowagiac, Eau Claire, Sodus and Silver Creek and it is expected the line will be ready for operation early in the spring of 1905.

The officers of the company are: President and purchasing agent, J. G. McMichael, who is also president of the Atlas Railway Supply Co., Chicago; vice-president, Henry C. Mason, Benton Harbor, Mich.; secretary and attorney, H. S. Grey, Benton Harbor. The company is incorporated with a capital stock of $750,000. The construction work is being done by the Bain Construction Co., F. Bert Olney, engineer in charge, with headquarters at Benton Harbor.

Convention of Westinghouse Managers.

During the week ending November 19th the district managers of the Westinghouse Electric & Manufacturing Co. held their annual meeting at East Pittsburg, to discuss plans and methods for the coming year. These conventions are annual occurrences and are productive of great good, bringing together men from all parts of the United States whose experiences are the natural outgrowth of conditions under which they labor. On Wednesday evening the management gave a banquet to the visiting managers, at which all of the executive officers of the company were present. A feeling of optimism was evidenced throughout the convention regarding the business situation and the prospects of continued prosperity throughout the country.

Large Contract for Brown Corliss Engine Co.

A contract from the City of Milwaukee to furnish and erect complete, at the North Point pumping station on the shore of Lake Michigan, near the end of North Ave., Milwaukee, one triple expansion high duty crank and fly wheel 20,000,000-gallon pumping engine, has been let to the Brown Corliss Engine Co., Corliss, Wis. The pumping engine has been the source of considerable discussion during the past few months and a great many prominent engine and pump builders of the country have submitted bids on this work. The engine will be built according to the plans and specifications prepared by the city, and plans and specifications submitted by the Brown Corliss Engine Co., the amount of the contract being $64,500. The contract was awarded after a thorough inspection of the Brown Corliss plant by the city engineer, and the entire Board of Public Works of Milwaukee, who reported that they found the concern amply able to execute the contract with efficiency and despatch.

First Electric Railway in Nevada.

The Nevada Transit Co. opened its line between Reno and Sparks to the public on Thanksgiving Day. Previous to this there were several private parties given by the officials. Although not entirely completed, the road is now operated regularly, cars being run from the Southern Pacific shops in Sparks to the Southern Pacific crossing at Sierra St. in Reno. This crossing is not yet in, as there is a large amount of special work involved. As soon as this is in place cars will be run through to the Virginia St. bridge, the present terminus of the line.

At present there are but two cars in operation, making half-hourly trips, but it is the intention of the compasy to put on more cars and otherwise improve the service as soon as possible.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

The decisions which have been reported in the Legal Department of the "Street Railway Review" since 1893 have been published separately by the Windsor & Kenfield Publishing Co. under the title "Street Railway Law," four volumes of which have been printed. Vol. I covers the period from January, 1894, to January, 1897; Vol. II from January, 1897, to July, 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901, to April, 1903. Vol. V is now in press. Price: Bound in sheep: four volumes, $10.00; single volume, $3.00. Bound in buckram: four volumes, $6.50; single volume, $2.00

RISK ASSUMED AND THAT NOT ASSUMED IN ATTEMPTING TO BOARD A MOVING CAR.

Schmidt vs. North Jersey Street Railway Co. (N. J. Sup.), 58 Atl. Rep. 72. June 13, 1904.

Although a person attempting to board a moving car takes the risk of injury resulting from its ordinary motion, he does not, the supreme court of New Jersey holds, assume the risk of injury from sudden and negligent increase of the motion of the car.

NOT LIABLE FOR INJURY TO ONE PASSENGER FROM STARTING CAR ON SIGNAL OF ANOTHER.

McDonough vs. Third Avenue Railroad Co. (N. Y. Sup.), 88 N. Y Supp. 609. June 10, 1904.

The plaintiff sued to recover for personal injuries which she alleged were sustained by being thrown by the sudden starting of the car while she was attempting to alight. The first appellate division of the supreme court of New York holds that the trial judge was right in charging that "if the jury find that the starting of the car was in response to a signal which the motorman supposed to come from the conductor, but which was actually made by the unauthorized action of a passenger, the plaintiff cannot recover."

A PATRON INCURS NO LIABILITY IN REPORTING MISCONDUCT OF CONDUCTOR.

Lancaster vs. Hamburger (Ohio), 71 N. E. Rep. 289. Apr. 26, 1904

A patron of a street railway company, the supreme court of Ohio holds, incurs no liability to a conductor by reporting to the superintendent of the company such conductor's misconduct while on duty toward a passenger, though in making the report he is prompted by ill will and a desire to secure the conductor's discharge from the service of the company.

PAYMENT OF ABROGATED LICENSE TAX TREATED AS PAYMENT ON AD VALOREM TAXES OWED.

City of Louisville vs. Louisville Railway Co. (Ky.), 81 S. W. Rep [illegible]. June [illegible], 1904.

Where a [illegible] tax of $50 [illegible] was levied under an ordinance enacted under an old charter, which was no longer in force, the court of appeals of Kentucky holds that the money paid under this ordinance after it had ceased to exist must be treated as paid on the ad valorem taxes which the company in fact owed.

UNWARRANTED CONSTRUCTION OR OPERATION OF STREET RAILWAY FOR WANT OF A CONTINUOUS ROUTE.

Altoona Belt Line Street Railway Co. vs. City Passenger Railway Co. (Pa.), [illegible] Atl. Rep. 177. May 23, 1904.

Where the requirement of the act under which a company was incorporated is that it shall have a continuous route, and this is impossible, because it adopted as part of its continuous route, recited in the application for its charter, certain streets upon which it can neither construct its railway, nor run its cars over the tracks already [illegible], the supreme court of Pennsylvania holds that as it cannot then, construct or operate the whole of its charter route, the construction or operation of any portion of it would be without warrant of law.

MOTORMAN ASSUMES RISK FROM TROLLEY POLE WHEN BEING REMOVED COMING INTO CONTACT WITH HIGH-TENSION WIRE.

Harrison vs. Detroit, Ypsilanti, Ann Arbor & Jackson Railway (Mich.), 100 N. W. Rep. 451. July 7, 1904.

A few months after an interurban electric line had been changed to the high-tension system, using standard 35-ft. poles to carry the high tension wires, a motorman and conductor climbed upon a car to change trolley poles. While the motorman was loosening the pole, and the conductor was lifting it, it gave way and formed an arc with the lowest high-tension wire. The danger, the supreme court of Michigan holds, was obvious and one assumed by the motorman. Nor does it consider that this was a case requiring instruction, the properties of these high-tension wires being unquestionably known to the motorman. As to the contention that he should have been told the precise location of this wire with reference to the top of the car, that the wire could be reached by a pole of the length of the trolley pole, it says that these facts were open to his observation and to the observation of every employe who ever passed over this road.

NOT REQUIRED TO LIGHT CURVES—OBLIGATION TO EMPLOYES.

Godfrey vs. St. Louis Transit Co. (Mo. App.), 81 S. W. Rep. 1230. May 10, 1904. Rehearing denied July 5, 1904.

The St. Louis court of appeals considers the proposition that a jury might find a company guilty of carelessness in failing to light a curve untenable. It says that there was no proof in this case that railway companies customarily put lights at the curves of their tracks, or that reasonable care demands such a precaution. In fact, it says it knows that it is not the custom to light those places. Railway companies are under legal obligation to employes to maintain a reasonably safe track and to furnish reasonably safe cars and other appliances. But to select an act like lighting the curved portions of track, which is only one of many precautions that may be adopted to make a track safe, and instruct a jury that they may find a railway company was negligent in failing to perform such an act, when there is no proof that it is the usage of well-managed railway companies, or indispensable to safety, is erroneous. As well tell the jury in the present case they might find the curve was too acute for safety (which was likely its fault, if it was faulty) without proof to show the fact; or single out any other possible defect

CARE REQUIRED OF PERSON STEPPING ON INNER FOOTBOARD. NOT REQUIRED TO POST NOTICE TO KEEP OFF INNER FOOTBOARD.

Allen vs. St. Louis Transit Co. (Mo.), 81 S. W. Rep. 1142. June 20, 1904.

The supreme court of Missouri, division No. 1, holds that instructions should have been given, which were asked, to the effect that, when the plaintiff stepped on the inner footboard, it became his duty to exercise such degree of care as the position he was in rendered reasonably necessary to prevent his being struck by a passing car, and if by standing upright, and not leaning out, he would have avoided being struck, yet failed to observe that care, he was not entitled to recover damages. It also holds that it was error to refuse an instruction asked that "the fact that no notices were posted in the cars warning passengers to keep off the inner footboard was not of itself such negligence as authorizes the plaintiff to recover in this action." That instruction the trial judge refused

to give, but added to it the following and gave it: "But the jury are to consider such fact, in connection with all the other facts in the case, in determining whether the defendants or their servants negligently operated the car upon which plaintiff was a passenger when he received the injuries complained of." The court holds that it was error to give the instruction as changed. It says that there was no duty devolving as to the defendants to post such notices, and therefore the omission to do so was neither negligence nor evidence of negligence.

REASONABLENESS AND APPLICATION OF RULE AGAINST CARRYING CUMBERSOME PACKAGES.

Ray vs. United Traction Co. (N. Y. Sup.), 89 N. Y. Supp. 49 June 30, 1904.

A rule of the company forbidding the carrying of "cumbersome" packages, the third appellate division of the supreme court of New York holds, was a reasonable one. In this case the intending passenger was carrying a steel cage about 2 feet square and from 2 feet to 2½ feet high—one purchased for and large enough to keep a parrot in. The jury apparently considered that this was not a "cumbersome" package, within the meaning of the rule. But the court does not think that finding was supported by the evidence. It says that a package that would reduce the carrying capacity of a seat to one-half if the package was deposited on the seat by the side of the carrier would evidently amount to an unmitigated nuisance if each seat was occupied by a party attempting to carry such a package on his or her lap. Therefore, in the judgment of the court, such a package is a "cumbersome" one within the purpose and intent of the rule stated. Furthermore, while the court would not hold that, as a matter of law, the decision of the conductor should be controlling upon that subject, yet it thinks it should have great weight, and his action in determining whether or not the rule is being violated in each particular case should not be reversed by a jury unless it is a case of willful or unreasonable judgment on his part. And in this case the court is of the opinion that the determination of the conductor should have controlled, and that he was justified in enforcing the rule against the plaintiff, and requiring her to leave the car if she insisted on carrying the cage.

CONDUCTOR CANNOT COMPEL PASSENGER TO UNFOLD TRANSFER—LANGUAGE NOT JUSTIFYING EJECTION.

El Paso Electric Railway Co. vs. Alderete (Tex. Civ. App., 81 S. W. Rep. 1246. May 18—June 15, 1904.

Alderete brought this action to recover damages for being ejected from a street car. He testified, among other things, that when the conductor approached him he said, "Fare." "I went into my pocket, and pulled out the transfer. It was folded up. He asked me to unfold it. I said it was a transfer. He said, 'Unfold it.' That was the second time he asked me. I said, 'Damned if I am going to unfold it; unfold it yourself.' He said, 'Give me a nickel.' He put his hand in my face this way, and threw it right back at me. I put it in his hand, and he threw it right back at me."

The court of civil appeals of Texas thinks that it sufficiently appeared that the plaintiff did not forfeit his right to remain on the car by what he did. It says that he was a passenger, had his transfer, and tendered it to the conductor when the latter requested his fare. The conductor had no right to reject the transfer and refuse to examine it because it was folded. The jury heard the plaintiff's statement as to how the ticket was folded, and saw the very ticket as he said it was folded, and probably concluded that the conductor's act in demanding that the plaintiff hand it to him unfolded was frivolous, arbitrary, and unreasonable. It might as well be held that if he had tendered a dollar bill folded the conductor could have refused it, and put him off if he did not unfold it.

The court thinks that the plaintiff was not guilty of improper conduct by which he forfeited his rights as a passenger by refusing to comply with the conductor's arbitrary demand, even though in doing so he made use of the emphatic language shown. The expression was neither obscene nor profane, and it did not constitute disorderly conduct justifying his eviction, especially where the jury might with much propriety, have considered that it was the natural result of provocation offered by the defendant's own officer.

WHERE THERE IS NO CONTRACT FOR CONTINUOUS PASSAGE IT IS LIMITED TO EXTENT OF RUN OF CAR ON WHICH FARE IS PAID—GENERAL CHARACTER AND DISPOSITION OF CONDUCTOR IMMATERIAL IN ACTION FOR EJECTION.

Brayer vs. Seattle, Renton & Southern Railway Co. (Wash.), 77 Pac. Rep. 495. July 12, 1904.

It appeared that the plaintiff boarded a car in Seattle, desiring to go to his home, at Fairview, a station outside of the city. The conductor demanded his fare, and he paid five cents, the customary amount. He did not inform the conductor that he desired to go to Fairview, and he made no inquiry as to how far that car would go. It also appeared by the evidence that the company intended that this car should go no further than Hillman City, which is a station nearer Seattle than Fairview. It further appeared that the plaintiff did not know that the car would stop at Hillman City, and inasmuch as a car, by schedule, should have left at 4:30 p. m., bound for a point beyond Fairview, he supposed that this car, which left at about that time, would go beyond his station. Before Hillman City was reached, the superintendent of the company took the motorman's place, and, upon reaching Hillman City, concluded that he had time to carry a few passengers as far as Brighton Beach, a station beyond Hillman City, while waiting for the next car to come. He apparently made this run as a matter of mere accommodation to certain Brighton Beach passengers, it being no part of the regular run of the car. At Brighton Beach he requested the plaintiff to take the next car, saying that he would tell the conductor on the other car to pick him up and take him on, which, however, he failed to do. The conductor on the car for Fairview demanded payment of fare, and for want thereof ejected the plaintiff.

In confirming a judgment for the company, the supreme court of Washington says that if there was a contract to carry the plaintiff as far as Fairview, then the minds of the plaintiff and the company's agents must have met upon that subject. Nothing, however, was said to the conductor upon the subject of the plaintiff's destination. The conductor knew that his car was bound to Hillman City, and not beyond. Under such circumstances, it was impossible for their minds to have met in an agreement to carry the plaintiff to Fairview for the fare he then paid. Nor does the court agree with his contention that if his contract was not, in the first instance, sufficient to carry him beyond Hillman City, it became sufficient when the superintendent said to him: "I will tell the conductor on the other car to pick you up and take you on." The court says that it will be observed that the superintendent did not say that the plaintiff would be carried upon the other car for the fare already paid. Doubtless the plaintiff so inferred, but the language used was not sufficient to make a contract to that effect, at least when unaided by any custom of the company to transfer passengers from one car to another to be carried further without additional fare. The court therefore thinks that the plaintiff had no contract except one for carriage as far as the car he first boarded was intended to go, viz., to Hillman City. When he was carried to the latter place, the contract was at an end. His carriage beyond that point was a mere gratuity—a license to him, revocable at pleasure, until he should pay fare, and thus effect a contract for further carriage upon another car. In short, the court holds that in this case there was no contract for continuous passage, and it was therefore limited to the extent of the run of the car upon which the fare was paid.

Moreover, the court holds that evidence touching the general character and disposition of the conductor who ejected the plaintiff was properly rejected, since his conduct and disposition as manifested upon the particular occasion were the only proper subjects for inquiry.

WHAT ARE DEEMED PORTIONS OF STREETS OCCUPIED BY TRACKS?

City of Boston vs. Boston Elevated Railway Co. (Mass.), 71 N. E. Rep. 295. June 23, 1904.

This was an action to recover of the defendant company the amount of a judgment obtained by one Findley against the city for a defect in a street caused by a depression in the pavement between the two tracks, but within a line drawn parallel with the side of the sleepers upon which the rails rested. The rails were laid in

wooden beams, which rested on sleepers imbedded in the street. The ties extended outside the rails on each side from 8½ to 10 inches. The street in the vicinity of the accident was paved from curb to curb with granite blocks.

The question was what is meant by the phrase "occupied by its tracks," in sections 32 and 33 of chapter 113 of the Public Statutes of Massachusetts of 1882, relative to the repair of paving which were still in force against the company. Revised Laws, chapter 112, Sec. 1. The city contended that it meant so much of the surface of the street as lay within lines drawn parallel to the outer ends of the sleepers on which the rails rested. But the supreme judicial court of Massachusetts thinks that it means the rails and the space between them on and over which the cars pass. It says that the provision relates to the surface of the streets, not to what is under the surface, and, when conssidered with reference to the surface of the streets, it thinks that it is obvious that this is what the case must mean. This is the construction which for many years the parties have put upon the statute, and it accords more nearly with the use of the word "tracks" in various provisions of the statutes, such as those relating to the removal of snow and the use of them, than the construction contended for by the city. The contention contended for by the city would make the provision with regard to the repair of unpaved streets 18 inches on each side of the track meaningless and unnecessary.

VALIDITY OF MODIFYING CONTRACTS EMBRACED IN ORDINANCES FOR EXTENSIONS AND CONSOLIDATION, AND OF SUBSEQUENT ORDINANCE TO APPLY RESERVATION OF PRIOR ONE FOR REDUCTION OF FARE—POWER TO MODIFY FRANCHISE CONTRACT, AND TO MAKE RENEWALS BEFORE EXPIRATION OF ORIGINAL GRANT—CASE FOR COURT OF EQUITY.

City of Cleveland vs. Cleveland City Railway Co. (U. S.), 24 Sup. Ct. Rep. 756. May 31, 1904.

An ordinance was passed by the city council of Cleveland, on August 25, 1879, granting to the Kinsman Street Railroad Company a renewal franchise for twenty-five years from September 20, 1879, to reconstruct, maintain, and operate its street railroad in and through certain streets of the city. Section 7 of the ordinance provided: "Said company shall not charge more than 5 cents fare each way for one passenger over the whole or any part of its line, but said company may charge a reasonable compensation for carrying packages; the council, however, reserves to itself the right to hereafter increase or diminish the rate of fare as it may deem justifiable and expedient." In 1880 the Woodland Avenue Railway Company became, by purchase, the owner of the Kinsman Street Railroad, and thereafter operated same. In 1883 the Woodland Avenue Railway Company was granted the right to construct an extension of its line, provision being made in the ordinance for a charge of one fare over the entire line, including the extension. In 1885, the Woodland Avenue Railway Company and the West Side Street Railroad Company were consolidated as the Woodland Avenue & West Side Street Railroad Company, the consolidated company being vested with all the property, rights and privileges of the two constituent companies. The ordinance, the acceptance of which accomplished such consolidation, provided, among other things, that for a single fare from any point to any point on the line or branches of the consolidated road no greater charge than 5 cents should be collected, and that 11 tickets should be sold for 50 cents, or 22 for $1. In the same year, the Woodland Avenue and West Side Street Railroad Company was authorized to lay an additional track and extend its line of railroad, with a similar provision as to fare, the right granted to terminate with the grant of the main line, in 1908. Again, in 1887, it was authorized to build an extension, with a similar provision as to fares. In 1893, with the approval of the common council, the Woodland Avenue & West Side Street Railroad Company and the Cleveland City Cable Railway Company, which latter, as the successor in right of previous corporations, operated two street railroad lines, became a consolidated corporation, under the name of the Cleveland City Railway Company. By the consolidation it was provided that the lines should be operated as one system, that proper transfers should be issued, and that but one fare should be charged for a continuous passage upon any portion of the consolidated lines. Then, in 1898, an ordinance was adopted by the city council to provide for a diminution of the rate of fare under section 7 of an ordinance passed August 25, 1879, entitled "An ordinance granting a renewal of franchise to the Kinsman Street Railroad Company," etc.

The supreme court of the United States holds that, taking all the circumstances into account, contracts had been engendered, and that such contracts, embodied in the prior ordinances, were impaired by the ordinance of 1898. As to the contention that the ordinances embodying the contracts were void, in so far as they attempted to deprive the city of the continuing legislative power to act on the reservation contained in the ordinance of 1879, by reason of section 2502 of the Revised Statutes of Ohio declaring that a municipal corporation shall not, during the term of a grantor or renewal thereof, release the grantee from any obligation or liability imposed by the grant, the court says that it has been held in Ohio, on reasoning commending itself, that a modification of a contract between a municipality and the owner of a street railroad, made in good faith, for the better accommodation of the public, is not void by virtue of said section 2502. It also accepts the decisions of the courts of Ohio that, under the statute, renewals may be made before the expiration of the original grant.

Respecting the contention that the case presented was not within the jurisdiction of a court of equity, the court thinks it sufficient to say that, in view of the controversies, confusion, risks, and multiplicity of suits which would necessarily have been occasioned by the resistance of the complainant to the enforcement of the ordinance, and in view of the public interests and the vast number of people to be affected, the case was one within the jurisdiction of a court of equity. This conclusion, it thinks, besides, inevitable, when it is borne in mind that the ordinance in question did not purport to reduce rates of fare upon the consolidated line, but was made operative alone upon a section of that line, and, therefore, necessarily would have engendered the enforcement of two rates of fare over the same line, leading to consequences dangerous to the public interest, peace, and tranquility, the extent of which it would be difficult in advance to perceive.

POWER OF CONDEMNATION UNDER ILLINOIS STATUTE—AT NARROW EMBANKMENT—LIMIT TO RIGHT OF DEVIATION FROM HIGHWAY—NOT ENTITLED TO SAVE DISTANCE—ADOPTION OF ELECTRICITY AS POWER DOES NOT ENLARGE POWERS OR CHANGE DUTIES—WHEN NO PUBLIC NECESSITY FOR ROAD THROUGH COUNTRY DISTRICTS.

Hartshorn vs. Illinois Valley Traction Co. (Ill.), 71 N. E. Rep. 612. June 23, 1904.

This company was incorporated under the general law of Illinois of 1872 (Laws 1871-72, p. 625), as a street and interurban railroad company, for the purpose of constructing electric street railways in and connecting a number of towns. Because of alleged difficulties in the nature of excessive grades, additional distances, and increased cost, the company determined to entirely disregard the grant of right of way over the roads from the county board, and construct its road almost entirely over private lands from La Salle to Utica, and this proceeding was instituted for condemnation, under the eminent domain act, of the right of way for part of the distance between said points, a considerable part of the right of way having been acquired by private grant. However, as the supreme court of Illinois read the affidavits of the various persons in behalf of the company it was impressed with the view that the most objectionable feature to the route abandoned, to the company, was the distance, which was conceded to be 2.45 miles greater than the route it proposed to take.

Now it does not appear to the court a substantial reason for entirely abandoning the highway that the traveled way, or a portion of the way, was by an embankment that was not wide enough to accommodate the general travel and the company's road. It says that there has at no time been any question of the right of the company, or roads similarly organized, to acquire, by condemnation or otherwise, the necessary land for such deviation from the highway as the physical conditions require, and if it be that at any point the road should be too narrow or the turns too abrupt, the court is entirely clear that the company would have the right to acquire the additional width or to acquire the necessary land for proper turns.

While this statute (Hurd's Rev. St. 1899, c. 131a, Sec. 1) provides

that a company such as this one may appropriate any property necessary for the construction of its road, we must not lose sight of the character of such road in determining what is necessary for its construction. Such railways may deflect from the highway where necessary, but they must make an honest effort to follow the highway, and, until it appears that they are following the highway, there is no basis or excuse for deflection, and no right to condemn private property upon the theory that they are deflecting or diverging from the highway. Abandonment of the highway is not deflection from it, within the law regulating such companies.

In considering the rights of these companies, we are not to look alone to that which will best promote their financial gain. They are asking for the power of the state to take private property, and it is only upon the theory of a public use that such right can be granted to them, and this company, in its effort to save distance, and thereby save expense of construction, and in its desire to establish and maintain rapidity of transportation, was, as the court thinks (taking the character of such roads into consideration), departing from the intention of the lawmaking branch of the government, by which such organizations were authorized. So far as they are authorized to travel through the country districts, it is upon the theory that they will be of benefit to the rural inhabitants, and not that only those living in towns, where regular stations shall be maintained, shall be the beneficiaries. They are presumed to follow the highways, making all the stops necessary for the accommodation of the people living along the highways. The fact that they have adopted electricity as their power, instead of the horse or the dummy, cannot enlarge their powers or lessen or change their duties. If the country districts are so sparsely settled that the traffic along them will not support such roads following them, then their construction is not a public necessity, and the power of eminent domain, upon the theory that they are to exercise a public function, cannot be called into action in their behalf. If they seek to travel across the country as do steam railroads, disregarding highways and disregarding the interests and conveniences of the country people, let them organize under the law regulating steam railroads, and be subject to the regulations of the statute and the burden cast upon such railroads. On the other hand, if they wish to avoid these burdens and to avail themselves of the greater freedom and the right to burden the highways, then they must be willing to observe and perform the duties that they owe to the public as such.

NO PRESUMPTION THAT A COMPANY WILL VIOLATE ITS CONTRACT — ANTICIPATION OF BREACH OF CONTRACT OR INJURIES NO GROUND FOR INJUNCTION—SIMILARITY OF INTERURBAN TO ORDINARY ELECTRIC STREET RAILWAY AND DIFFERENCE FROM STEAM RAILROAD — CARRYING OF LIGHT EXPRESS AND MAIL MATTER—NOT ADDITIONAL BURDEN UPON STREET—LIABILITY FOR SPECIAL DAMAGES.

Nordhurst vs. Ft. Wayne & Southwestern Traction Co. (Ind.), 71 N. E. Rep. 642. July 1, 1904.

It will not be presumed, the supreme court of Indiana says, that a railroad company will violate its contract with the city prescribing the terms and conditions upon which it may use the streets thereof, and an allegation of a complaint that it intends to do so, in advance of any act of the company constituting such violation, cannot prevail against the presumption of good faith and fair dealing. Or, as the court again says, future breaches of that contract, or violations of its terms by the company, resulting in special damage to the property of the plaintiff, an abutting property owner, may hereafter entitle him to maintain an action against the company for such injuries, but the mere anticipation of such breaches and injuries cannot authorize the court to enjoin the construction and operation of the railroad.

Both kinds of roads, namely, ordinary electric street railroads and interurban electric railways, when deemed necessary, use the T-rail, and their cars are propelled by the same motive power. The carriage of light express matter, passenger baggage, and mail matter upon street cars would not constitute ground of complaint on the part of abutting lot owners. If only one car is run, the street is occupied and obstructed by it to no greater extent than it would be by a street car. If two constitute a train, they will take up no more space and do no more injury than a motor car and trailer, which are commonly run upon street railroad tracks when the business of the company requires such additional car. The fact that light express matter, passenger baggage, and United States mail matter are carried on a car does not affect the property owner, nor injure his property. The transportation of articles of this kind does not create any resemblance between the interurban electric railroad and a steam railroad carrying ordinary goods and merchandise, and results in none of the annoyances and injuries which are caused by either passenger or freight trains on such a railroad. A fair comparison of the incidents and consequences attending the running of a single interurban electric car carrying passengers and baggage, light express matter, and United States mail matter over the streets of a city, or resulting therefrom, with the real and substantial annoyance, inconvenience, danger, and injury to property attending the operation of passenger and freight trains on steam railroads, will demonstrate that most, if not all, the ills and injuries anticipated from the former are imaginery, or at least greatly exaggerated.

This court has held that an electric street railroad constructed and operated wholly within the city limits is not an additional burden upon the street, and that the owners of abutting real estate are not entitled to compensation on account of such appropriation and use. It is equally well settled, on the other hand, that a railroad corporation cannot construct a common passenger and freight railroad upon the streets of a city, in the absence of a license from the abutting lot owners, without compensation first assessed and paid or tendered. This distinction does not rest upon a difference in name—one being denominated a street railroad or a passenger railroad, and the other a commercial or freight railroad—nor upon the motive power employed, nor upon the kind of rail used, nor upon the length of the railroad. It results from the nature of the business done by each of the two kinds of railroads, and the physical agencies and manner by which and in which that business is carried on. Those of the one are consistent with the use of the street by the lot owner and the general public, and, if not directly beneficial to the abutting real estate, are not detrimental to it. They relieve the streets from some of the burdens of travel upon it, they facilitate travel between different parts of the city, and they enhance the value of abutting property by increasing the convenience of access to it. The business of the other class of railroads, and the means by which it is necessarily carried on, require the service of entirely dissimilar agencies and methods.

Discriminations in the terms and conditions on which a public way could be used in favor of the abutting lot owners, the residents on the particular street, or the inhabitants of the city, and against nonresidents, could not be tolerated. Rapid and cheap transportation of passengers, light express and mail matter, between neighboring towns and cities may be quite as necessary and as largely conducive to the general welfare of the places so connected and their inhibitants as the like conveniences within the town or city. Where such transportation is furnished by an interurban electric railroad operated under the conditions and restrictions contained in the agreement in this case, the court does not think a construction and operation of such a railroad in such a manner constitutes an additional servitude upon the street which entitles abutting property owners to compensation.

For any actual and special damage sustained by the abutting lot owner by reason of the construction of the railroad, or resulting from its use, the lot owner has his remedy by an action at law. The railroad will be liable to the abutting lot owner for any special injury to his property occasioned by the negligence of the company in constructing its railroad or in operating it. Nothing that has been said in this opinion is to be understood as denying or in any degree abridging that right.

The annual meeting of the Brooklyn Engineers' Club was held at the Oxford Club, 109 Lafayette Ave., on Thursday evening, December 8th, at which the annual reports of the board of directors, officers and committees were received and officers for the ensuing year were elected. The annual dinner was held the same evening at the Oxford Club at 7 o'clock and addresses were made by several prominent speakers.

The Rockford & Interurban Railway Co. is among the first to issue the 1905 calendar. It is a very convenient size 4½ x 9 in., and shows half-tone engravings of some of the views along its lines, including power stations, etc.

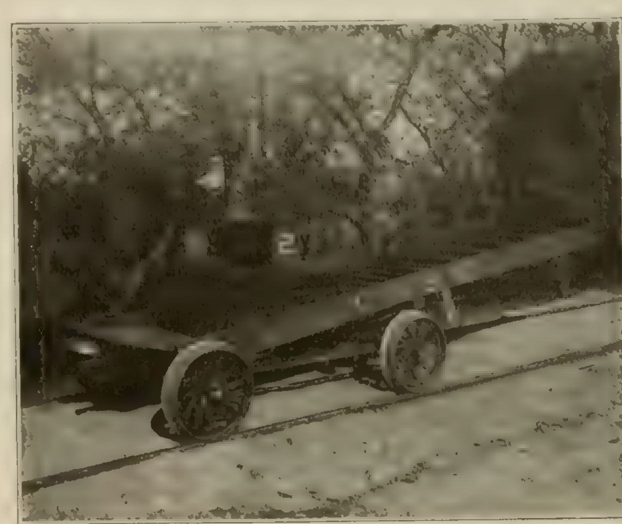
International Railway Employes Association.

Considerable spirit was shown in the recent election of officers of the International Railway Employes' Association held in Buffalo November 19th, some 1,700 votes being cast. The annual election always arouses much interest and friendly rivalry, but this year's balloting was more lively than ever. There are four permanent officers of the association, as follows: W. Caryl Ely, president; T. E. Mitten, first vice-president; W. S. Sullivan, secretary; B. F. Rankin, treasurer. The officers elected were a second vice-president and three trustees. Following the election, President Ely gave his annual address. The insurance feature is the most important one in the association; in case of death an employe's family is paid $150 and if an employe is sick for more than a week he gets one dollar per day for 90 days. The dues of the association are 50 cents per month.

Cleveland and Southwestern Repair Car.

By courtesy of Mr. H. A. Nicholl, general manager of the Cleveland & Southwestern Traction Co., we are enabled to illustrate the gasoline motor car used by this company for line inspection and repair work. The car is one of the regular 4½-h. p. runabouts made by the Olds Motor Works, of Detroit, excepting that flange iron wheels have been substituted for the rubber tired wheels in order that the car may be operated on the rails. A few minor alterations in the seat for the men have been made, a gong placed on the front end, and a tool box placed at the back. This box serves as a rear seat. The ladder which was attached to the car at the Traction company's shops is made of poplar, a wood which is both light and tough. Experience with this car has shown that the linemen are able to do almost any kind of repair work and the capacity is such that they can carry with them an ample supply of wire, line material and tools. Two men operate the car and it can be readily lifted from the track when necessary.

LINE CREW AT WORK.



CLEVELAND & SOUTHWESTERN REPAIR CAR.

Poles of Reinforced Concrete.

The Steel Concrete Construction Co., of 100 State St., Albany, N. Y., has placed upon the market poles of concrete reinforced by steel, a few of which have been installed by the Schenectady Railway Co. and the United Traction Co. of Albany, with a view of determining whether they would be satisfactory for their wants. The Schenectady Railway Co. has put in place two poles, which are 35 ft. in length, 6 in. square at the top and 15 in. square at the bottom. This pole complete weighs about 4,500 lb., the concrete of which it is composed being made up of one part cement and four parts blue lime stone crushed to pass through a ½-in. screen. The concrete is strengthened by twisted square steel bars ranging in size from ½ in. to ⅝ in. The bars are twisted cold, this being done in a machine especially designed for the purpose. The amount of steel used in the pole described is about 250 lb., the weight of the steel depending altogether upon the stress which it is contemplated the poles will have to withstand. In the poles described the working stress is a pull of 1,000 lb. at a height of 15 ft. from the ground. The cost of these poles is given at 35 per cent less than a steel pole designed to stand the same stress. They are set in the ground about 5 ft. deep, the base being surrounded by concrete. The pins forming steps for mounting the pole are of steel and are inserted when the concrete is cast. The concrete poles may be painted and it is considered that the life is practically infinite.

The Union Traction Co., of Albany, has had a 26-ft. pole of similar construction in use in the city of Watervliet for the last eight months which is reported to have given the best of satisfaction. For the foregoing particulars of the poles installed by the Schenectady Railway Co., we are indebted to the general manager, F. F. Peek.

Youthful Inventors.

A dispatch from Boston says that two fifteen-year-old boys of that city have established a wireless telegraphic connection between their homes, half a mile apart. This recalls the fact that thirty days after the appearance of the first published accounts of Bell's invention of the telephone, two New York boys had built and were successfully operating an experimental telephone system of their own. These two boys have since achieved distinction in the electrical field, and have for many years been allied in business. They are Prof. F. B. Crocker, of Columbia University, and Dr. Schuyler Skaats Wheeler.

November Meeting Ohio Interurban Railway Association.

The fourth regular meeting of the Ohio Interurban Railway Association was held at the Boody House at Toledo Nov. 17, 1904. The meeting was called to order at 10:30 a. m. by the president, Harrie P. Clegg.

The minutes of the last meeting were then read, which recited the recommendations decided upon by the association regarding special cars and compensation to newspapers.

In the matter of special cars the association recommended that a uniform rate of twenty cents per mile be made for the operation of special cars over foreign tracks, the company owning the cars to assume entire cost of the crews and be liable for accidents to the equipment or passengers, and the foreign company to furnish the pilot when the car was on its line.

Regarding the newspapers, the association recommended that contracts at a fixed rate per line for special notices and a fixed rate per inch for all time tables be made and paid for in advertising mileage based on the regular one-way single-trip fare. For carrying papers, if flat rate, ½ cent per pound was recommended, this to be paid for in advertising.

After the Columbus meeting of the association, the executive committee took up the matter of requiring bonds from those entering the interchangeable mileage agreement, and, on further consideration, decided that no bond would be asked. The form of agreement was decided upon; under this agreement the representative of each road signing the contract becomes a trustee for the funds derived from the sale of interchangeable coupon books.

After the minutes had been approved, the president announced the work of the committee on rules, and the report of the rules committee was ordered printed and copies sent to the members of the association.

The secretary read the list of the members who had joined since the last meeting; these included the following:

John A. Wright, Cleveland Varnish Co.
J. W. Brown, Pittsburg, McKeesport & Connellsville Ry.
J. G. Kipp, Electric Railway Equipment Co.
Robert Dittenhaver, Toledo & Indiana Railway Co.
W. H. Fledderjohann, Ft. Wayne & Springfield Ry. Co.
H. E. Blemker, Cincinnati Metal Co.
C. C. Collins, C. L. & S., D. S. & U., C. G. C. & S. W.
G. S. Shinnick, Columbus, Buckeye Lake & Newark
C. P. Wright, Standard Brake Shoe Co.
R. R. Streblan, Lake Shore Electric Ry.
C. O. Scranton, Stark Electric Ry.
H. A. Austin, American Brake Shoe & Foundry Co.
W. B. Tarkington, Detroit, Monroe & Toledo Short Line.
Matthew Slush, Detroit, Monroe & Toledo Short Line.
Robert S. Belknap, Pennsylvania Steel Co.
D. H. Lavenberg, Toledo & Indiana Ry.
S. C. Douglas, Lake Erie Southern Traction Co.
Jas. W. Selvage, Holland Palace Car Co.
Haywood G. Brown, Dayton & Troy Electric Ry.
John T. White, Dayton, Covington & Piqua Traction Co.
T. B. Tarsney, Detroit, Flint & Saginaw Ry.
Henry W. Staats, Traction Mutual Insurance Co.
J. A. Hanna, Peckham Manufacturing Co.
R. W. Palmer, General Electric Co.
C. E. Prior, Columbus, Urbana & Western Ry.
Walter G. Payne, Columbus, Urbana & Western Ry.

President's Address.

Mr. Clegg expressed his satisfaction that the association was again able to take up its regular meetings and that the membership now comprised 155 persons interested in the operation of electric railways. In reviewing what had been accomplished, he stated that the interchangeable coupon ticket had been adopted by 15 roads and was in service. The rules for employes, recommended by the association, had been adopted by two member companies. The questions of transportation of employes and of exchange of courtesies with newspapers had been thoroughly discussed, with advantage to all concerned. The greatest benefit, however, of the association was considered to be the closer relationship into which the railroad officials had been brought by reason of the association and its monthly meetings.

In conclusion Mr. Clegg mentioned some of the things which the Dayton Interurban companies were doing; they were operating the fastest trolley service, carrying passengers on regular schedule; operating cars over foreign roads, operating buffet cars, shipping live stock in car-load lots, conducting an extensive interline business, by means of an auxiliary company (the Interurban Transfer & Delivery Co.), checking baggage from a residence to its destination over their lines, and making rate and differential agreements. In carrying out this work, the Dayton companies very quickly found, particularly with regard to baggage and tickets, that any plan which they might propose would be of but little value unless connecting roads would co-operate with them, and it was necessary to employ a man to present these matters to the connecting roads and secure their co-operation. All this work of securing co-operation was now being done largely through the association, and Mr. Clegg expressed the hope that all members would find this to be of equal advantage to them.

The chair then introduced Mr. F. J. J. Sloat, chairman of the committee on interline business. Mr. Sloat stated that interline coupon tickets had been very simply designed, but fortunately they had served their purpose, but that there was a great deal of necessary confusion because each company designed its own forms and had in view principally the convenience of its own men. He considered that the time had come when a general form should be devised, as there were, for example, in the vicinity of Dayton 500 miles of electric railway divided into 30 and 40 miles stretches over which such tickets should be good. After examining a large number of coupon tickets, principally those by the steam railroad, he had reached a conclusion as to what was needed. First, there should be a proper contract to cover the use of the ticket so that the passenger would know his rights as well as the rights of the company; second, there should be a provision regarding the care of baggage now becoming an essential feature; third, the auditing stub and the form itself should have a limit stub or mark; fourth, each road in the association should be given a number and the coupon on the ticket should bear the number of the issuing road and the number of the road on which it is to be used; fifth, a uniform color of ticket should be adopted.

The matter of class should also be provided for, as some companies may wish to sell standard form tickets at less than the regular rate; to care for this the coupon would be punched to indicate first or second class, according to the rate. Half-fare tickets should have a large "½" printed upon them.

Mr. Sloat stated that great progress was being made in the development of a machine to manufacture tickets as wanted, a roll of blank paper being fed to the machine in the ticket-selling office, and a simple manipulation resulting in printing almost any form of ticket desired. The ticket, as now made by this process, would comprise three parts: a coupon for the conductor to collect, a second one for the passenger to keep, and a third to be retained within the machine so that there would be a complete record of the entire transaction.

In speaking of needed records of tickets, Mr. Sloat presented the form designed by the Cincinnati, Dayton & Toledo Co.; on this the records are made as follows: When tickets are sold over a given road, say the Dayton & Toledo, a record is made of the date of the sale, the stations between it is good, and the number of the ticket. When the first half of the ticket is returned it is checked off on this form. A copy of this form would be sent to the Dayton & Toledo Co., and it would in its turn send a corresponding record of tickets sold to the Cincinnati, Dayton & Toledo Co. and a few

sheets filed in a loose leaf ledger give a complete record of the month's business.

Mr. Sloat's committee, which has for the other members J. O. Wilson, Cleveland & Southwestern Traction Co.; W. R. McKoewn, Indianapolis & Eastern Ry., and Robert Dittenhaver, Toledo & Indiana Ry., was given power to act and instructed to report the plans decided upon to the association at the next meeting. This committee stated that its work was not affected by the question of checking parcels and trunks, as the only point in which baggage could enter into the ticket form would be in defining liability of the company in case of loss.

The president announced as a special committee to take up the question of interchange of baggage and report at the same time as the interline ticket committee: C. E. Spring, Fred J. Green, J. S. Young, of Toledo, and F. W. Coen.

An invitation was received from Mr. Matthew Slush, president of the Detroit, Monroe & Toledo Short Line Ry., asking the association to visit Detroit as the guests of his company.

The rest of the morning session was taken up by the discussion of the plans of mutual electric and traction insurance. Mr. H. W. Staats, who is actuary for the Electric Mutual Insurance Co. and the Traction Mutual Insurance Co., recently organized in Cleveland, made an extended address explaining what had been done in the line of mutual insurance by the factory interests of the country, the advantages of this plan of insurance, the necessary conditions to insure success and the plans of the companies with which he is connected. One of the most striking statements was a resume of the statistics compiled for the electric railway of Massachusetts, which showed that during the last 10 years these companies had paid out in premiums nearly 3½ times as much as had been collected in losses. The inference is that insurance rates are too high, much too high, and that the railway companies must put their property in good shape and carry their own risks.

Afternoon Session.

When the convention met for the afternoon Mr. E. C. Spring, chairman of the committee on freight business, took the chair and called upon Mr. Sloat to open the discussion.

Mr. Sloat stated that his views on this matter were that the question of freight and the question of express were two distinct things; however, on the electric railways the present difference was that if the rate received was good the traffic was called express; if not it was called freight. In 1900 the Southern Ohio Express Co. was organized to operate over the C. D. & T. and now includes the S. T. & P., the D. & T. and the Western Ohio lines, the rates varying from 25 cents to 35 cents per hundred, based on the C. D. & T. mileage of 55 miles with an additional rate beyond. The average operating expenses for three years ran about 90 per cent, due to a considerable extent to cartage. However, wagon delivery is considered essential to the success of the express business unless better terminal facilities are provided, or, in other words, operating expenses are not based on the operation of your car alone, but also of the handling of the business. It seemed to him that the proper and profitable solution of the express and freight business was the organization of an express company which would carry through express over the various interurban lines, having its own organization for soliciting and handling business, the roads over which it operated being paid on a percentage or mileage basis.

Mr. George W. Parker, general freight and passenger agent of the Detroit United Railway, in the discussion of this question stated that south of Detroit the competition of the express companies and steam road was very strong and his company was unable to make any arrangements for interchange of business with them. Particular attention has been directed to light package and freight business with good results, traffic arrangements having been made between his line and steamers to Buffalo, Detroit and adjoining territory. The company's terminal is very conveniently located. The company does not operate a wagon delivery, although it had a contract with a reliable cartage company. The company operates 12 cars per day, one car every two hours in the city of Detroit. Convenient sidings are provided in the suburbs and a fairly good carload business has been developed in hay, lumber and gravel. The company at night operates by steam the section of road between Chesterfield and Marine City, a distance of 28 miles; during the day the line is operated electrically. The company has three engines and double truck 40,000-lb. capacity cars, having physical connections with the Grand Trunk at Chesterfield and depending upon it to take all freight.

Mr. J. H. Huber, general baggage agent of the Canton & Akron, stated that his company did not compete with steam road rates, and confines its business to the express. The company operates four cars between Canton and Uhrichsville, using the old line express tariff. The company has a billing arrangement for through business from Cleveland, with a car leaving Cleveland at 9:15 and arriving at Akron 11:20. It also has cartage service, using two wagons at present and will put on a third if the business continues to increase.

Mr. Stebbins, of Columbus, reported that his company operated express cars over about 150 miles of road and generally gave two deliveries a day. While most companies were finding the package and express business more profitable this company had developed a very good car lot freight busines, some of the points reached not having any connection with steam roads, in which case the steam road concerned made arrangements for interchange of business, the steam company's cars being used in this business. From one town alone the company handles as many as 15 cars per month.

Mr. Stebbins' observation had been that companies handling package business exclusively have quite an expense for wagon delivery as well as for agents, labor, etc. It was his contention that better terminal facilities would tend to decrease this expense and promote the business in general.

Mr. Tarkington, of the Detroit, Monroe & Tôledo Short Line, stated that his company had had a car twice a day between Toledo and Monroe, a distance of 85 miles, but that the business did not justify it and the service was cut to one car per day.

Mr. Shinnick, of the Columbus, Buckeye Lake and Newark, stated that a very nice freight business had been developed on that line, one car making four trips per day over the line, in which both freight and express matter are handled. The company also handles some car lot business although the city ordinances prevent its handling a freight car in the city and thus interferes with convenient delivery. The company has the same system of billing that express companies have and interchanges business with the C. L. & S., the D. S. & U., and settles on a mileage basis. The great trouble in the handling of freight is the lack of organization; his company handles coal and some other road does not; it handles trunks and some other road does not.

Mr. Young, of the Toledo, Bowling Green & Southern, reported that his company had started in the freight and express business October 15th. The line runs through the oil region and has considerable business in oil tools and some hay. The company interchanges with the Terminal Railway Co. at Toledo and is thus enabled to make suitable delivery of car load freight, the terminal company furnishing the cars.

Mr. Green, of the Springfield, Troy & Piqua, stated his company turned the express business over to the Southern Ohio Express Co. Arrangements have been made with steam roads for the interchange of car load freight business, the steam road furnishing the cars.

Mr. Carpenter, of the Western Ohio Railway Co., stated that the majority of roads had been built for passenger service and were not constructed to handle freight properly, but that the express business was more in their line. Local conditions had a great deal to do with the handling of freight; while one road might develop a very good local freight business another could not, and while one road might secure considerable car lot freight its connection would not be in a position to handle it. The lack of standardization and the construction of the roads will not permit of a general freight business.

Mr. Abbott, of the Roberts & Abbott Co., of Cleveland, stated that his company, in its experience as consulting engineers, up to recently had discouraged its clients in the handling of freight, because the ordinary standard electrical equipment was not able to handle freight, other than in less than car lots, which is practically express. However since the advent of some of the later forms of alternating current motors electric roads may be equipped for handling freight. Taking into consideration the power of a freight locomotive, which is from 600 to 1,000 h. p., such a current thrown

on and off at some of the power houses would only meet with disastrous results. While an old road may be equipped for the handling of heavy freight the expense of equipment would not be justified by the amount of business that would be handled. A good many electric roads which are handling freight use a steam locomotive with good results. Too many roads figure on high freight rates, while as a matter of fact they can get but little more than the steam roads; people are not after quick delivery on freight; that is express. Mr. Abbott then gave the figures which some of the steam roads are getting per ton-mile: 3.3, 3.6, 1, 4, 2.5, 5.4, 2.3, 1.9, 1.4 and 2 cents. The smaller steam roads are getting near 4 cents per ton-mile, while the larger roads are getting between 1 and 2 cents, so that an electric road would have to handle a great deal of business to make money at this rate. The steam locomotives offer the best solution for most of the roads built, about half of which could operate light locomotive by changing a few grades, curves, etc., and while some roads are built on steam road standards in the country, track construction in the city prevents operation if city ordinances do not prohibit it.

Mr. W. H. Morley, of the Grand Rapids, Grand Haven & Ann Arbor, stated that his company had six motor freight cars, three of which were built last spring. The company has through traffic arrangements with the lake steamers to Chicago, and points beyond on a very good percentage basis and handles an average of two car loads each way per day of through business and about the same amount of local business. The road is built of 70-lb. steel with a maximum grade of 1 per cent; the freight is handled on express time and business is rapidly increasing.

Mr. Clegg stated the freight business on his road was handled by the Southern Ohio Express Co. entirely. His contention was that if the steam roads throughout the country derived from 80 to 90 per cent of their earnings from freight he did not see why the electric roads could not enjoy a portion of this business, considering the success that they had met with in the passenger field.

Mr. Spring heartily endorsed the remarks of Mr. Clegg and further said that the standardization of freight business as well as the standardization of all other departments seemed to be the solution of the problem and that while his road had been very successful in the handling of freight, both in car lots and less than car lots, more success might be achieved were the interchange of business made possible by the standardization of interurban roads.

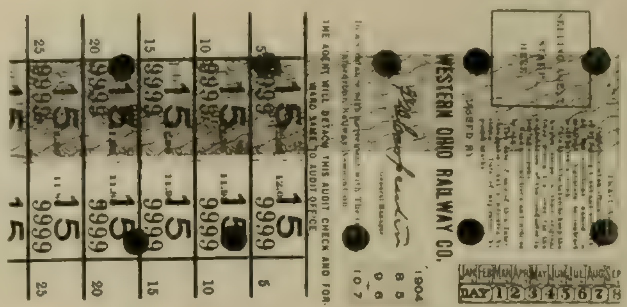
Mr. Lang then summed up the discussion of the afternoon, stating that he was heartily in sympathy with Mr. Spring, Mr. Clegg and Mr. Sloat; that as a very large portion of the earnings of the steam roads is from the freight business there are good possibilities for the development of such a business on the interurban lines; that the interurban lines have developed an excellent passenger business and there is apparently no reason why the growth of their freight business should not be as good, although today there are limitations placed upon its growth by the construction and arrangements of their roads. The growth may be slow but inasmuch as a start has already been made let everyone meet the conditions as they may exist. The adverse conditions that confront the freight business in the way of heavy grades, sharp curves and inadequate power are as well factors in the operation of passenger cars and anything that is done to further freight business cannot but tend towards the betterment of the passenger business. Why not organize a company to operate freight and express business over several lines, taking for example the growth of the Southern Ohio Express Co., which would result in a reduction of expenses for rent, office expense, wagon service and increased and better facilities for handling merchandise at all points, securing the largest returns for both companies and a reduction in operating expenses that will result in a reduction of transportation charge to the shipper?

Announcement was made by the chair that interchangeable coupon tickets had been placed on the market by 15 roads in Ohio and other roads in the association were invited to adopt them, after which the meeting adjourned.

Notes.

By courtesy of Mr. W. B. Brockway, acting secretary of the Street Railway Accountants' Association, the Association had on exhibition Book 1500 of the Accountants' collection of blanks and forms, the contents of which related to freight and express

Samples of the interchangeable coupon tickets were distributed among the members in attendance. These books at that date were adopted by 15 companies. A section of the coupon strip is reproduced



SECTION OF INTERCHANGEABLE COUPON STRIP.

in the accompanying engraving. The strip is 2⅞ in. wide, and each ½ in. set off by heavy cross lines represents one 5-cent fare. The 240 coupons represent $12.00 at regular rates, and the book is sold for $10.00.

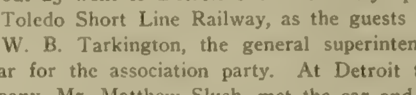
Just before the afternoon session was called to order a photograph of the members present was taken by flashlight.

At 5 o'clock, after the adjournment of the afternoon session, a party of about 25 went to Detroit over the newly opened Detroit, Monroe & Toledo Short Line Railway, as the guests of that company, Mr. W. B. Tarkington, the general superintendent, having a special car for the association party. At Detroit the president of the company, Mr. Matthew Slush, met the car and extended an invitation to celebrate the opening of his new through line at a dinner at the Russell House. An elaborate menu was served and those present had a most enjoyable evening. At 9:10 the special car left Detroit for the return trip; Mr. Tarkington accompanied the party and delivered them in Toledo at 11 o'clock.

The Ludlow Supply Co., of Cleveland, was represented by Col. W. E. Ludlow, who exhibited a working model of the Cleveland track drilling machine, and drawings of the company's new rail grinding machine.

The McClinchie Advertising Strap.

The accompanying illustration of the McClinchie advertising strap illustrates the latest design of this device, some improvements having been made since it was first illustrated in the "Review". The patented feature of this device is the metal frame for holding the advertisement, the strap itself not being covered by patent, although it is an essential part. The frame is provided with lugs at the top and bottom, each lug having two holes through which the two



THE M'CLINCHIE ADVERTISING STRAP.

branches of the strap loop pass. The frame having been placed in position the strap is secured by a single rivet and as the strap passes freely through the lugs of the frame, neither is weakened in any respect. The frame can be placed as near the strap rail as is desired, and when placed is held in the proper position by the rivet. Frames are furnished in brass, nickel or with an oxidized surface, as may be preferred, and thus can be made to conform to the color scheme of the interior of the car. The frame is in one piece and will easily outlast any number of straps.

The advertising card which fits the frame illustrated is 4½x3¾ in. and is inserted into the frame from the rear, being slipped into place and secured by inserting a cardboard strip under the lugs which

holds the card. The owner of the patent on this device is Uria McClinchie, manager of the Indiana Furniture Co., 152 East 23rd St., New York City.

The advantage to railway companies doing their own advertising business is that the frames provide additional space, which may even be classed as preferred space, since passengers using the straps can scarcely overlook the advertisement. If the company leases the advertising space in its cars the strap frames provide so much additional space that can be let.

Deltabeston Magnet Wire.

Many efforts have been made to devise an insulation for wire used in the winding and insulation of armature, field and magnet coils and the D. & W. Fuse Co., Providence, R. I., through its wire department has recently published a phamphlet on "Deltabeston" magnet wire and the winding and insulation of railway motor field coils, which will no doubt be of considerable interest to our readers. "Deltabeston" wire is insulated with practically pure asbestos which has been treated in a manner that its insulating properties are exceptionally good, and which, as far as the temperature rise goes, is practically indestructible, while at the same time the thickness of the insulation compares favorably with that of ordinary double cotton insulation. In the winding of coils with this wire there is considerable danger of injury to the insulation owing to the presence of a waterproofing compound which prevents the wire from passing readily between the jaws of a clamp as cotton covered wire, and a special device has been designed for this purpose. Elaborate experiments have been conducted recently looking towards the production of a field coil insulation which would withstand unusual temperatures and would not be readily affected by water so that the life of the coil might be readily increased with gratifying results.

This process includes: first, the employment only of material which will not be affected by any ordinary motor temperature; and, second, the treatment of this so as to render it absolutely impervious to water. In the construction of such covering that portion of the coil upon which the terminals are fixed is insulated by wrapping with a single thickness of asbestos paper; over this and under the terminal is placed a thin sheet of micanite upon which the terminal, after being soldered to the wire, is securely bound with asbestos twine. The asbestos paper is then formed about the coil by dampening it with a thin solution of flour paste, the paper being cut into various shapes as more readily conform to the irregular form of the coil. The paper employed for this purpose is about .01 in. thick. There are two covers of two layers each, the first layer of paper being applied after thoroughly coating the coil in a paraffine compound. While the first layer is still damp the second layer of paper, cut in different designs from the first, is applied; for the third layer that method of applying the first layer is again used, and in the fourth that of the second layer is repeated. The coil is dried out slowly, and then placed in an oven at a temperature of 300° F.; on taking the coil out, while hot it is immersed in one of the paraffine insulating compounds. When the coil is cooled down it is ready for the second jacket or cover, the application of which is identical with that of the first one, after which when it is dry an outer wrapping of asbestos tape about .03 in. thick is applied. The coil is then placed in an oven at 300° F., taken out and immersed in a bath of good baking japan. Upon removing it from the japan it is allowed to drain, then baked for a period of 3 or 4 hours, given another japan bath and another baking, which completes the coil.

In order to determine the relative value of this form of insulation two elaborate tests were made of coils wound with "Deltabeston" wire and insulated in the manner described, and those wound with the ordinary asbestos paper and cotton insulation. Two iron cases were secured, representing the motor cases, completely enclosing the coils and the coils were connected up in series. The test consisted in subjecting these coils to an abnormal current for a long period, taking careful measurements of the resistance, the insulation and the temperature of exterior of coils, of terminals and of the copper of the winding. The result of the test showed that apparently the "Deltabeston" insulation was slightly lower than the cotton, which is attributed in this particular case to the fact that the moisture was not carefully driven out of the paper before the coil was immersed in the insulating solutions. On the other hand it was noted that the "Deltabeston" insulation recovered more rapidly than the cotton every time the circuit was opened. The maximum temperature reached by the "Deltabeston" coil was considerably higher than that of the cotton coil, which was due to the higher resistance and the lower heat conductivity of the material employed in covering the coil. At the end of 97 hours continuous run, when the temperature of the copper wire had gone slightly above 900° F. in the "Deltabeston" coil and about 780° F. in the cotton covered coil, water was run into both cases. At this time the cotton covered coil had been reduced to a mass of charcoal while to all appearances the "Deltabeston" coil was quite uninjured. A careful examination of the coils showed that the cotton covered coil has been completely destroyed, while the "Deltabeston" coil was practically intact and required no more attention than a dipping in the japan to soften up the outer coating which has become somewat hard, owing to the high temperature and long baking to which it had been subjected.

Gasoline Inspection Car.

A new type of the Oldsmobile railroad inspection car is shown in the accompanying engraving. It is known as the Model No. 2 tonneau car. This car is similar in general construction to the Oldsmobile railroad inspection car No. 1, with the exception of having a tonneau added which gives it a capacity of from six to eight persons. This car is designed so that the tonneau can be removed and a platform added which will carry the necessary men, tools and material for ordinary railroad repair work. The No. 2 tonneau car is operated by a gasoline motor of 7 h. p. and has a

GASOLINE INSPECTION CAR

speed of from 30 to 35 miles per hour; the speed is variable and under perfect control. The engine and gearing are the same as used in the regular Oldsmobile runabout and the motor is started by a crank while the car is standing, in the same manner as the ordinary automobile.

The car is built for standard gage, has a 62-in. wheel base, oak sills, 20-in. pressed steel wheel of M. C. B. pattern, cold rolled steel axles, Hyatt roller bearings, and powerful brakes of the expanding clutch type. These cars have ample capacity for water and gasoline to run the car one hundred miles or more and the cost of operating is very slight, as a gallon of gasoline is sufficient to drive it from 20 to 25 miles.

One of these cars has run something over 3,000 miles on a prominent railroad where there are grades as high as 3 per cent and has demonstrated its capacity for running at a satisfactory speed up these grades with a full load. From a full stop on a maximum grade

the car quickly developes a speed of 20 miles per hour.

In operating the car in backward motion it is geared to run at about one-half the forward speed.

The Railway Appliances Co., of Chicago, is the sole selling agent for these cars in the United States.

Shawmut Fuses.

The "Shawmut" National Electrical Code enclosed fuses, manufactured by the Chase-Shawmut Co., Newburyport, Mass., are illustrated and described in Bulletin No. 28.

Of the many features of the "Shawmut" fuse special attention is directed to the fact that these fuses are designed and made to conform to the latest specifications of the Underwriters National Board, whereby the products of the different manufacturers of this material must be interchangeable. That is to say, the fuses of a given class must be so constructed that it will be possible to use them in any other manufacturers cut-outs, made to conform to the National Electrical Code standard. Considerable attention has been directed along these lines by the manufacturer of "Shawmut" fuses, who was aided no doubt in its efforts in this line from the fact that in selecting dimensions for the National Electrical Code standard fuses, two of the standards selected conform to this conmpany's regular line of material, enabling it to save its complete line of porcelains in both 30 and 60 amperes, 250-volt sizes. The Chase-Shawmut Co. advises us that it has been working on this material for quite a long period, and can now say that it is the first manufacturer to place the material on the market, having a complete line in stock for immediate delivery.

Pueblo & Beulah Rapid Transit Co.

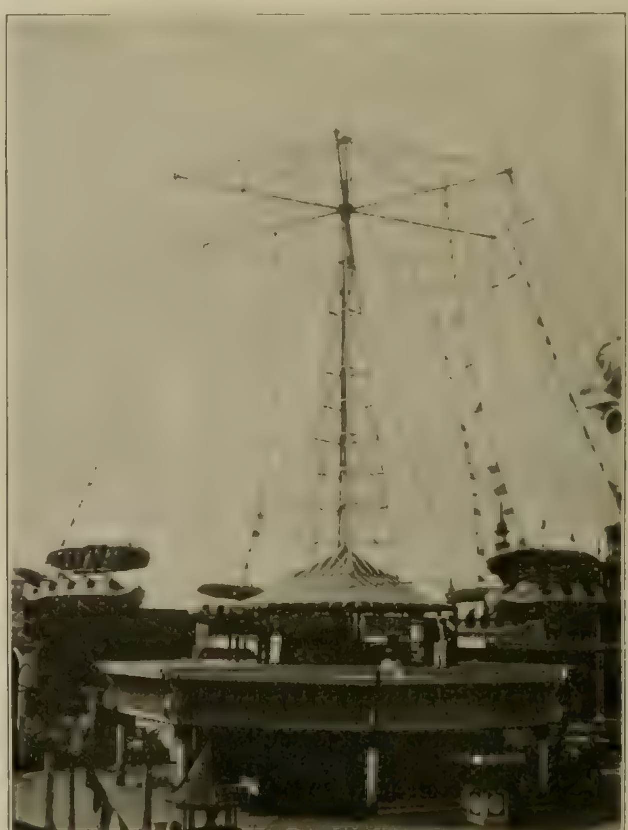
The Pueblo & Beulah Rapid Transit Co., Pueblo Col., has been incorporated under the laws of Colorado to construct and operate railways by electricity or other power in the counties of Pueblo, Fremont, Custer and Huerfano. The incorporators of this company are: James N. Carlile, ex-state treasurer and a well-known contractor and builder of railroads; Charles Henkle, wholesale grocer; H. R. Holbrook, civil engineer and president of the Laguna Canal Co.; J. J. Burns, late superintendent of the Denver & Rio Grande R. R. at Pueblo, and W. A. Beatty, of St. Louis, Mo., late general freight and passenger agent of the Tennessee Central R. R. It is the purpose of this corporation at the beginning to construct and operate a freight line in the city, and a main line outside of the city from Pueblo to Beulah, a distance of about 30 miles, with branches to lime-rock, lime, fire-clay, cement, granite and onyx quarries, and to all out-croppings of coal and iron ores which have recently been discovered but are as yet undeveloped.

A perpetual franchise and right-of-way have been secured outside the city of Pueblo, while the franchise in the city remains in force until Apr. 9, 1940. The franchise grants the right to construct and operate cars in the city of Pueblo by means of electricity, either the overhead system, the storage battery system, or any new or improved mechanical motive power which is now known or may hereafter be invented. It is given the right to transport passengers, freight and express over ten miles of streets in Pueblo, which virtually belts the city. The passenger line will extend through the residence part of the city and to many suburbs while the freight line will pass a greater part of the large factories extending in a southerly direction along the east side of the cities of Pueblo, Bessemer and Minnequa to a junction with the passenger division, where the main line begins and extends in a southwestern direction, 30 miles, all in Pueblo County, to and through the Beulah Valley. The grade at no point will exceed a 1¾ per cent grade and will be an unbroken down grade from the Beulah Valley to Pueblo, the grade always being with the load and against the empties. The franchise provides that one per cent of the gross earnings of the city lines from the passenger service is to be paid to the city annually and there is no tax of any character upon the freight or express service either inside or outside of the city, nor upon the passenger service outside of the city. It is proposed to locate the power house at the coal mines, which will insure a very low cost for power. The gage will be 4 ft. 8 in., which is standard, and during the construction period and as soon as the outside line can be completed, the line will probably be operated by steam for a considerable time before the electrical service is ready for operation.

The estimate of cost of building the line and equipment complete, using not less than 60-lb. steel rails, has been prepared and is placed at $1,100,000 and includes 30 miles of track outside and 10 miles inside of the city, power plant and sub-station, all line work, rail-bonds and high tension lines, two 50-ton electric freight locomotives, 10 passenger cars of 200 and 300 h. p. and fencing right-of-way, etc. The freight equipment will consist of 50 drop bottom cars, 10 box cars and 5 stock cars, which will be provided on the car trust or lease plan, all the rolling stock to be equipped to run in either electric or steam service. The capitalization of the company consists of common stock, $1,200,000; preferred stock (6 per cent cumulative), $300,000; five per cent, first mortgage gold bonds, $900,000.

The Circle Swing Flying Machine.

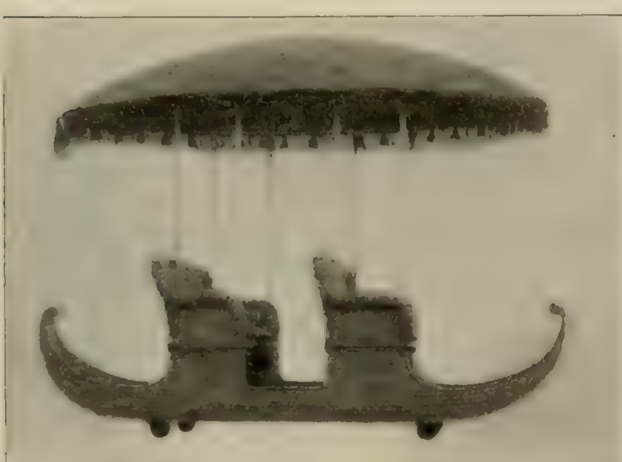
The demands of the public for outdoor amusement and excitement during the past few years have brought about the development of many attractive devices, such as the scenic railway, the shoot-the-chutes and the loop-the-loop. The latest novelty to meet these demands is the circle swing, which was first operated during the summer of 1903 in a single resort, and which during the past season has attracted a great deal of attention at the various parks and resorts where it was in operation. The circle swing is a unique piece of mechanical ingenuity and consists of a high steel



THE TRAVER CIRCLE SWING.

tower, in the center of which revolves a vertical shaft, keyed to the hub of which are six radiating arms. From these are twenty-four ½-in. steel cables, from which are suspended six cars to carry passengers. The cars are modeled after air-ships, having pointed ends and a cigar-shaped body, with a small propeller at the rear of the canopy. The shaft is operated by an electric motor, which causes the spider, cables and cars to revolve about the tower.

The construction of this device is strong and durable. The tower is made of steel angles, galvanized after being cut and punched, so that no part of the structure will rust. The 1905 towers are equipped with braces much heavier than those used heretofore, and many improvements have been made recently, including a hand brake for stopping machines more quickly after the current is shut off, thus economizing time and increasing the earning capacity. The entire weight of the revolving parts is carried on a 4-in. vertical steel shaft and means are provided for adjusting the height of shaft and gears. One of the features that make this device a popular resort attraction is the scheme of decoration. During the day gaily-colored flags flutter in the breeze made by the whirling machine, while at night the hundreds of electric lights, which are strung in festoons beneath the arms and rods of the superstructure and down the cables to the cars, give the swing the appearance of an illuminated revolving pyramid.



A CAR ON THE CIRCLE SWING.

The swing is built in three sizes, the No. 1 swing having a 60-ft. tower, the No. 2 machine an 80-ft. tower and the portable swing a 40-ft. tower. The No. 1 swing is equipped with six cars, carrying four passengers each; 20 complete trips per hour are made when operating at full capacity; the power is applied through a 15-h. p. motor; the swing is illuminated at night by 500 incandescent lights wired for either 110, 220 or 500 volts; the space required for this size swing is circular, 100 ft. in diameter. The No. 2 swing differs from the No. 1 in that it has six cars seating eight passengers each, requires a 25-h. p. motor for operation, has for illumination 1,000 8-c. p. lamps, and requires a space 140 ft. in diameter. The portable swing is especially adapted to small places which could not support a No. 1 swing continually, and it is so constructed that it can be moved at little cost of time and labor. There are 12 cars which seat two persons each and the plant is operated by a light 10-h. p. gasoline engine. All swings are erected complete ready for operation, including fence, platform, ticket-booth, etc. During the season of 1904 ten of the No. 1 swings were in operation at various resorts throughout the country, and the No. 2 swing was built on the Pike at the St. Louis Exposition; Euclid Beach, Cleveland, O.; North Beach, Long Island, N. Y.; and Chestnut Hill Park, Philadelphia. The Traver Circle Swing Co., 66 Broadway, New York, is the sole manufacturer of circle swings, and made the installations described

Metallic Phosphor for Tempering Babbitt Metal.

The New Era Manufacturing Co., Kalamazoo, Mich., makes a material known as "Metallic Phosphor," which is used as a tempering agent in babbitt metals. Different brands and grades of babbitt combine with different proportions of metallic phosphoro to produce the best results. This is due to the fact that the principle difference between the low and high grade babbitts is caused by the different quantities of tempering agent they contain. Therefore the better the quality of the babbitt the less metallic phosphoro is required.

In high-grade babbitts, such as "Magnolia" metal, "Copper Genuine," etc., 2½ per cent of metallic phosphoro is required. In medium grade babbitts, such as No. 1, "Extra," "Duro," and other antifriction graphite metals, ranging in price from 12 to 15 cents per pound, 5 per cent, or 1 lb. in 19 lb. of babbitt is recommended. For commercial No. 4 babbitt, 10 per cent or 2 lb. is used with 18 lb. of babbitt.

The New Era company states that this last combination is reported to give the most economical and desirable service that can be secured and that it is especially adapted for heavy bearings and electric railway service, and its cost is about one-third that of high-grade babbitt metals giving similar service. No extra trouble or expense is caused by using this tempering agent, as it may be added when the babbitt is melted for use.

The subject certainly merits attention and investigation. Babbitt metal bills are prominent items in the expense of operating electric railways, and a possible opportunity to avoid more than one-half of the ordinary expense in that line will not escape the careful consideration of a conservative management.

Electric Traction From Gas Power.

A somewhat unique departure from established methods in electric traction has recently been undertaken at Warren, Pa. The Warren & Jamestown Street Railway Co. is equipping an a. c. single-phase electric railway system to operate between Warren, Pa., and Jamestown, N. Y., for which power will be supplied by gas engines using natural gas. The equipment is now being constructed by the Westinghouse companies at East Pittsburg, Pa.

The power station will be located at Stoneham, Pa., two miles from Warren. The initial equipment will consist of two Westinghouse gas engines, each of 500 h. p. capacity. They will be of the horizontal single-crank double-acting type, direct connected to two 260-kw. Westinghouse generators furnishing current at voltage sufficient for direct use upon the high-tension transmission line. The power equipment also comprises a 55-h. p. Westinghouse gas engine for operating air compressor and exciter unit. Natural gas will be used, furnished by the local distributing company. In this district the gas has a calorific value of about 1,000 B. t. u. per cu. ft.

Transformer sub-stations, five in number, will be located along the right of way. These will receive the high-tension current from the transmission line and reduce the voltage to such an extent as to render it more suitable for use in single-phase motors. The present motive power equipment will comprise four quadruple sets of Westinghouse single-phase motors, each approximately 50 h. p. capacity.

An interesting feature of the system is the arrangement for operating the alternating current motors upon the direct-current trolley lines within the city limits of the termini.

The Warren & Jamestown Street Ry. is not a newly organized system, as it has operated part of the present lines for a period of eleven years. Three years ago the company began experimenting with the use of gas power, with sufficient success to influence them in the now exclusive adoption of gas engines for their entire power generation. The operation of the new system will be watched with much interest by the engineering public, and its success will mark an important advancement in modern electric railroading.

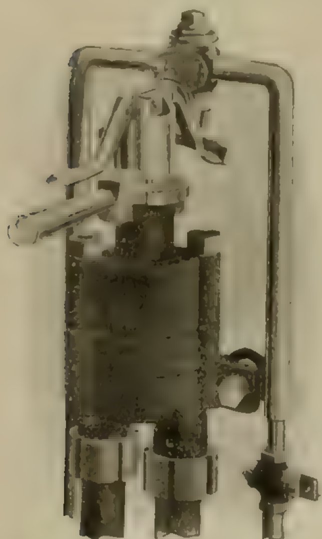
Columbia & Montour Electric Railway Co. Improvements.

A number of improvements have been decided upon by the Columbia & Montour Electric Railway Co., of Bloomsburg, Pa. These include the erection of a generating plant at Berwick, the installation of a 150-kw. rotary converter in the substation at Willow Grove, in addition to the 100-kw. converter that is now in use, and an extension of the system into Nescopeck. The officers of the road are: President, B. F. Meyers; vice-president, E. R. Sponsler; treasurer, W. M. Ogelsby; general manager, D. G. Hackett.

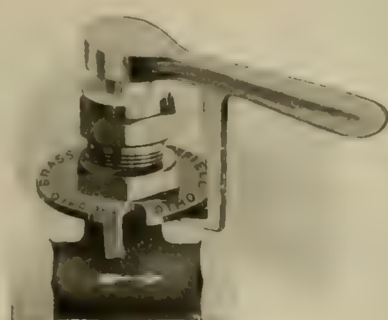
"A THANKSGIVING STORY," is the subject of a pamphlet which has been distributed by the Ohmer Fare Register Co., of Dayton, O.

Nichols-Lintern Pneumatic Track Sander.

It is well established that in order to secure rapid acceleration or to maintain high speeds, thereby meeting the demands of the public, a thoroughly efficient track sanding device is necessary, as without such provision there is invariably an excessive power consumption, due either to the spinning of the wheels or the heavy equipment which is necessary to prevent such spinning. Realizing this necessity, the Ohio Brass Co., Mansfield, O., has placed on the market the Nichols-Lintern pneumatic track sander, a device that bears the same relation to the ordinary track sanders that the modern air brake does to the old form of hand brake. A thin layer of sand properly and evenly deposited on the rails is an invaluable aid in starting a car and the saving of power effected by the prevention of the slipping of wheels is considerable as well as the loss of schedule time, the abuse of equipment and the congestion of traffic.



SUPPLEMENTARY VALVE SANDER ATTACHED TO ENGINEER'S BRAKE VALVE.



INDEPENDENT SANDER VALVE.

TRUCK ATTACHMENT.

Among the many features claimed for this device the supplementary sander valve, which is herewith illustrated, is prominent. The principal feature of the supplementary valve is that the handle interlocks with the handle of the brake valve and rotates with the latter, so that the sander can be operated with the brake valve in any position, giving the motorman absolute control of the sander at all times. The waste of sand is automatically prevented, it being automatically shut off as soon as the pressure of the valve handle is released. In order to get the greatest braking efficiency with any braking apparatus, the condition of the rail must be the best available. A bad rail or one in a slippery condition necessitates several applications of the air brake before the speed is checked, while on the other hand, with the Nichols-Lintern sander a slight application of sand will stop the car in less time and with less air than is required to make a stop without this sander. The result is that less air is required with than without this device. In throwing the brake valve in the emergency stop position the supplementary valve automatically opens and sands the track without attention on the part of the motorman and the prevention of accidents by quick stops is of no little consideration.

SAND TRAP.

The sand trap and the manner of its attachment to the car floor are clearly shown in the accompanying illustration, it being so arranged that it can be placed at almost any convenient part of the car where the hose can reach the wheel, a feature that appeals strongly to the master mechanic. The sand trap is designed to be absolutely air and water tight and the tendency of the sand to clog is further eliminated by the manner in which the air acts upon it. A special truck attachment is employed by which the hose is held directly in front of the wheels at all times, the flexibility of the hose enabling it to follow the various movements of the trucks whether on straight or curved track.

The independent sander valve is intended to take the place of the supplementary valve, where for any reason it is desirable to use a separate valve for operating the sander. This valve may be connected to the pipe at any point where it is convenient to the motorman. It is so constructed that the flow of sand may be easily controlled and regulated as conditions require.

Duner Car Closets.

The long distances over which electric railways are now operating makes a toilet room an essential part of the furnishings of a passenger car, and the limited space at the disposal of the designer has made improvements in the fittings extremely desirable. The Duner Co., of 116 South Clinton St., Chicago, is now calling the attention of the trade to several special designs of car closets which are particularly adapted for electric railway cars. The advantages claimed for these are: Combined water or dry closet; easily changed to a dry closet, if water fails; made of enameled iron in two separate hoppers, detachable for cleaning; made to use water from gravity tank or from tank under air pressure as specified; will flush and keep clean with use of little water; allows no cold air or dust to enter car through closet; will not freeze from outside cold; simple construction; made right or left handed by simply reversing handle.

The material is of enameled iron and the shape of the tray can be made to conform with any drawing furnished.

The Columbus, Greensburg & Richmond Traction Co., at the annual meeting, held November 18th, chose the following directors: Amos K. Hollowell, Harris F. Holland, William P. Myer, August M. Kuhn, Walter McConaha, Charles E. Barrett and Albert H. Carter. At a meeting of the directors, held immediately after the stockholders' meeting, the following officers were elected: President, Harris F. Holland; vice president, Walter McConaha; secretary, Albert H. Carter; treasurer, William P. Myer.

Personal.

MR. A. R. McADOO, of New York City, has been elected president of the Winnebago Traction Co., Oshkosh, Wis.

MR. W. F. HARVEY, auditor of the Elgin, Aurora & Southern Traction Co., has removed his headquarters from Aurora to Elgin, Ill.

MR. A. L. MARHOFF, who has been appointed superintendent of the Michigan Traction Co. to succeed Mr. S. J. Dill, has taken charge of the work.

MR. HENRY F. KELLOGG, well known to street railway men, has assumed the management of the railway department of the Frank Ridlon Co. of Boston.

MR. JAMES GUTHRIE McMICHAEL, president of the Atlas Railway Supply Co., Chicago, was married to Mrs. Augusta Beil Tatham, on Tuesday, November 1st.

MR. A. H. STANLEY, general superintendent Public Service Corporation of New Jersey, was married to Miss Grace Lowrey Woodruff, Monday, December 7th, at Milwaukee, Wis.

MR. CLINTON PALMER, assistant superintendent of the Cincinnati, Dayton & Toledo Traction Co., who has had his office at Hamilton, O., will remove his headquarters to Middletown.

MR. J. W. MUMPER, superintendent of the Hanover Light, Heat & Power Co., and Hanover & McSherrystown Street Railway Co., has resigned his position to accept a more lucrative one in New York City.

MR. S. M. MANIFOLD, recently elected sheriff of York County, Pa., has resigned as general manager of the York County Traction Co., to assume the duties of sheriff. His resignation is effective Jan. 1, 1905.

MR. LOUGHMAN PENDRED, representing the editorial department of "The Engineer" of London, has recently made an extended trip in the United States investigating American practice in lighting and traction work.

MR. C. E. WARWICK, division superintendent of the Cincinnati, Dayton & Toledo Traction Co., in charge of the Hamilton city lines, has resigned to become superintendent of the Galveston City Railway Co., Galveston, Tex.

MR. OREN S. HUSSEY, formerly connected with the laboratory of Thomas A. Edison, and later with the Thomson-Houston Electric Co., and The General Electric Co., has been elected vice-president of the Frank Ridlon Co., of Boston.

MR. WILLIAM J. BOWMAN has been appointed master mechanic of the Elgin, Aurora & Southern Traction Co., at Aurora, Ill., having resigned his position as superintendent of the car barns of the Cincinnati, Dayton & Toledo Traction Co.

MR. WILLIAM BARCLAY PARSONS has resigned as chief engineer of the Rapid Transit Commission, of New York, and will hereafter devote himself to the work of the Panama Canal Commission, of which he is a member, and to general practice.

MR. C. S. RAY formally took charge of the track construction work of the Owensboro Street Railway Co., Owensboro, Ky., November 15th, and Superintendent T. R. Morton, who had been looking after the entire work, will direct the operation of the line.

MR. J. B. WILSON, a member of the board of directors of the Dallas (Texas) Consolidated Electric Street Railway Co., has been elected president of the company to succeed E. J. Cannon, who recently resigned on account of having been elected city treasurer.

MR. ALBERT T. LEACH, treasurer of the Kenfield Publishing Co., was married on November 24th to Miss Clara Blanche Harris, daughter of Mr. Overton Harris, of Harris, Mo. Mr. and Mrs. Leach will be at home after January 1st at Hotel DelPrado, Chicago.

THE STOCKHOLDERS of the Willimantic (Conn.) Traction Co. have recently elected Thomas F. Cavanaugh of Boston, Peter H. Corr of Philadelphia, Walter H. Clark of Hartford and W. D. Grant and W. A. Arnold of Willimantic, directors for the ensuing year.

PROF. VICTOR B. SWENSON, of the University of Wisconsin, [illegible] at Anderson, Ind., superintending [illegible] construction and equipment of the test car which is to be used in determining the air resistance to electric cars moving at high speed.

THE EVANSVILLE & EASTERN ELECTRIC RAILWAY CO., at a recent meeting of the directors, elected F. W. Reitz vice-president to succeed J. W. Fuquay, and W. H. McCurdy, president of the Hercules Buggy Co., a member of the board of directors.

MR. J. K. PUNDERFORD, general manager of the Consolidated Railway Co., New Haven, Conn., has recently added to his jurisdiction the lines of this company in the city of Meriden, including the extension recently constructed between Wallingford and Montowese.

MR. M. C. LUDLAM, who for a number of years was connected with the Public Service Corporation of New Jersey, has been appointed general superintendent and assistant to General Manager J. A. Trawick of the Little Rock Railway & Electric Co., Little Rock, Ark.

MR. R. K. MICKEY, who has been associated with the National Carbon Co. for over ten years, has resigned his position as assistant sales manager for that company, and has been elected secretary and sales manager of the American Carbon & Battery Co., St. Louis, Mo.

MR. FRANK E. SCOVILL, on the eve of his departure to become manager of the Laredo (Texas) Electric Light & Railway Co., was presented with a handsome gold watch by the employes of the Austin Electric Railway Co. and with a diamond stud by his many friends of the Austin Club.

MR. A. J. BEMIS, who was formerly manager of the Brockton & Plymouth Street Railway Co., has recently removed to Sydney, Nova Scotia, to become manager of the Cape Breton Electric Co., Ltd., which, like the Brockton & Plymouth property, is under the direction of Stone & Webster, of Boston, general managers.

MR. ALEXANDER E. ORR, president of the Rapid Transit Commission of New York City, has resigned the presidency of the South Brooklyn Savings Bank, a financial institution of which he has been the head for the last 16 years, on account of the pressure of his duties in public affairs, especially in connection with the Rapid Transit Commission.

MR. THOMAS F. WHITELSEY, general manager of the Toledo Railway & Terminal Co., has resigned that position. Mr. Whitelsey has had a long and successful railroad career, having formerly been in the service of the Lake Shore, and later with the Ohio Central before going to the Toledo Railway & Terminal Co., shortly before the road was completed.

COL. DANIEL BURNS DYER, who was formerly at the head of street railway interests at Atlanta, Ga., has recently written a very interesting article on early Oklahoma days. Colonel Dyer was among the first at the opening of that territory, was elected the first mayor of Guthrie and among the foremost in laying the foundation for the present progressive capital.

DR. LOUIS DUNCAN has become associated with the staff of the Allis-Chalmers Co. of Milwaukee, as an expert in electrical patent work in connection with its electrical department, The Bullock Electric Manufacturing Co., of Cincinnati. Dr. Duncan will continue to make his headquarters in New York, at 56 Pine St., where he will be closely in touch with the legal and executive offices of the Allis-Chalmers company.

MR. RICHARD W. MEADE, assistant to the president of the New York City Railway Co., resigned December 1st to become president of the New York Transportation Co., with offices at 49th St. and 8th Ave., New York City, vice Mr. Henry Sanderson, resigned. The executive duties performed by Mr. Meade as assistant to the president of the New York City Railway Co. will hereafter devolve on Mr. Frank S. Gannon, vice-president.

MR. G. R. SCRUGHAM has retired as president and general manager of the Interurban Railway & Terminal Co., Cleveland, O., and was succeeded by Mr. Charles H. Davis. The Interurban Railway & Terminal Co. is a consolidation of the Cincinnati & Eastern Electric Railway Co., the Suburban Traction Co. and the Interurban Terminal Co., which was perfected September of last year with a capital of $2,500,000. The road has over 100 miles of track and is in good physical condition.

MR. W. J. SANDO has been appointed manager of the pumping machinery department of the Allis-Chalmers Co., with headquarters at Milwaukee. Mr. Sando is a man of recognized ability and a member of the American Society of Mechanical Engineers, the Boston Society of Civil Engineers, New England Water Works Association, American Water Works Association, New York Elec-

trical Society, Boston Society of Art, American Association for the Advancement of Science, and the Engineers' Club of New York.

MR. GEORGE A. SAYLOR was recently appointed superintendent of the Indianapolis, Columbus & Southern Traction Co., succeeding Mr. A. B. Hogue, resigned. Mr. Saylor has been connected with the Columbus & Southern Co. ever since the road has been operating, and his promotion is a well deserved recognition of his work for the company. In taking charge of the operation, Mr. Saylor has a high standard to maintain as during the five years since the road was opened, there has never been an accident which resulted in broken bones.

MR. J. B. McCLARY, who resigned as manager of the railway department of the Birmingham Railway, Light & Power Co. on Jan. 1, 1904, to enter into business for himself, has again entered the railway field as general manager of the Sheffield Company, Sheffield, Ala., assuming the duties of this office December 15th. The Sheffield Co. is a strong corporation, controlling the lines of street railway connecting Sheffield, Florence and Tuscumbia and the water and light plants of Sheffield. Mr. McClary will have supervision of all these departments, and the office will give him full opportunity for the exercise of his splendid executive ability. Mr. McClary was associated with the street railways of Birmingham for 16 years and in 1901 became manager of the railway department upon the consolidation of the gas, electric light and railway companies. For seven years before his connection with the street railway company he was with the Pratt Coal & Iron Co. and the Tennessee Coal, Iron & Railway Co., and as secretary of the Woodward Iron Co. The business of J. B. McClary & Co., of Birmingham, will be continued and developed along larger lines, the style of the firm being changed to McClary, Jemison & Co.


J. B. McCLARY

MR. C. O. SIMPSON, treasurer and auditor of the Birmingham Railway, Light & Power Co., was host at the luncheon of the Hillman, Wednesday, November 16th, his guests being the delegates of the Street Railway Accountants' Association and their wives in attendance at the National Association of Railroad Commissioners' convention. An enjoyable tally-ho ride over the city and to points of interest followed the luncheon, including a stop at the Country Club for a lunch about 5 o'clock. The party consisted of Mr. and Mrs. H. C. Mackay and two children of Milwaukee, Mr. and Mrs. C. N. Duffy of Chicago, Mr. and Mrs. W. F. Ham of Washington, and Mr. W. B. Brockway of New York.

MR. HENRY SANDERSON'S retirement as president of the New York Transportation Co. was made the occasion of the presentation to him, by the executive staff and employes of the company, of a testimonial in the form of a handsome desk set of Tiffany bronze, and engrossed and framed resolutions, the presentation speech being made by H. H. Vreeland. Mr. Sanderson's resignation is the result of his decision to enter a new field of activity as a member of the firm of Eddy, Brown & Sanderson, recently formed to do a general banking and brokerage business as members of the New York Stock Exchange. He will remain a director and member of the executive committee of the New York Transportation Co.

Obituary.

MR. CHARLES ROBERT PENINGTON, paymaster and cashier of the Chicago City Railway Co., died at Phoenix, Ariz., November 30th. The interment was at Oakwood Cemetery, Chicago, December 5th. Mr. Penington was the son of Mr. T. C. Penington, treasurer of the Chicago City Railway Co., and had been in the employ of the company for twenty years. His death was the ultimate result of a severe cold contracted a year or more ago from which he never recovered. His wife and two children survive him.

HON. JOHN C. BRADY, president of the Erie Electric Motor Co., which operates the street railways of Erie and has been an important factor in Erie's suburban growth, died at his residence at Erie, Pa., Tuesday evening, November 15th. Mr. Brady was born at Ft. Dodge, Ia., Oct. 2, 1858, and was educated at the Lake Shore Seminary, North East, Pa. He read law and was admitted to the bar in 1879. He was elected mayor of Erie in 1887 and since 1889 has been identified with the Erie Electric Motor Co.

MR. FRANK MURPHY, president of the Omaha & Council Bluffs Street Railway Co., died suddenly at the Waldorf-Astoria Hotel, New York, December 13th.

Long Distance Excursions.

During the past summer the Indianapolis & Northwestern Traction Co. has made a considerable effort to develop what may be called a long distance excursion business. The general agent of the company, F. D. Norviel, makes his headquarters at the Terminal & Traction Building at Indianapolis, and, of course, makes every effort to secure strictly electric interurban excursion business, such as picnic parties, Zionville being the most favorable for Sunday school and societies of various kinds from Indianapolis. The regular rate from Indianapolis to Zionville is 25 cents one way and 45 cents for the round trip; on excursion business of the class just mentioned a flat rate of 25 cents for the round trip is made to parties of 100 or more, tickets being furnished to the superintendent of the school or the secretary of the organization.

By long distance excursion business first mentioned, however, is meant those excursions on the steam roads entering the territory of the Indianapolis & Northwestern, of which the latter can take advantage for promoting traffic over its own line. The Indianapolis & Northwestern parallels the Big Four from Indianapolis to Lebanon, thence it runs to Frankfort, which is a point on the Monon, L. E. & W. and the Clover Leaf lines. The Northwestern terminal at LaFayette is on the line of the Big Four, the Wabash and the L. E. & W. In undertaking to run excursions to distant points the electric line is to some extent handicapped by reason of the refusal of the steam railroads to recognize it and officially interchange traffic. However, in practice it is found that the steam lines are glad to take care of all the passengers that the electric road can deliver to them, and there have been no practical difficulties in the way of working up the business. During the season just passed the Indianapolis & Northwestern has advertised six excursions to Chicago, on each of which were carried from 150 to 500 passengers. In one instance, the excursion was from Lebanon to Chicago over the Big Four. On this occasion the electric line carried only 150 passengers between Indianapolis and Lebanon, and it was not considered at all successful. In two instances the steam road excursion was from Frankfort to Chicago, Indianapolis passengers being taken by the electric line from Indianapolis to Frankfort. The numbers carried by the electric line on both occasions were comparatively small. What are considered the successful excursions were those from Lebanon to Chicago via the Monon, when the electric line has the haul from Indianapolis to LaFayette. The rate charged was $1.00 from Indianapolis to LaFayette and $1.25 from LaFayette to Chicago. While the Big Four station at LaFayette is about the same distance from the street railway tracks as is the Monon station, the latter is more centrally located and probably by reason of being more widely advertised appears to be considered more convenient by patrons from Indianapolis, at any rate the Monon excursions from LaFayette have been the more successful.

In November the Indianapolis & Northwestern was enabled to advertise an excursion to St. Louis for $4.40 for the round trip in competition with the steam roads excursions from Indianapolis, in which the rate was $6.00 for the round trip for similar accommodations. From November 14th to 30th, inclusive, the Clover Leaf route made a rate of $3.00 for the round trip to St. Louis from stations on its line between Forest and Kirkpatrick inclusive; from other points the rate was $3.50. As the section between Forest and Kirkpatrick includes Frankfort the Indianapolis & Northwestern at once advertised a $4.40 rate from Indianapolis to St. Louis via Frankfort, $1.40 being the regular rate on the electric between Indianapolis and Frankfort. The first day this rate was put in effect 5 passengers for St. Louis were secured, the second day 13, and the third, fourth and fifth days 30 each.

It is the intention of the Indianapolis & Northwestern Traction Co. to put on an early car, leaving Indianapolis about 4 o'clock, to connect with the regular Chicago milk train on the Monon, which leaves LaFayette at 6:00 a. m. Inasmuch as this car will be the first to leave Indianapolis and have practically a clear road all the way through, it will be quite practicable to make this run in less than two hours, and so insure the connection at LaFayette.

The Chicago Subway Co.

The Chicago Subway Co., of New Jersey, has been organized with a capital stock of $50,000,000 and is composed of men who represent 90 per cent. of the railroads having Chicago terminals. The directors of the new company, it is said, will include E. H. Harriman, who represents a large interest in the Illinois Central and Chicago & Alton, as well as control of the Union and Southern Pacific system; James Stillman, president of the National City Bank of New York; Jacob H. Schiff, of the banking firm of Kuhn, Loeb & Co.; P. A. Valentine, of Armour & Co., a director in various railroads; and A. G. Wheeler, president of the Illinois Telephone & Telegraph Co.

The Subway company has taken over the entire stock of the Illinois Telephone Construction Co. and two-thirds of the capital stock of the Illinois Tunnel Co. and stands ready to take over all the remaining stock of the tunnel company at the terms on which it required the two-thirds. The Illinois Telephone Construction Co. will remain as the home operating company, but owned by the Chicago Subway Co., President Wheeler of the Illinois Tunnel Co. retaining his present position. Two thousand tons of freight per day are now being handled in the 15 miles of tunnel already constructed and the new owner will extend and improved the system with a view of transporting the freight of the steam roads interested in this underground system.

The charter filed by the Chicago Subway Co. is very broad, from which it is evident that the organizers of the company have in mind many possible developments of the future. The company is empowered by its charter to conduct freight, passenger and power transportation business, to construct, acquire and operate railroads by electricity or any other power, to maintain and operate telegraph and telephone lines and exchanges and systems, to acquire, construct and operate tunnels and all terminal properties and appliances.

World's Fair Awards.

In addition to those enumerated in the November issue of the "Review," the following awards have been made to exhibitors at the Louisiana Purchase Exposition:

The Elliot Frog & Switch Co., East St. Louis, Ill., was awarded a gold medal. While the company makes track appliances for electric street and interurban lines, the exhibit was confined to material used by steam roads and consisted of its well known "Eureka" spring rail frog for main line service, its improved sliding frog for use in yards, which gives a continuous rail on both tracks, and split switches showing improvements in adjustable features. The company also exhibited its rigid frogs, switch stands and the Hasty three throw split switch.

The Locke Insulator Manufacturing Co., of Victor, N. Y., was awarded a gold medal for its exhibit of high potential glass and porcelain insulators and special insulating material.

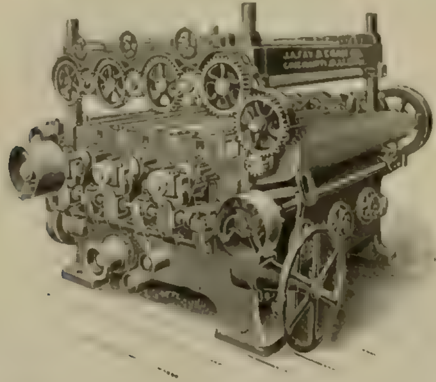
The Green Engineering Co., of Chicago, was awarded a gold medal for its exhibit, the highest award given to any stoker exhibited. The exhibit was described in the "Daily Street Railway Review" for Wednesday, October 12th.

New Patent Sanding Machine.

The electrotype here represented is that of a sanding machine especially designed by the J. A. Fay & Egan Co., 250 W. Front St., Cincinnati, for use in obtaining smooth surfaces on materials used in the manufacture of carriages, furniture, cars, etc.

The machine is particularly recommended for use where a perfectly smooth surface is desired either for varnishing or painting. It is [illegible] and [illegible] and [illegible] the work of several machines for doing this character of work. The three [illegible] polishing

cylinders upon which the paper is placed have a vibratory motion to prevent the formation of lines, and are equipped with a device



for quickly applying the sandpaper and giving it the proper tension. Each cylinder carries a different grade of paper, the third cylinder giving the final and smoother finish.

The feed is very powerful, and consists of eight feed rolls, four above and four below, driven by a train of heavy expansion gearing, and will open to receive material 8 in. thick. The machine is made to work material from 30 to 80 in. wide, and has a brush attachment which cleans the stock after it has passed through the machine. The pressure rolls are so arranged that the adjustments can be made easily, quickly, and accurately, and the feed started and stopped instantly.

Northwestern Electrical Association.

The Northwestern Electrical Association at its last meeting decided to include street railway interests in the association and has accordingly sent out an invitation to the various street railway companies to join the organization. This is an inter-state organization, whose convention proceedings, papers and discussions have been found very valuable to its members and those interested in electric light and power development. Prominent manufacturers and dealers make excellent exhibits of the most modern machinery, apparatus, appliances and supplies at the meetings of the association and original papers of direct business interest are read and discussed. Owners, managers and superintendents of electric light, power or railway plants, electricians, electrical or mechanical engineers, and all persons engaged in the business of generating and supplying electricity for commercial or public use, are eligible to active membership, while all manufacturers of and dealers in electrical machinery, supplies, appliances or material, are eligible to associate membership. In the past the association has done much good for the lighting and power interests for the Northwest and there is no reason why the association should not be equally beneficial to street and interurban railway interests.

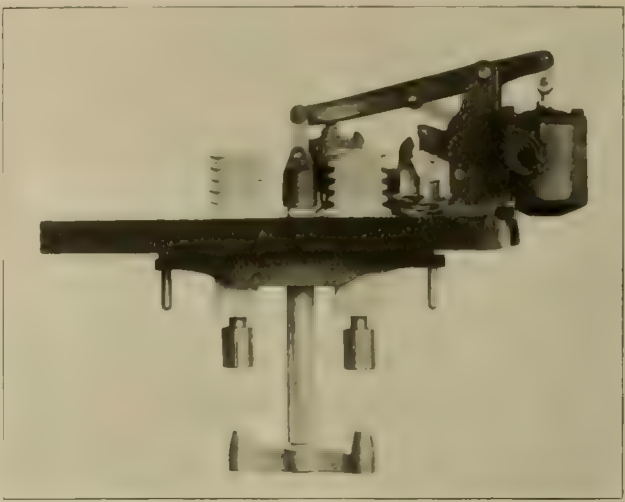
The association at present includes the states of Illinois, Michigan, Wisconsin, Minnesota, Indiana and Iowa. The officers of the association are: President, T. F. Grover, Fon du Lac, Wis.; first vice-president, George B. Lukes, Evanston, Ill.; second vice-president, Ed. Daniell, Menominee, Mich.; secretary and treasurer, Thomas R. Mercein, Milwaukee, Wis. The directors are W. H. Schott, Chicago; D. C. Jackson, Madison, Wis., and H. Almert, Oak Park, Ill. The association has independent legislative committees in each of the above mentioned states, of which S. B. Livermore, of Winona, Minn., is chairman. The members of the legislatives committees are as follows: Illinois—E. P. Maxwell, Dixon; W. H. Schott, Chicago; H. Almert, Oak Park. Michigan—W Worth Bean, St. Joseph; W. F. Kingan, Sault Ste. Marie; Ed. Daniell, Menominee. Wisconsin—John I. Beggs, Milwaukee; C. H. Williams, Madison; W. P. Bragg, Monroe. Minnesota—S. B. Livermore, Winona; H. J. Gille, St. Paul; G. D. Shepardson, Minneapolis. Indiana—J. H. Harding, La Porte; A. M. Barron, South Bend; H. W. Frund, Vinennes. Iowa—F. L. Diserens, Cedar Rapids; C. C. Hammond, Mason City; and the manager of the Eagle Grove Electric Co.

The next meeting of the association will be held in Milwaukee, commencing on Wednesday, Jan. 18, 1905.

Westinghouse Oil Circuit Breakers.

The new type of electrically operated automatic oil circuit breaker which is illustrated herewith has recently been put upon the market by the Westinghouse Electric & Manufacturing Co. It is designed for voltages of from 3,300 to 25,000 and is adapted to the modern system of distant control.

This circuit breaker is made in single pole units, each being mounted apart from the switchboard in a brick or concrete compartment. Combinations of different numbers of poles are made by placing the units side by side. The base of each unit is of treated soapstone and carries two heavy porcelain insulators which support the stationary contacts and the connection to the external circuit. On breaking the circuit the final arc is taken by a special tip, which is easily replaced.



WESTINGHOUSE OIL CIRCUIT BREAKER.

The movable contacts are in the shape of truncated cones which fit into corresponding surfaces made of copper springs. This insures a positive contact over the entire surface. The inner surface of the tanks is shaped so as to require the minimum amount of oil and the open position is in all cases maintained by gravity. A powerful electro-magnet is arranged with its movable core attached to a system of levers so that when the magnet is energized the circuit breaker is closed. A second electro-magnet acts as a tripping coil and may be controlled by a relay. A small switch mounted on the base operates by the motion of the levers in opening or closing the main switch and this controls a telltale indicator and lamp. These circuit breakers have no live parts exposed.

Advertising Literature.

"HAPPY DAYS" is the title of the picture that decorates the December calendar of the Lumen Bearing Co. of Buffalo, N. Y., maker of Lotus lining metal.

GENERAL ELECTRIC CO. publications of recent date include "Supplement to Supply Catalog No. 7575. Parts of B-13 and B-23 Controllers;" flyer No. 2144, "Pillow Blocks;" bulletin No. 4391, superseding No. 4224, "Air Blast Transformers;" and bulletin No. 4390, superseding No. 4188, "Electric Railway Locomotives."

THE UNITED TELPHERAGE CO., 20 Broad St., New York City, includes in its recent publications circular No. 53, "Electricity applied to the conveying of ashes from the boiler room to cars, hoppers, dumps or barges," and No. 54, "For hoisting and transporting material between barges, scows, steamers or sailing vessels and railroads, piers or warehouses."

THE NEW HIGHWAY BRIDGE across the Miami River at Elizabethtown, O., is believed to be the longest simple truss span in the world. It has a length of 586 ft. from center to center of end pins. The bridge is for Hamilton County and was designed and is being manufactured by the Brackett Bridge Co., of Cincinnati, of which Mr. H. G. Tyrrell is chief engineer.

THE CLAYTON AIR COMPRESSOR WORKS, 114-118 Liberty St., New York, manufacturer of the Clayton air compressors, in its Bulletin C-201 describes and illustrates the many types of single and duplex air compressors manufactured at its works. The main features of Clayton compressors include completely water-jacketed air cylinders, self-contained and removable air valves and seats, extra heavy flywheels, and all reciprocating parts adjustable for wear.

W. N. MATTHEWS & BRO., 600 Carleton Bldg., St. Louis, exclusive distributers of Stombaugh guy anchors and steam scale knockers, are distributing some striking advertising literature in the interest of their products, which include a card with pictures of Miss Columbia and Uncle Sam, advertising Stombaugh guy anchors as "America's Best," and a folder, the outside of which has the appearance of a door and across which is written, "No Admittance Except on Business."